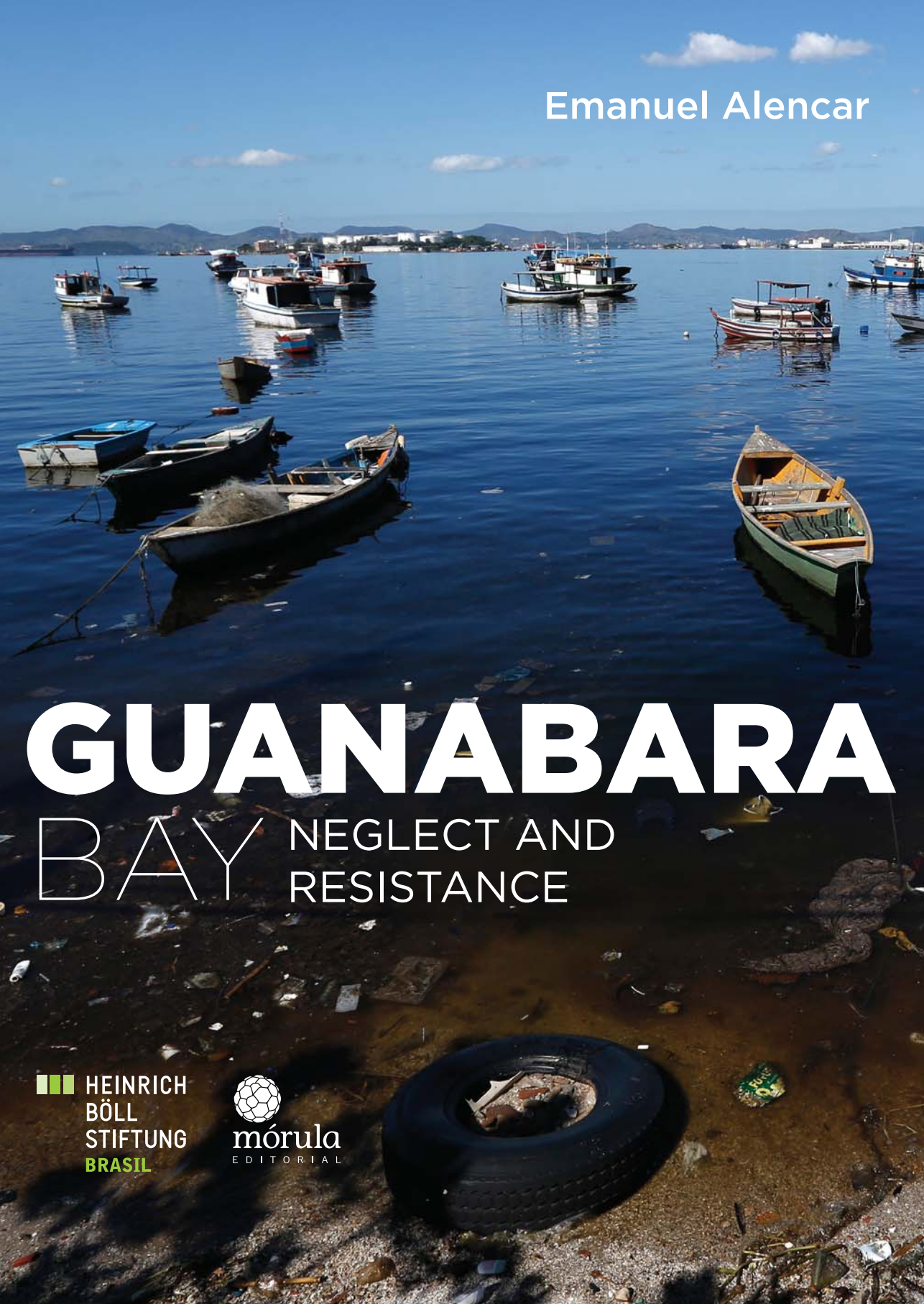
Emanuel Alencar



GUANABARA BAY

NEGLECT AND RESISTANCE

HEINRICH BÖLL STIFTUNG BRASIL

mórula EDITORIAL

The Guanabara Bay has great significance for us Brazilians. It is not only the *cariocas* and *fluminenses* – respectively, the Rio de Janeiro city and state dwellers –, we are all saddened by the images of dirt and neglect disseminated all around the world. We want to be proud of it again, to see it clean, healthy, to swim on its beaches. To change this scenario, it is first of all necessary to seriously analyze the causes, and recognize the historical mistakes and omissions that led to such degradation. More than that: it is necessary for us to observe the errors made during the recent unsuccessful attempts to revert this disastrous situation. The young and already awarded journalist Emanuel Alencar is significantly contributing to this necessary analysis process. With a lot of talent and inspiration, he researched and carefully wrote about the Guanabara Bay Pollution Clean-Up Program (Programa de Despoluição da Baía de Guanabara – PDBG), the Rio de Janeiro State Petrochemical Complex (Complexo Petroquímico do Estado do Rio de Janeiro - Comperj), the pre-salt project and many other aspects related to the threatened integrity of the Guanabara Bay and the attempts of cleaning it. The reading of *Guanabara Bay: neglect and resistance* lead us to a better appraisal of the dimension and diversity of the problems that we still have to face in order to have the Guanabara we all want and deserve.

DORA NEGREIROS
PRESIDENT OF INSTITUTO BAÍA DE GUANABARA

Emanuel Alencar

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HEINRICH BÖLL STIFTUNG
BRASIL

mórula
EDITORIAL

EDITORIAL COORDINATION
Marianna Araujo
Vitor Monteiro de Castro

GRAPHIC DESIGN
Patrícia Oliveira

PROOFREADING
Augusto Gazir

PHOTOGRAPHS
(COVER AND 4TH COVER)
Custodio Coimbra

CONTENT EDITION
Marilene de Paula
Dawid Bartelt
Manoela Vianna

INFOGRAPHICS' CONTENT
Emanuel Alencar
Felix Buchwald
Karina Merêncio
Manoela Vianna

CIP-BRAZIL. CATALOGING IN PUBLICATION
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To my family, my safe harbor.
To Maíra Amorim, partner for all times.

I dedicate this book to all the beauties of the
Guapi-Mirim Environmental Protection Area - APA,
the most pleasant place in Rio de Janeiro.

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PHOTOGRAPHY BY CUSTODIO COIMBRA

Foreword

BAY POLITICS AND POLITICKING

TO DESCRIBE THE GUANABARA BAY ENTRANCE IN WORDS OF DELIGHT and enchantment, viewing the city, then still located up the Morro do Castelo hill, was a mandatory exercise on reports of foreign travelers that visited Rio de Janeiro in past centuries. The set of hills, water, green forests and the white color of the colonial capital's two-story houses offered a sensuous experience of beauty that many deemed as unique.

Therefore, when we speak of the Guanabara Bay, we speak about a national symbol, internationally known and protected by the UN since 2012 as a World Heritage Site. Nevertheless, we also speak of one of the major problems and scandals related to the 2016 Olympic Games.

It is true that, in the past, slaves already used to dispose of their master's and the street waste directly in its waters, but it was with the industrialization and massive population growth in the city and its surroundings, especially as of the 1960's, that the environmental problem in the Bay have seriously worsened. Nowadays, the sewage of more than 10 million people and 12 thousand industrial facilities in Rio de Janeiro and 16 other municipalities reach the Bay. It is more than 18,000 liters of raw sewage per second being daily released in it, as the following writing reveals. Along with it, and maybe in even greater amount than the tons of waste floating in the water surface, are the imperceptible to the naked eye hazards: fecal coliforms, highly toxic chemical pollutants (such as ascarel and organotin),

and also highly toxic heavy metals, such as mercury, that seriously threaten the marine health and life in the Bay.

The discussions concerning the quality of the water that the Olympic athletes shall face do not properly reflect the scenario. The sailors shall compete for medals in a natural channel that goes from the Bay mouth to the Rio-Niterói Bridge. This channel is strongly benefited by the water exchange due to the tides, which bring clean water from the ocean and takes portions of the dirt out of the Bay. There are other large parts of the Bay, further into it, in its depths and coves, that are barely reached by the new water, and whenever they are, it is in much smaller proportions. There is little circulation and the dirt accumulates. In the whole, the Bay presents itself little differently from how it was when Rio de Janeiro was announced as a candidate city to host the 2016 Olympic Games. The official announcement took place in September 2007, along with the also official promise that the Bay would be trash and raw sewage-free by the beginning of the Games. The target, which was fixed in 80% of trash and sewage reduction until the Game's start, was publicly abandoned by the Rio de Janeiro Governor Luiz Fernando Pezão in 2014, when he stated that it could only be achieved in 2018. However, specialists believe it will not be possible until 2030.

What was amongst the biggest promises of the Olympics' legacy for the Rio de Janeiro city and state dwellers (and even for the humanity) is now the biggest failure of this legitimizing strategy. But not only for the Olympics. In past decades, the Guanabara Bay cleaning was not impeded by shortage of money. The Guanabara Bay Pollution Clean-Up Program (Programa de Despoluição da Baía de Guanabara – PDBG), described in detail in the following writing, spent 1.2 billion of dollars, lasted seven state governor tenures, was never completed and wasn't able to significantly improve the environmental quality of the Bay, as the writing of the journalist Emanuel Alencar concludes. Such writing was produced at the invitation of the Heinrich Böll Foundation and is hereby presented with great pleasure.

We may conclude that shortage of money has not been the reason why the Bay is currently in such calamitous state. This is the result of an acute lack of politic will, supported by the institutionalized failures of the Brazilian political system and associated with a policy of oil extraction at any social or environmental cost.

Sewage treatment plants were built, but the collection networks that were supposed to connect the plants to the sanitation systems were not, and neither was the municipalities' level of basic sanitation increased. There were simply no sufficient communication and cooperation between the various administrative levels to change the situation. The Environmental Sanitation Program for Municipalities in the Guanabara Bay Area (Programa de Saneamento Ambiental da Baía de Guanabara dos Municípios do Entorno – PSAM), PDBG's successor program, approved in 2011, faces the same problem up to the present. Therefore, the Guanabara Bay constitutes an equally ecological and political scandal.

In its work in Brazil, the Böll Foundation has seen the sometimes disastrous complex social-environmental effects of the development model in force in the country. Regarding the Guanabara Bay, it is not different. For the ones that have the decision-making power, it is seen as an exploitation area, especially for the oil industry. There is an oil refinery in operation in its banks, the Duque de Caxias Refinery (Refinaria Duque de Caxias – REDUC), and a second one under construction. In recent years, the Bay became this industry's parking lot for vessels, oil platforms and tugboats: the main base of the Pre-Salt project. On all pre-Olympics debates regarding the Bay clean-up, triggered by the international attention, such occupation of the Guanabara space was never questioned, and thus, in practice, the continuous pollution was determined.

There are those who resist the Bay's decadence and the processes that led to it. Even because they fight for their own survival. That is the Guiana dolphins' case; approximately 40 of them still insist to have Guanabara as their habitat. That is the case

of people like Alexandre Anderson, fisherman and president of the Association of Men and Women of the Guanabara Bay Sea (Associação Homens e Mulheres do Mar da Baía de Guanabara – AHOMAR), in Magé, case which has been accompanied for years by Böll Foundation. His boat was destroyed by the military police; his fishing route was blocked by gas and oil pipes; and for three years he has been prevented from performing his profession because he fears for his life and lives hidden with his wife in a protection program for human rights defenders. That is the case of environmentalists, human rights activists and other people who care for the Bay's destiny, and teamed up to form the Baía Viva ("Live Bay", in free translation) campaign. After all, what the state Environment secretary André Corrêa told the author of this publication is true: the previous programs has been Executive Branch's projects. They need to inform, include and ensure the population involvement, and also to provide people with environmental education. Nevertheless, more than that, to overcome the past failures and make the 12 billion reais deemed necessary by the state government to recover the Bay surrounding area worth, political will and coordination are required in the municipal, state and federal levels, as well as to control the industries surrounding the Bay (which know exactly what they are doing). And, not lastly, it is also needed to solve the social-environmental conflicts, because, after all, it would be perverse to recover the Bay and increase the number and quality of its fishes while still preventing the traditional fishermen and their families of making their living from fishing. The so-called sustainable development – the development that aims to promote both social and environmental justice – path will only be open if such conflicts are solved.

DAWID DANILO BARTELT
DIRECTOR OF THE BRAZILIAN OFFICE
OF HEINRICH BÖLL FOUNDATION

Introduction

TO DISCUSS THE REASONS WHY the Guanabara Bay has never become a cleaner environment is not a trivial task after more than 20 years from the implementation of government programs solely aiming at this objective. There are plenty of examples worldwide of recovery of historically degraded environments[1]. London gave dignity to its River Thames in the decade of 1960; in South Korea, the Cheonggyecheon stream was restored in less than four years; the huge Chesapeake Bay, main estuary of the United States, with impressive 166000 km², shall be 100% free of pollutants until 2025.

To talk over the situation of the bay, postcard and venue for the regattas of the Olympic Games 2016, I have searched for references over more than 30 publications, among papers, reports and scientific articles, and a dozen interviews with researchers, environmental activists, fishermen, managers and civil servants. The almost consensual discourse points out the political environment as the great villain, decisive for the very modest progress towards clean-up. At the very begin of the investigation, I was able to notice a history of corruption, complete neglect concerning the public purse, lack of monitoring by the surveillance authorities, lack of engagement by the society and dissemination of half-truths by the environmental bodies.

There was a plenty of conflicting information. In such cases, I have searched for more sources – some of them accepted to speak on the condition of anonymity –, in an attempt to get the most close to the reality information. Whenever it was not possible to establish a consensus, I have used the journalistic technique that accompanied me for 12 years of work in editorial

1. *Cf. infographic on pages 90 and 91.*

offices: I gave voice to multiple sides. I insisted to have answers to my questionings from the various agents that somehow deal with the bay, for them to give their opinions, to refute the criticism. It was not always well succeed. Briefly, I took as basis the lessons of Master Clóvis Rossi, renowned journalist: "journalism is the exercising of four verbs that everyone is able to perform: to see, to read, to listen and to narrate". Because, yes, this is an essentially literary journalism book.

In the first chapter, there is a brief history of the bay and its natural beauties, which persist in surviving. In the second one, there is the degradation history. The third section is dedicated to the discussion on the political and environmental crisis in which we are submerged. "I am Guanabara", the fourth chapter, brings up reflections of eight individuals historically related to the daily routine of the bay. To conclude, in the fifth chapter, there is an evaluation of what to expect from Guanabara during the sailing competitions of the 2016 Olympics.

Please make no mistake, reader(s): to discuss the clean-up of Guanabara when more than 1.6 million of houses in Rio de Janeiro do not even count with sewerage systems is a fantasy. Or dishonesty. Nevertheless, there is, there always is, a light at the end of the tunnel. It is possible to recover the bay. The persistent 34 Guiana dolphins sheltered under its waters are a proof of it.

A WONDER SCENARIO

AN ESTUARY SURROUNDED BY AN EXUBERANT GREEN BELT, dotted by islets from which waters a range of species of fishes and crustaceans used to sprang up. This could be a good summary of what Guanabara Bay used to mean for centuries, until the arrival in Brazil of the Portuguese Royal Family, in 1808. Discovered by the Américo Vespúcio expedition to the Brazilian cost in January 1st, 1502, Guanabara Bay evoked ecstatic reactions in visitors and residents ever since. If, at that time, the Portuguese could not distinguish between estuaries and bays – that is the origin of the naming of Rio de Janeiro –, the idyllic scenario was well understood by people from all over the world. Well understood and very well recorded, by the way. A trip through time, through the memory of travelers and writers, presents a collection of compliments to Guanabara Bay.

In his literary work *Story of a Voyage to the Land of Brazil*, a reference of the XVI century, the French preach, missionary and writer Jean de Léry (1534-1613) makes extensive reports on the bay, even exalting the great fauna diversity that included "terrible whales", aside from sharks, rays and dolphins. Jean de Léry headed to Brazil with other thirteen companions in November 1556, with the colony founded a year earlier by Nicolas Durand de Villegagnon as destiny and reported in his book what he found:

Such river is full of a range of species of fishes (...). However, make notice right away of the excellent white seabreams, the sharks, rays, dolphins and others, medium and small-sized, some of which I will describe in details in the fishes chapter. I must also mention the terrible whales that would daily show us their enormous fins outside the water and, enjoying this large and deep river, would come so close to our island that we could hit them with harquebus shots. However, as they have a hard leather and a thick blubber, I do not believe that the bullets could penetrate them at the point to cause any injury; they would keep going down their way and, I suppose, would not die.[2]

2. *Léry, 1961, p. 89.*

Guanabara Bay view, featuring the Sugarloaf Mountain.
PHOTOGRAPHY BY FOTOSEARCH

The Tamoios dominations

It is worth making an important record. At the time, Guanabara was surrounded by tribes of two different indigenous populations that, although being rivals, belonged to linguistic group of Tupi: the Tamoios (or Tupinambás) and the Temiminós (also known as Maracajás, in other words, margays). In the half of the 16th century, the Maracajás were isolated in what would be the future Ilha do Governador – where, according to the French cosmographer André Thevet, who lived in Guanabara for a while at that time, there were 36 *tabas* (indigenous villages). In accordance with relatively reliable estimates, approximately 8 thousand inhabitants formed the tribe, surrounded by 70 thousand Tamoios[3], which were commanded by the dreaded Cunhambebe.

In such context, in November 10th, 1555, the French explorer Villegagnon crossed the Gauanabara Bay with two carracks, a small boat for provisions and circa 600 men. By his 45 years of age[4], he would establish a fortification in the location that would later be named after him – currently the Naval Academy of the Brazilian Navy, but then, the Forte Coligny (Fort Coligny). In the middle of the 16th century, the French explorers were trying to establish the Antarctic France in Brazil. The project that ended up being bombed by the Portuguese had as purpose the transformation of the colony into a powerful military and naval base, from which the French Crown could try to control the trade with the Indies.

The encounter of its troops with the Tupinambás did not represent a conflict – the tribe, commanded by Cunhambebe, and the French were allies. However, other kind of tension did happen, as Elman describes[5]:

> Invariably peaceful, the first interactions with the natives are all characterized by the amazement caused amongst the French by the natural sensuality of the indigenous women. It is a real clash of civilizations. The Guanabara Bay world reveals itself indeed as genuinely new to the Catholics, haunted by the

3. *Fernandes, 2013.*
4. *Doria, 2015.*
5. *Elman, 2008, p. 260.*

> sins of the flesh. For the chaste Villegagnon and his troop of men without women, the temptation test announces itself as particularly too hard to resist.

Villegagnon plans progressed with the establishment of the colony in the region of the current Flamengo Beach, in 1556. The small village, built by the mouth of the Carioca River, was named Henriville, as a homage to King Henry II (1519-1559). The defeat to the Portuguese would occur in 1640, with the taking of the Forte Coligny (Fort Coligny - in the Villegagnon Island). In the following decades, the Tupinambás and Temiminós would be practically extinct.

After the foundation of the city of Rio, in 1565, by Estácio de Sá, the occupation of the Guanabara hollow was mainly based on the sugarcane monoculture. The rivers had a key role in the region's occupation and in the distribution of the sugar produced by the sugar mills. Under the environmental perspective, the 17th century was a disaster, having consequences on Guanabara[6] due to the deforestation and the population increase.

"Luxuriant Forests"

The 18th century was marked by the mining rush in the colony, which will end up conferring the title of national capital to Rio, in 1763. The mineral production in Minas Gerais was distributed through the Rio port. Marshes, lagoons and the bay itself were embanked. The coast of the city of Rio de Janeiro was completely occupied, from Glória to Gamboa. However, none of this could take away the beauty of Guanabara. In 1766, Louis Antoine de Bougainville, which would be the first French to circumnavigate the Earth, registered a visit to Rio as follows:

> During our staying in Rio de Janeiro, we enjoyed the spring of poetry. This bay's view will always provide the travelers with the most lively pleasure (...) There is nothing richer than the scenario of such landscapes, which are offered all over.[7]

6. *Amador, 2013, p. 62.*

7. *Bougainville, 1772, pp. 143-144.*

The arrival of the Portuguese Royal Family, in 1808, and the ports opening to the friendly nations have increased the trading and imposed a new rhythm to the Bay.

> The first concrete notice to make a mangrove disappear we have is dated of 1811, when the Prince Regent, acknowledging the ever more impetuous increasing of the city, and therefore the increasing need for creating houses for its inhabitants, decided to promote the occupation of a place named Cidade Nova, and exempted the payment of the Décima Urbana [an urban buildings tax] to the constructions built in the location. In the Prince Regent determination there was also, even if with little consistence, a brief mention that the draining and embankment of the marshlands should be useful, once they would bring benefits to the public health.[8]

All these transformations would not mean water quality harm. In 1857, in the romantic novel *A Viuvinha*, the writer José de Alencar would describe it as "clear and serene". At that time, the Guanabara Bay hollow was already deeply changed by a new cycle: the coffee cycle, that would incur in the deforestation of the Tijuca, Pedra Branca and Mendanha massifs. At request of Irineu Evangelista de Souza, the Baron of Mauá, the São Diogo estuary – a wetland area between Praça Quinze and the current Avenida Francisco Bicalho – received channelization works. Nevertheless, in her *Diário de uma viagem ao Brasil* (Journal of a Voyage to Brazil, and Residence There, During Part of the Years 1821, 1822, 1823), Maria Graham (1785-1842) describes the wonders of her arrival in Rio in December 1821:

> Nothing I have seen now is comparable to the beauty of the bay. (...) Lofty mountains, rocks of clustered columns, luxuriant wood, bright flowery islands, green banks, all mixed with white buildings; each little eminence crowned with its church or

8. Chaves, 2008, p.70

> fort; ships at anchor or in motion; and innumerable boats flitting about in such a delicious climate, – combine to render Rio de Janeiro the most enchanting scene that imagination can conceive.[9]

Deeper deteriorations occurred indeed in the 20th century, between the years of 1930 and 1990, due to the urbanization process led by the urban industrial model. Brazil's urbanization rate rose from 31.2%, in 1940, to 75% in 1990[10]. This is the period of the embankment, urban infrastructure megastructure projects and industry expansion in the Bay's surroundings. The construction of the Avenida Brasil, in 1946, connecting the Rio Centre to the city suburbs, reflects the consolidation of the progress ideal through the prioritization of roadway. The Santos Dumont Airport (1936) and the Cidade Universitária (1952) are also expressions of such period. The Flamengo Park, one of the main recreation areas of the city, with 1.2 million m², is dated from such period as well (1965)[11]. The Rio de Janeiro International Airport (Tom Jobim), in Ilha do Governador, is built in 1977.

Resisting mangroves

Nowadays, showing a great ability of overcoming all kinds of adversities, the Bay still houses a huge environmental and economic asset. With an area[12] of 377 km² – not including the islands –, its water surface is source of tons of capture fishery per month, and of the largest continuous mangroves forest of the Rio state (located in the Guapi-Mirim Environmental Protection Area (APA), created by a federal decree in 1984). Such mangroves perform an important role in the nature. They maintain high rates of productivity in estuarine waters through the nutrients recyclings.[13]

Solely inside the limits of the Guapi-Mirim APA, the most preserved area, in the northeast of the Bay, the Guanabara mangrove

9. *Graham, 1990, p. 174.*
10. *Amador, 2013, p. 175.*
11. *Rio de Janeiro City Government website. Available at <http://www.rio.rj.gov.br/web/riotur/exibeconteudo?id=157258>*
12. *Amador, 2012, p. 96.*
13. *Araújo and Maciel, 1979.*

currently comprises 60 km². Having as base studies conducted by the National Institute For Space Research (Instituto Nacional de Pesquisas Espaciais - Inpe), the biologist Maurício Muniz, head of the APA, estimates that in the last 20 years 16 km² of red and white mangrove forest were reforested through actions financed by environmental compensation measures. The vegetation plays the role of a water natural filter and purifier, increasing the quality of the rivers that flow into the Bay. It is not a coincidence that the most clean rivers of the ecosystem flows through the APA, such as the Guapi-Macacu and Guaraí.

Fishing sector has a turnover of BRL 14.3 million a year

According to a research conducted by the Brazilian Institute of Environment and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis – IBAMA) (2002), the aforementioned constant renovation of nutrients and the connection with the sea make Guanabara the habitat of more than 245 fish species. The Bay's fisheries production in the period of April 2001 to March 2002, registered in 32 unloading points, was just over 19 thousand tons, which corresponded to a total sales value of approximately BRL 14.3 million. Although the lack of statistics prevents a more up-to-date assessment, such data indicates that life still goes on in Guanabara. However, it is important to remark that the data presented herein refer to the fishery unloading in the Bay, which does not necessarily correspond to that ecosystem's fishery production.

The atlantic anchoveta for industrial purposes, with average selling price of BRL 0.25/kg, corresponds to 12.5 thousand tons of the total amount, what is equivalent to the approximate value of BRL 3 million. When the atlantic anchoveta and the twait shad – also designated to the industrial processing – unloadings

are disregarded, the total harvest amounts circa 6.3 thousand tons and the value of BRL 11.2 million, corresponding to the average unit price of BRL 1.76/kg[14].

In an article published by the *O Globo* newspaper in August 2014, the biologist Marcelo Viana, head of the Marine Biology Department at the Federal University of Rio de Janeiro (UFRJ), highlighted that there is a predominance of gafftopsail catfishes and small whitemouth croaker, besides the atlantic anchovetas and twait shads, more resistant to adverse conditions animals. The common snook, Patagonian flounder, southern brown shrimp and sea trout stocks have decreased due to the rising pollution:

> The flounder fishing, for example, is restrict to the central channel and the bay's mouth (low estuary), where there is interchange with the ocean water during the high tide. However, the bay is still rich with marine animals. There are approximately 230, including rays and some sharks.[15]

The table at right[16] summarizes the fisheries production and value, as well as the unloading area.

The Guanabara birds population is also very biodiverse. Surveys published by Petrobras in 2013 pointed the existence of 76 species (39 of waterbirds and 37 land birds). A red colored bird with a distinctive beak, the spoonbill (*Ajaja ajaja*) is regarded as an endangered species and still can be seen in the Guanabara Bay basin. There are also the visitors that travel long journeys: it is the case of sandpipers and the solitary sandpipers (*Tringa solitaria*), which arrive in September and stay in the mangroves, feeding up and resting, until March/April, when they return to the North Hemisphere regions, where they reproduce.

14. *Jablonski, 2002, p. 5.*
15. *Alencar and Schmidt, 2014.*
16. *Jablonski, 2002.*

Fishermen at the Gradim fishing colony, in São Gonçalo, Rio de Janeiro.
PHOTOGRAPHY BY CUSTODIO COIMBRA

FISHERIES IN GUANABARA BAY IN 2001-2002

MAIN UNLOADING POINTS:

SEINE FISHING
Ilha da Conceição (Dom Diniz Pier and Sardinha 88 Pier), Jurujuba, Praia Grande and Ponta da Areia, in Niterói, Fênix Pier, in São Gonçalo

GILLNETTING, SEINE, HANDLINING, TRAWLING AND DIP NET
Olaria, Magé and Gradim, in São Gonçalo

UNLOADING POINTS	32
PRODUCTION (TONS/YEAR)	19000
1ST TRADING PRICE	BRL 14,300,000.00
FISHERMEN	3700
REGISTERED BOATS	1402
MAIN FISHING TECHNIQUES (Nº OF BOATS)	
GILLNETTING	870
SEINE	109
HANDLINING	101
TRAWLING	84
DIP NET	80
MAIN SPECIES (TONS)	
ATLANTIC ANCHOVETA	12500
BRAZILIAN SARDINELLA	675
WHITEMOUTH CROAKER	1390
LEBRANCHE MULLET	1093
GAFFTOPSAIL CATFISHES	317
LARGEHEAD HAIRTAIL, WHITE MULLET, SHRIMP, CRAB, BROWN MUSSEL AND OTHERS	2165

SOURCE: IBAMA, 2002

Architectural treasuries

Historic buildings, such as Fortaleza de Santa Cruz, a fort in Niterói that is regarded as one of the most valuable samples of the military Luso-Brazilian architecture, are part of the Bay's view. Its waters reflect centuries of invasions, resistances and bloody battles. There are 12 forts – excluding those by the open sea, as Forte de Copacabana – that help to tell the history of Brazil and the French and English effects on our culture. As we have seen, Forte Coligny (Fort Coligny - currently, Ilha de Villegagnon, where the Naval Academy of the Brazilian Navy is located, by the Santos Dumont Airport), even before the Portuguese rule, represented the French dream of founding the Antarctic France.

The foundation of the city of São Sebastião do Rio de Janeiro is closely related to the Fortaleza de São João, a fort at Urca. Comprised of the strongholds-forts of São Martinho, São Teodósio, São José e São Diogo, that was the place where Estácio de Sá landed with his troops at a beach between the Sugarloaf and the Cara de Cão Mountains, in 1565, to reintegrate the Portuguese territorial occupation, building a small sized fort up.

According to Adler Homero Fonseca de Castro, historian and researcher of the National Institute of Historic and Artistic Heritage (Instituto do Patrimônio Histórico e Artístico Nacional – Iphan) and specialist in military weapons, during the Brazilian Independence battles, from 1822 to 1826, there were 80 forts in Rio and Niterói, although the majority of such constructions were provisional or badly-built, like Bateria do Engenho da Serra. About the variety of styles put together, Adler states:

The São João complex (in Urca) is very interesting for having an Italian design (the standard type of fortification between 1530 and 1870). When speaking of more modern fortifications, Santa Cruz (in Niterói) is relevant for having parts that goes from the 16th century to the 20th century, with magnificent bunkers built due to the risk of a war against England, in 1863. In relation to the world modern military architecture, from the late 19th century and beginning of the 20th century, Copacabana (at open sea) is an exceptional fort, the only one of its kind in the world. With such fort, Rio was the most well defended city in Latin America.[17]

17. *Interview with the author, in November 2015.*

18. *Available at <http://www.cml.eb.mil.br/index.php/fortes-e-fortalezas>. Accessed January 10th, 2016.*

Fortifications at the Guanabara Bay

FORTIFICATION	LOCATION	CONSTRUCTION AND RENOVATION YEAR
FORTALEZA DE SÃO JOÃO	RIO	1565, REVONATION IN 1618
FORTE DA LAJE	RIO	1555 (NAMED RATIER), RECONSTRUCTED IN 1716
FORTALEZA DA CONCEIÇÃO	RIO	1715
FORTE DE SÃO TIAGO DA MISERICÓRDIA	RIO	1568/1603
FORTE DE VILLEGAGNON	RIO	1555/1777
FORTE DA ILHA DAS COBRAS	RIO	1696/1765
FORTALEZA DE SANTA CRUZ	NITERÓI	1555, IMPROVED IN 1567 AND REOPENED IN 1612
FORTE DO IMBUHY	NITERÓI	1863, BUT REOPENED IN 1901
FORTE BARÃO DO RIO BRANCO	NITERÓI	1567
FORTE DO PICO	NITERÓI	1567
FORTE DE GRAGOATÁ	NITERÓI	1696
FORTE DA BOA VIAGEM	NITERÓI	1698

SOURCE: Website of the Eastern Military Command/ Brazilian Army[18], and historian Adler Homero

Albamar restaurant, which operates in the only remaining tower of the former city market Mercado da Praça XV, demolished in 1962. PHOTOGRAPH BY MAURO MOTTA

Imposing rocky outcrops, such as the Sugarloaf, Cara de Cão e Corcovado Mountains, grant the Bay a unique scenario in the whole world. Museums with modern design make the connection of past and future times, like the Contemporary Art Museum (Museu de Arte Contemporânea - MAC), designed by Oscar Niermeyer, in Niterói, the Rio Art Museum (Museu de Arte do Rio - MAR) and the Museum of Tomorrow, both located at Praça Mauá.

The list of historic landmarks includes the water surface of the Botafogo bay (Municipal Decree dated of 1988) and the Albamar restaurant, location of the former city market, founded in 1908 by Pereira Passos[19]. In neogothic style, Ilha Fiscal, that was designated as historic landmark by the State Institute of Cultural Heritage (Instituto Estadual do Patrimônio Cultural – Inepac) and is known for holding the last ball of the Empire, in November 15th, 1889, is another attraction open to the public.

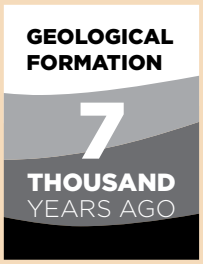
The watershed of Guanabara Bay follows the rhythm of the second largest metropolitan area in Brazil – the third in South America and twentieth when considering the whole world. In the surroundings of the channels, rivers and streams that drain into Guanabara, live 8.4 million city dwellers, in 16 cities. The region contributes substantially to the national economy. In such space are concentrated 700 important oil facilities, like Duque de Caxias Refinery, founded in 1961 and responsible for approximately BRL 4.8 billion a year in taxes paid to the government.

Although having undergone a drastic change in its operational planning, the Rio de Janeiro Petrochemical Complex (Complexo Petroquímico do Estado do Rio de Janeiro –Comperj) still employs nowadays approximately 6.3 thousand employees, according to Petrobras information[20]. Such number of employees has fallen sharply since the beginning of the economic crises, in 2015, and the discontinuation of construction works.

19. Guia do patrimônio cultural carioca 2008 – *an initiative of the city government of Rio, supported by the Rio de Janeiro Real Estate Market Company Directors' Association (Associação de Dirigentes de Empresas do Mercado Imobiliário – Ademi-RJ).*

20. *As reported by the newspaper* O Dia *on August 24th, 2015.*

GUANABARA BAY IN NUMBERS



WATERSHED

The average renovation time of 50% of the volume of its waters is **12 DAYS**

Magé River

NEARBY POPULATION

Living in 16 municipalities, from which, **8.4 MILLION** are in the watershed of Guanabara

DEPTH 1m TO 20m

Paquetá

Ilha do Governador

INDUSTRIES

NITERÓI

143 **RIVERS AND STREAMS**

The ones with greater streamflow are Macacu and Caceribu

RIO DE JANEIRO

GREATER STRAIGHT LINE LENGTH

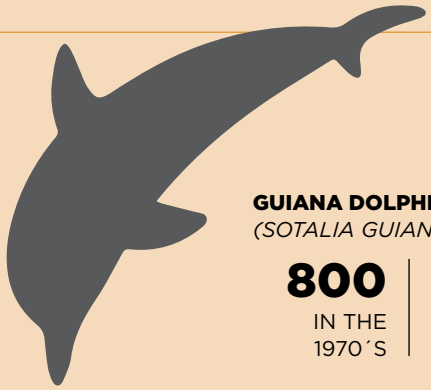
36km

between the Copacabana edge and the mouth of the Magé River

Copacabana

WATER SURFACE LENGTH

FLORA AND FAUNA



GUIANA DOLPHINS
(SOTALIA GUIANENSIS)

800
IN THE
1970´S

38
IN 2016

GREEN TURTLES
(CHELONIA MYDAS)

43%
of the Itaipu Beach turtles suffer from Fibropapillomatosis disease, a type of herpesvirus

SEAHORSES
OBSERVED BY
BIOLOGISTSS

297
IN 2014

14
IN 2015

ATLANTIC OCEAN

SOURCES: AMADOR (2002), Petrobras (2013), Fisheries Institute of Rio de Janeiro State (Instituto de Pesca do Estado do Rio de Janeiro – FIPERJ), State Environmental Institute (Instituto Estadual do Ambiente – Inea), and Geosciences Institute of Fluminense Federal University (Universidade Federal Fluminense - UFF)

The fauna diversity is one of the main features of Guanabara Bay. PHOTOGRAPH BY CUSTODIO COIMBRA

Such economic, social and environmental importance has always been connected to the natural beauties. That is what Rio de Janeiro is internationally famous for. In 2012 July, Unesco has added the "Carioca Landscapes between the Mountain and the Sea" on the World Heritage List. According to a text on the entity's website[21], in Rio, the symbiosis between the city and landscape is unique, even more remarkable than the value of the historic site itself, the monuments and architecture.

Located in the beauties of Guanabara, the enormous and stunning Rio de Janeiro environmental asset has helped to boost the ever-increasing number of visitors in the city. Data collected from the State Secretary of Tourism give us the dimension of such landscape rediscovery, both by foreigners and Brazilians. The Sugarloaf and Corcovado, just to mention the most remarkable cases of spaces that are inseparable from the Bay's dynamics, have received 3.29 million visitors[22] in 2014, a 40% rise in two years.

21. *With Rio, now Brazil has 19 sites on the World Heritage List of Unesco. Available at <http://www.unesco.org/new/pt/brasilia/about-this-office/single-view/news/rio_becomes_the_19th_brazilian_site_in_the_world_heritage_list_of_unesco#.VaVa3KRViko>. Accessed December 10th, 2015.*

22. *2014 Statistical Yearbook of the State Secretary of Tourism (Seltur).*

The green Bay: conservation areas

The Guanabara Bay basin area also counts on 27 municipal, state and federal conservation units. On the water surface, there are two: the Environmental Protection Area (Área de Proteção Ambiental - APA) Guapi-Mirim and the Ecological Station (Estação Ecológica - Esec) Guanabara, in which the fishing is controlled. Besides, the Bay is considered a Permanent Preservation Area and an Area of Relevant Ecological Interest by the state Constitution and the Organic Law of the city of Rio de Janeiro, respectively.

The guarantee of water supply to 1.7 million city dwellers of the eastern region of Rio de Janeiro city (São Gonçalo, Itaboraí and Niterói) comes from the Guapiaçu and Macacu rivers, which are located in the Guanabara basin.The preservation of forests and mangroves is crucial for the operation of the Imunana-Laranjal system, operated by the Water and Sewage State Company (Compania Estadual de Águas e Esgotos – Cedae), that is under constant water stress. Reasons range from the poor management in distribution losses control to the lack of reservoirs capable of regulating the rivers' flow.

Such area is protected by the Macacu River APA, founded in December 5th, 2002, via state law, comprising 19.5 hectare. The Macacu River basin stands out for housing a significant amount of native fishes and may be pointed as the main biodiversity pocket in Guanabara.

The latest conservation unit in the watershed is the Alto Iguaçu APA, in Baixada Fluminense, founded in January 15th, 2013, via state decree. The goal of such creation is to have the APA, with its 22 thousand hectare, operating as a buffer, reducing the disorderly urban sprawl of the lands in the area of influence of Arco Metropolitano – a.k.a Raphael de Almeida Magalhães Highway, which crosses the city and connects several surrounding municipalities.

Sea transportation in Guanabara

The Guanabara waters reflect architectonic richness and house a huge biodiversity, but they are also used as crossing by many city dwellers of the Metropolitan Area as well. The use of the Bay for navigation is dated back to the Empire period, when, in the middle of the 19th century, Dom Pedro II would travel by steamboats around Mineiros Pier (in the surroundings of Praça Mauá) and Mauá Beach, in Magé. There, the Emperor would continue his journey by train to Raiz da Serra, through the first railway in Brazil, built by Irineu Evangelista de Souza, the Baron of Mauá (1813-1889).

As it is shown in the website of the National Transport Infrastructure Department (Departamento Nacional de Infraestrutura de Transportes – DNIT)[23], The Mauá Railway, enabled the integration of the rail and waterway modes of transport, introducing the first intermodal operation in the country. The company conducted by the Baron of Mauá was named Imperial Steam Navigation Company and Petropolis Railroad (Imperial Companhia de Navegação a Vapor e Estrada de Ferro Petrópolis), and operated the rail and waterway services.

In 2014, there were 77.9 thousand daily passengers travelling by the ferries that cross the Bay[24], in four waterway transport lines that connect Rio to Niterói, Ilha do Governador, and Ilha de Paquetá. The system is operated by the private company CCR Barcas, and carries 3.1% of the total number of passengers carried by inter-municipal waterway and roadway transports.

Steam-powered vessels regularly travel the route Rio-Niterói ever since 1835, what, at that time, represented an initial connection between the population of the Empire capital and the people from *Banda d'Além*, as Niterói was known at the time[25]. In the aforementioned year, the Nictheroy Navigation Society (Sociedade de Navegação de Nictheroy) started to operate with "three ferries would travel each hour, with capacity for 250 passengers, in a period from six in the morning to six in the evening".

23. Available at <http://www1.dnit.gov.br/ferrovias/historico.asp>. Accessed February 22th, 2016.

24. Data provided by the concessionaire CCR Barcas to the author in March 2016.

25. Pacífico, 2010, p. 7.

In 1967, the federal government established the Guanabara Bay Transportation Service (Serviço de Transportes da Baía de Guanabara – STBG S.A), which carried out passenger, cargo and vehicle transportation between Rio and Niterói. It was a semi-public company and used to operate the waterway transport system in the Bay.

However, ten years later (1977), after the construction of the Rio-Niterói Bridge (that caused a significant drop in the STBG S.A. number of passengers) and the amalgamation of the former Guanabara state and the state of Rio, the company's control was transferred to the state government, with its name being switched to Navigation Company of the State of Rio de Janeiro (Companhia de Navegação do Estado do Rio de Janeiro – Conerj).

In February 1998, on the initiative of the state government (Governor Marcello Alencar), a private-companies consortium assumed Conerj's shareholding control under the concession regime of 25 renewable years, creating Barcas S/A. Recently, in 2012, the Grupo CCR assumed the concession, acquiring 80% of the company's shares.

The promise of a safer and more efficient system has nevertheless quickly dissipated. In 2007, following a Port Authority orientation, the government even banned five ferries that were in terrible condition from navigating until the necessary repairs were carried out[26]. In one of the more serious events, the Gávea catamaran crashed into a Praça Quinze dock, leaving 54 people injured.

The poor quality of the services provided was also investigated by a Congressional Investigative Commission at the Legislative Assembly of Rio, in December 2008. The final report, dated of June 2009, recommended the resumption of the midnight line services in the Rio-Niterói stretch and the construction of the São Gonçalo station. Such suggestions remained aspirational.

26. Alencar, 2012. Available at <http://oglobo.oglobo.com/rio/estado-vai-licitar-construção-de-9-barcas-por-278-milhoes-5749207>. Accessed March 10th, 2016.

WATERWAY TRANSPORT ON GUANABARA BAY

- Steam-powered vessels regularly travel on the Bay, taking the Rio-Niterói route, ever since 1835[27].
- The system operated by CCR Barcas carries 3.1% of the total number of passengers carried by the inter-municipal waterway and roadway transport.
- In 1998, the system was privatized and the Barcas S/A companies consortium assumed the shareholding control of the Navigation Company of the State of Rio de Janeiro (Conerj) under the concession regime of 25 renewable years.
- In 2012, the Grupo CCR Barcas assumed the concession alone, with no public tender, and acquired 80% of the companies' shares.
- CCR Barcas is the 4th largest passenger waterway transport operation in the world[28].
- The concessionaire has 24 vessels and 1,100 employees[29].
- More than 20 thousand people consulted by a research have shown dissatisfaction with the service provided by Barcas[30].
- From the nine traditional ferries taking the routes, one was built in the 1950's, four in the 1960's, two in the 1970's and three in the 1980's[31].
- A study conducted by the Federation of the Industries of the Rio de Janeiro State (Federação das Indústrias do Estado do Rio de Janeiro – FIRJAN), published in 2015, proposes 11 connections on the Bay

ACCIDENTS

JULY 2015

The ferry Boa Viagem crashed into a wall of the Praça XV station while carrying 900 people, leaving 15 injured passengers. A Conduct Adjustment Agreement was executed to enable the payment of compensation to the victims[35].

MAY 2015

The ferry Vital Brazil, built in 1962, crashed into a floating dock when arriving at the Cocotá platform, Ilha do Governador, northern zone of Rio. More than 700 people were stucked in the vessel for more than 2 hours, waiting for help. The responsible consortium was fined on BRL 400 thousand.

NOVEMBER 2011

The catamaran Gávea I, that was carrying 907 passengers, crashed twice into a disabled dock at Praça XV, leaving 55 people injured. The concessionaire Barca S/A stated that, with the crashing impact, some of the seats crashed of got loose[36].

that could take a hundred thousand cars away from the streets of Rio[32].

- The implementation of the Ferries line São Gonçalo x Praça XV is an old demand, a promise from the governors in the last three elections, and could improve the traffic in Niterói Centre, Rio-Niterói Bridge and in the accesses to Gasômetro and Rodrigues Alves. There is no forecast to the new line opening[33].
- According to CCR, the great amount of trash in the Bay interferes with the travel time. During rainy seasons, the amount of floating trash may triplicate, causing the breakage of parts and heating of engines of the vesselss[34].

27. *Pacífico, 2010.*
28. *Available at http://www.grupoccr.com.br/barcas . Accessed March 10th, 2016.*
29. *Idem.*
30. *Available at <http://radios.ebc.com.br/ecos-da-terra-genero-e-sustentabilidade/edicao/2016-02/populacao-e-movimentos-demonstram>. Accessed March 12th, 2016.*
31. *Available at <http://www.grupoccr.com.br/barcas/embarcacoes/barcas-tradicionais?id=7 >. Accessed March 10th, 2016.*
32. *Available at <http://g1.globo.com/rio-de-janeiro/noticia/2015/08/ligacoes-hidroviarias-tirariam-das-ruas-do-rio-cemmil-carros-diz-firjan.html >. Accessed March 20th, 2016.*
33. *Available at <http://paneladepressao.nossascidades.org/campaigns/622>. Accessed March 7th, 2016.*
34. *Available at <http://www.grupoccr.com.br/barcas>. Accessed March 10th, 2016.*
35. *Available at <http://g1.globo.com/rio-de-janeiro/noticia/2015/07/apos-acidente-no-rio-passageiros-de-barca-podem-ser-indenizados.html and http://noticias.r7.com/rio-de-janeiro/estado-assina-termo-que-garante-indenizacao-a-vitimas-de-acidenteem-barca-na-praca-xv-17072015>. Accessed March 10th, 2016.*
36. *Available at <http://m.folha.uol.com.br/cotidiano/2011/11/1013417-acidente-com-catamara-deixa-55-feridos-no-rio-11-ficam-internados.shtml?mobile> and <http://ultimosegundo.ig.com.br/brasil/rj/bombeiros-confirmam-55-feridos-em-acidente-com-barca-no-rio/n1597387593513.html>. Accessed March 15th, 2016.*

WHEN THE PAST IS SHAMEFUL: THE "BLACK HOLOCAUST"

The Guanabara Bay has also witnessed a shameful past. The Valongo Pier, nowadays located few meters away from the water, in Rio port area of Gamboa, was the disembarkation point of 706 thousand slaves from 1790 to 1830[37] – a mark in the African Diaspora, which reflects the "black holocaust". A history that only recently has gained the necessary attention from the society. In November 20th, 2013, the Black Awareness Day, the Valongo Pier was designated as Rio de Janeiro city cultural heritage by the Rio World Heritage Institute (Instituto Rio Patrimônio da Humanidade - IRPH), related to the city government.

"There is no monument in the continent, no place of remembrance with the symbolic and historic power of Valongo Pier", stated the anthropologist and photographer Milton Guran[38], adding that in almost four centuries of slavery, the city of Rio de Janeiro, and consequently, the Guanabara Bay, have received alone approximately 20% of all the enslaved Africans that arrived in the Americas alive.

For its historical relevance, the Pier is running for the Unesco World Heritage title. The recognition may take place in December 2016. In 1831, Valongo was closed when the transatlantic traffic was banned by pressure from England. However, the rule was solemnly ignored and was ironically named as *lei para ingles ver* – in a literal translation, an only for British eyes law, created just for the sake of appearances. The historian Júlio Cesar Medeiros da Silva Pereira, director of the New Blacks Institute for Research and Memory (Instituto de Pesquisa e Memória Pretos Novos – IPN), reinforces that the landing of slaves would not be ceased until the middle of the 19th century:

> The largest numbers of slave trafficking are dated from after 1830, that being the period when the trafficking became illegal. And continued up to 1850. Not through Valongo anymore, but along the Rio de Janeiro coast.[39]

37. Pereira, 2014, p. 105

38. Interview with the author, in January 2016.

39. Interview with the author, in March 2016.

INNOVATION ISLANDS: FROM NATURALISM TO AIRCRAFT FACTORY

The Guanabara Bay is dotted with islands and islets – which once summed more than 80, and currently are more than 40, amounting 40 km^2 of surface[40] – that deserved a separate book. There are many stories to be told about such pieces of land that include Rio de Janeiro districts, like Ilha de Paquetá and Ilha do Governador, were the Antônio Carlos Jobim International Airport is located, and even a university centre, Ilha do Fundão, constructed by the embankment of eight smaller islands, from 1949 to 1952. Let us stick with just few examples of the least talked about, but not least worth the record islands.

On an island in the surroundings of São Gonçalo, the dancer and naturalist from the state Espírito Santo Dora Vicacqua, known as Luz del Fuego, founded the first naturalist refuge in Latin America in 1954. According to what the biographer Cristina Agostinho states in her book *Luz del Fuego: A bailarina do povo*[41], there were tough rules in the colony: it was expressly forbidden to take alcoholic beverage in, swear and have sex. To ensure the strict compliance with the rules, she would act as a watchdog. Several Hollywood movie stars visited the island at that time, such as Ava Gardner, Brigitte Bardot and Steve McQueen.

Always remembered for her sensual dance with a snake wrapped around her naked body, Luz del Fuego had a tragic death: her body was found together with the body of an island's guard in the bottom of the Guanabara Bay, less than one hundred meters away from Ilha do Sol, in 1967. A fisherman confessed the crime, which was committed in vengeance.

Ilha do Viana, nearby Mocanguê, in Niterói, was one of the properties of the industrialist Henrique Lage (1881-1942) and, during the Second World War, housed the Brazilian Aircraft Factory (Fábrica Brasileira de Aviões). That was the place where Muniz M-7, the first Brazilian aircraft manufactured in series, took off from. The plane would fly at a maximum speed of 190 km/hour and crossed the Rio-São Paulo stretch in 2 hours and 40 minutes in 1936[42].

Another island that gained notoriety is Brocoió, that houses a beautiful palace built in the 1930's, designed by the French Joseph Gire, which was also responsible for the Copacabana Palace design. The Brocoió Palace is used as the Rio state governor summer residence, but its premises have not been used for a long time. In recent years, BRL1 million were spent on a renovation, after Sérgio Cabral (PMDB) management – 2007 to 2014 – announced that it would be opened for the public. BRL 298 thousand were spent on a restoration project, and BRL 755 thousand with the on-site works. The museum-house, however, has never made it off the drawing board[43].

40. Coelho, 2007, p. 39.

41. Agostinho, C. Luz del Fuego: a bailarina do povo. Rio de Janeiro: Best Seller, 1995.

42. Ribeiro, 2007, p. 172.

43. Amorim, 2015.

OUR DAILY DEGRADATION

ON HIS RECORDS, ANTHONY KNIVET (1560-1649), an English explorer that arrived in the colonial Brazil accompanied by pirates and was abandoned among Indians and settlers, has always expressed critical perspective on the Portuguese rulers. At the time of his arrival in Rio, in 1592, 27 years after the city foundation by Estácio de Sá, he witnesses a conflicting relationship between men and the ecosystem. There was the need of dominating nature, the floods (any resemblance to the current days is not a mere coincidence), imposing the colony's perseverance conditions. Proposals for embanking the mangroves, which were regarded as unhealthy areas of disease dissemination, were coming from everywhere.

Taking into account that for every action, there is an equal and opposite reaction, the first movements for environmental protection were soon created. In the 16th century, Jesuits were supporting the mangroves defense movements. According to the historian and researcher Nireu Cavalcanti[44], people had as habit catching shellfishes and wood at the mangroves, whose wooden sticks were exported to the grapevines in Portugal. They have succeeded in breaking the environmental heritage deterioration. However, in 1759, as the King D. José I of Portugal determined the expulsion of the Jesuits from all Portuguese territories, the exploitation was resumed.

The expansion of the city occurred at an alarming pace, especially in the 19th century, during the coffee cycle, that sped up the degradation history. In just 11 years, the population has almost

44. Interview with the author, in September 2015.

doubled: from 137,038 in 1838 to 266,466 in 1849 – 110,602 enslaved persons and 155,864 free persons[45]. By the end of the 18th century, the population of Rio was about 50 thousand people, rose to 140 thousand with the advent of Pedro II, to 500 thousand by the end of his reign, and then to nearly 700 thousand in the beginning of the 20th century.

Rio de Janeiro already had serious liabilities in sewerage system in the 19th century. Nireu Cavalcanti reports that Rio dwellers used to dispose of their excrements on several beaches of the Bay. If nowadays such habit sounds repulsive and outrageous, it was absolutely trivial and acceptable at the time:

> In Dom Pedro II's time, the city had approximately 140 thousand inhabitants. With the densification of all districts, and with no sewage treatment, the rivers started to receive ever-greater volumes of sewage. All that would end up in the bay. At Rua Santa Luzia (city center), there was a slaughterhouse that operated until 1840, focus of animals' waste. Another pollution focus was Ponta da Armação, in Niterói. By the end of the 19th century, with Rio great industrialization, large amounts of heavy metals started being disposed of in the bay.[46]

The report of the writer Joaquim Manuel de Macedo in the book *Memórias da Rua do Ouvidor* is noticeable. He describes the sad routine of the slaves known as "*tigres*" (tigers), which at the time would carry barrels filled with excrements. The destination of such repulsive fluid: Guanabara Bay.

> Then the most fetid and disgusting disposal of houses was made in open barrels that slaves and *negros de ganho* ["slaves for hire" who had to deliver a fixed sum to their owners] would carry to the sea, and Rua do Ouvidor, an accessible straight-line to the beach, was one of the most popular among such loaders of the repulsive barrels, from eight o'clock in the evening until ten.[47]

45. Mattos, 2004, p. 32

46. Interview with the author, in September 2015.

47. Macedo, 1952, p. 99.

The notion of the Rio de Janeiro society in the 19th century, during the Empire, was that the sewage could not cause health problems. The installation of septic tanks in lots, the urban densification and disposal of sewage in public areas were ever rising. And none of that was supervised with the due concern by the authorities. Founded in 1864, after Dom Pedro II demanded studies on England's rain water drainages and sanitary sewages, the Glória Sewage Treatment Plant (Estação de Tratamento de Esgotos da Glória) located at Rua do Russel started treating the sewage of the center of the city, but there was no water quality control. It was a very early stage treatment. The Bay started receiving a larger amount of organic matter and highly polluting elements.

In the beginning of the 20th century, President Rodrigues Alves (term of office from 1902 to 1906) lead the biggest geographical transformation of the Bay: the embankment of an area of 5 million m², which corresponds to five times the area of Flamengo Park[48]. The city center won a modern port (that started operating in 1910), new expressways and a lot of concrete in place of marshes and wetlands. The surroundings of Guanabara would be deeply changed, gaining the shapes we can see nowadays.

A good source for measuring the urbanization effects on the Bay is the destruction of its mangrove forests. Until 1500, when the settlers got to the area, the mangroves used to cover an area of approximately 261.9 km² of the coastline, occupying an area that goes from the Berquó River mouth (in the southern Rio de Janeiro district of Botafogo) to Lagoa de Itaipu (in the Oceanic Region of Niterói)[49]. Currently, the remaining area is of circa 81.1 km², being 95% of such territory in the limits of Guapi-Mirim APA.

48. *Information provided by the architect and urban planner Augusto Ivan de Freitas Pinheiro, in March 2016.*

49. *Amador, 2012, p. 373.*

50. *Pires, 2010, p. 2.*

MANGROVES OVER THE TIME50[50]

	1500	2015
OCCUPIED AREA	261.9 KM²	81.1 KM²

Across the Bay, 81.1 km² of mangroves still resist.
PHOTOGRAPH BY MARCELO PIU

Oil and sewage Bay

Already in the 20th century, the sardine processing in the Bay's surroundings impose a large focus of pollution. The lack of environmental quality in Guanabara has accelerated since 1940, with the population growth being accompanied by a voracious industrialization. The protection of natural resources agenda was not a society's demand yet – the State Foundation of Environmental Engineering (Fundação Estadual de Engenharia do Meio Ambiente – Feema) was only created in 1975. The industrial park of the Duque de Caxias refinery (Reduc), operating since 1961, ensured undeniable and significant economic advances to the country, but also implied environmental losses, such as in the oil and industrial effluents spill case.

In October 2011, a Federal Police technical report indicated the disposal of hydrocarbons, oils, and grease by Reduc in the Iguaçu River – that flows into Guanabara – in amounts surpassing

the limits allowed by the legislation. Such environmental crime led to the execution of a Conduct Adjustment Agreement by Reduc and the State Environmental Institute (Instituto Estadual do Ambiente – Inea) in October of that year, determining BRL 1 billion in investments to cease failures in the treatment of effluents and to upgrade Reduc's facilities until 2016.

An Inea report dated of September 2015 point out that the Petrobras refinery fulfilled 75% of its obligations. There were 18 met actions, in investments that amount BRL 771.65 million. The conclusion of such actions is forecasted to February 2017. Among the not fully met measures are the conclusion of a drainage adjustment system and the biological treatment of oily effluents.

The past events do not benefit Reduc when it comes to sustainability. According to a Public Prosecution Department civil proceeding, at the time, the refinery did not notify the Brazilian

Duque de Caxias Refinery (Refinaria Duque de Caxias – Reduc) is one of the largest refineries in Brazil in terms of oil refining capacity.

PHOTOGRAPH: SÃO PAULO COASTLINE OIL INDUSTRY WORKERS' UNION (SINDICATO DOS PETROLEIROS DO LITORAL PAULISTA)

National Agency of Petroleum, Natural Gas and Biofuels (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis - ANP) and the Brazilian Institute of Environment and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis – IBAMA) about another spill that took place in April 2011, preventing the surveillance actions of both agencies. The coordinator of aquatic mammals activities of the State University of Rio de Janeiro (Universidade Estadual do Rio de Janeiro – UERJ) José Lailson Brito criticizes the total absence of regulation and control of the oil activities in Guanabara:

> The pre-salt elected the Guanabara Bay as operation center. There are several terminals and shipyards, due to the oil industry, and a pressure for increasing the anchorage areas (of vessels), something absolutely absurd, such as in areas located near to the environmental protection ones.[51]

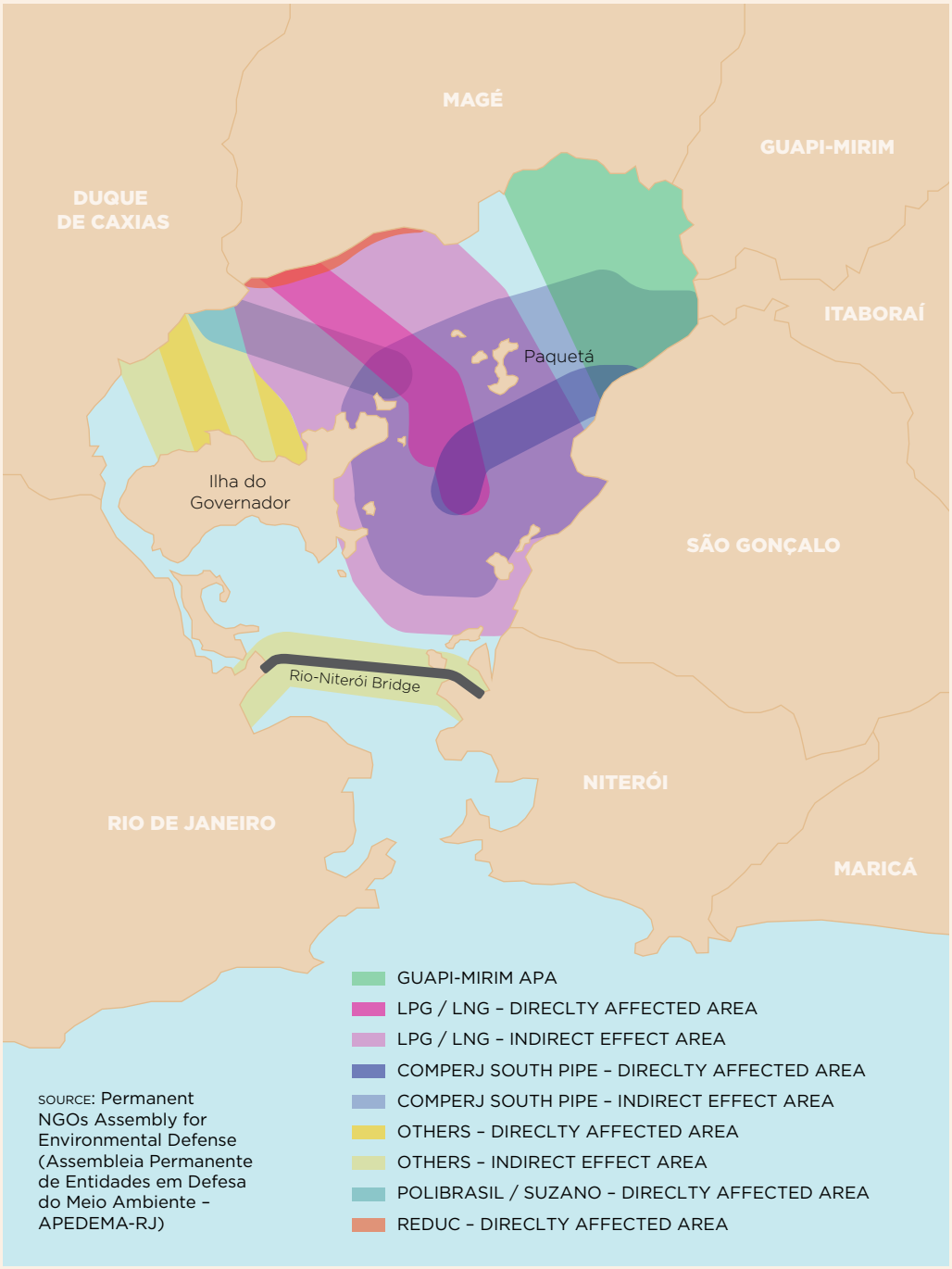
The researcher mentions the oil exploitation in deep sea and the effects of such Petrobras activity in the Guanabara routine. The Bay is used for testing the state owned company's exploitation platforms that operates in the watersheds of Santos and Campos. The discovery of oil and gas in layers about 5 thousand to 7 thousand meters below the sea level on the coastal area from Santa Catarina to Espírito Santo, in 2006, was announced as a great Brazilian achievement.

The reserves are located at a distance of 300 kilometers from the southeast region, which concentrates 55% of the country's GDP (sum of all goods and services production). The total area of the pre-salt province (149 thousand km²) corresponds to almost three and a half times the state of Rio de Janeiro. A recent research presented by the Brazilian Oil and Gas Institute of State University of Rio de Janeiro (Instituto Nacional de Óleo e Gás da Universidade do Estado do Rio de Janeiro - Uerj)[52] indicates that pre-salt may still have undiscovered oil and gas sufficient to supply the current needs of the whole world for more than five years.

51. Villela, 2015. Available at <http://agenciabrasil.ebc.com.br/geral/noticia/2015-08/botos-da-baia-de-guanabara-estao-entre-os-animais-mais-contaminado-do-mundo>. Accessed January 10th, 2016.

52. Reuters, 2015. Available at <http://g1.globo.com/economia/noticia/2015/08/pre-sal-do-brasil-contem-176-bilhoes-de-barris-de-petroleo-e-gas-diz-estudo.html>. Accessed January 10th, 2016.

MAP OF FISHING EXCLUSION IN GUANABARA BAY



SOURCE: Permanent NGOs Assembly for Environmental Defense (Assembleia Permanente de Entidades em Defesa do Meio Ambiente – APEDEMA-RJ)

Fishing restricted to 12% of the Bay

Guanabara is the main point of support for vessels dedicated to high seas operations that range from specialized activities, like submarine pipes launching, to simple transportation of supplies to the platforms through tugboats.

Divided by several activities, the fishing one ends up being pushed aside in the Bay. According to information provided by the geographer Carla Ramôa Chaves, author of the Master's dissertation *Mapeamento participativo da pesca artesanal da Baía de Guanabara*[53] (in free translation: "Participative identification of artisanal fishing in Guanabara Bay"), with the increase of the exclusion and safety areas, remains only 12% of space for the activity of fishermen.

The effects of such exclusion cause often irreversible and permanent impacts on these people's lives. The next pages' map, from the Permanent NGOs Assembly for Environmental Defense (Assembleia Permanente de Entidades em Defesa do Meio Ambiente – APEDEMA), shows that fishermen have to dispute ever-smaller areas, especially nearby the Guapi-Mirim APA.

Chaves states that 44% of the Guanabara Bay is occupied by the oil industry, considering the indirect effect areas of the industrial facilities. According to her assessment, the Bay is saturated:

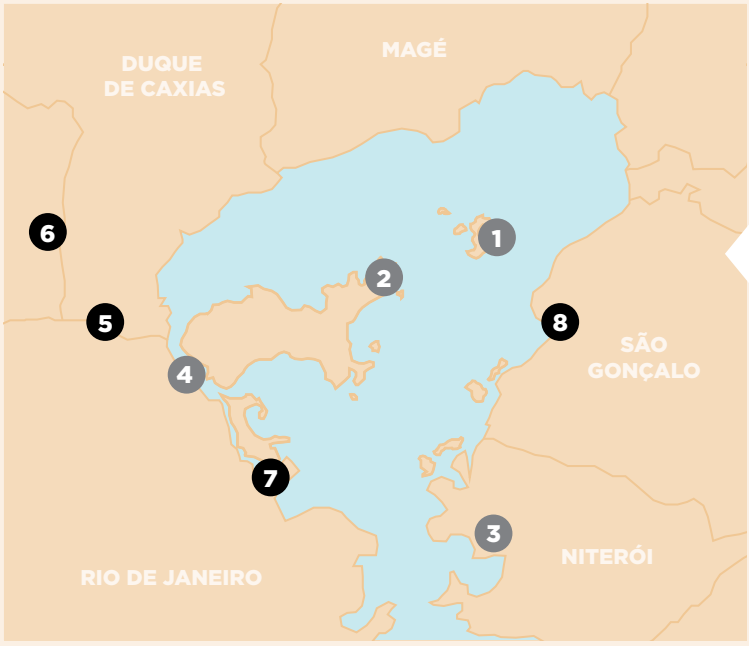
> The oil industry effect causes cumulative and synergistic impacts, bringing other activities to the Bay, such as offshore services provision by platform supply vessels [the anchored ships]. The increase of vessels has a direct and aggressive influence on Guiana dolphins' lives. Considering the occupation of the waters and the attraction of other elements to it, the oil industry promotes the bay's saturation.[54]

53. Chaves, C. R. Mapeamento Participativo da Pesca Artesanal da Baía de Guanabara. Master's dissertation in Geography. Rio de Janeiro: Universidade Federal do Rio de Janeiro, Centro de Ciências Matemáticas e da Natureza, Instituto de Geociências, 2011.

54. Interview with the author, March 2016.

INEFFECTIVE PLANTS, UNACHIEVABLE TARGET

BUILT PLANTS RENOVATED PLANTS

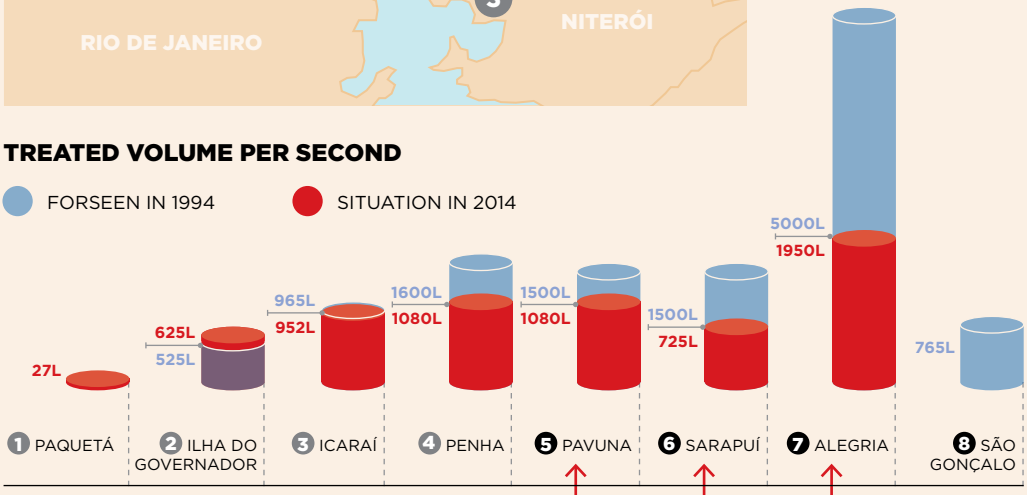


GUANABARA BAY

- **AREA:** 380km²
- **WATERSHED:** Approximately 4000km²
- **MONEY SPENT ON THE PDBG*:** US$ 1.2 billion
- **FORESEEN DURATION FOR THE FIRST STAGE:** 5 years
- **ACTUAL DURATION OF THE FIRST STAGE:** 12 years

TREATED VOLUME PER SECOND

FORSEEN IN 1994 SITUATION IN 2014

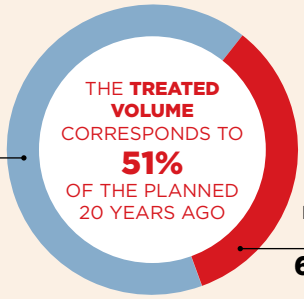


41.8% 67.4% 73.1%

NETWORK AND SEWER TRUNKS' CONCLUSION PERCENTAGE FOR THE THREE PLANTS

Inaugurated in 1998 and up to now does not operate due to lack of network and sewer trunks.

The 8 plants constructed by PDGB should treat **11,882l/s** of sewage.

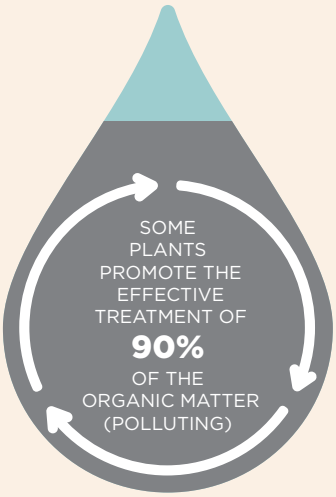


But actually treats **6.069l/s**.

(*) **PDBG:** *Programa de Despoluição da Baía de Guanabara* (Guanabara Bay Pollution Clean-Up Program)

SEWAGE

That is the amount of domestic waste that reaches its waters *in natura*, with no treatment at all.



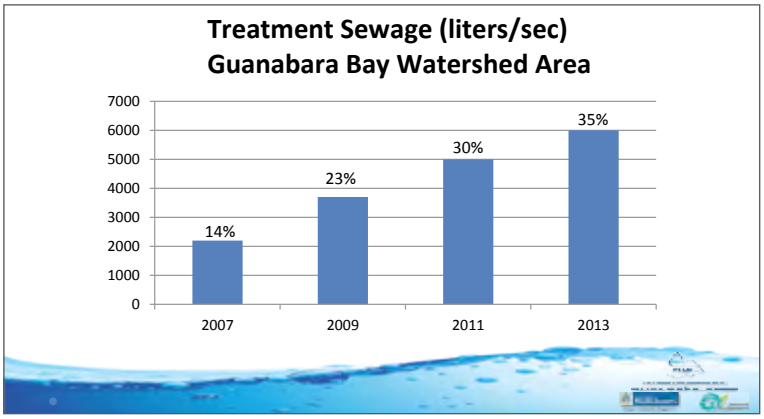
However, there are no tertiary sewage treatment plants promoting the removal of compounds like nitrogen and phosphorus yet. They can – individually and/or in combination – leverage the eutrophication of receiving waters, accumulating decaying organic matter in it and causing intoxication of marine animals.

SOURCE: ALENCAR; SCHMIDT, 2014

As you read this sentence, thousands of liters of sewage are disposed in Guanabara. Pursuant to forecasts provided by the engineer Adacto Ottoni, Professor at the State University of Rio de Janeiro (Universidade do Estado do Rio de Janeiro – Uerj), every second, 18 thousand liters of domestic waste reach its waters *in natura*, with no treatment at all. Such forecast is based on the nearby population and the sewage treatment rate of the eight plants constructed by the Guanabara Bay Pollution Clean-Up Program (Programa de Despoluição da Baía de Guanabara – subject of the next chapter). The eight stations were designed to treat 11,882 liters per second, but effectively treat only 6,069 liters per second[55], i.e., 51% of the planned two decades ago. In short, nowadays only a quarter of the sewage produced by the population in the surroundings of the Bay is effectively treated. The percentage of treated domestic sewage was always subject of controversy. In a presentation made in 2013 to the government agencies and scholars of the American state of Maryland, the representative of the Rio government stated that the rate of treated sewage in Guanabara was reaching 35% in that year (see following image).

55. 2014 data, based on information provided by Rio de Janeiro Water and Sewage State Company (Companhia Estadual de Águas e Esgotos – Cedae) to the newspaper O Globo*, in August 24th, 2014.*

Presentation by PSAM in a meeting with authorities from Maryland, United States of America, in 2013.



Whether the domestic sewage treatment rate is 25% or 35%, the fact is that such situation is not comfortable at all. To make matters worse, the state government insisted for a while in establishing an unachievable target: to treat 80% of the domestic sewage before the 2016 Olympic Games. In November 2013, the website of the Department of Environment presented[56] a report regarding the measures that would be adopted in order to meet the target of "depolluting 80% of the Guanabara Bay waters until 2016", in accordance with was determined in the Olympic Games Tender Documents. The percentage was widely publicized by the media. Almost two years later, in March 2015, there was no other choice to the Governor Luiz Fernando Pezão other than admitting to the press that they "would not have time enough" to meet the target[57].

Seven of the eight plants have secondary treatment systems, i.e. a grade capable of providing the efficient removal of 90% of the organic matter (biochemical oxygen demand) and therefore, indirectly, the removal of 90% of the suspended solids. And one of them, the sewage treatment plant ETE Icaraí, provides "chemically assisted primary treatment", process in which chemicals (ferric chloride and polymers) are previously applied

56. *Available at <http://www.rj.gov.br/web/sea/exibeconteudo?article-id=1867028>. Accessed December 2nd, 2015.*

57. O Globo *newspaper of March 24th, 2015. Available at <http://oglobo.globo.com/rio/pezao-admite-que-meta-de-tratar-esgoto-da-baia-de-guanabara-nao-sera-cumprida-ate-olimpiadas-15689514>. Accessed September 10th, 2015.*

to the primary decantation unit. The technology ensures the removal of 70% of suspended solids, and therefore, indirectly, the removal of BOD (biochemical oxygen demand) in an equal rate, 70%[58]. There are no tertiary treatment plants, which provide the removal of compounds such as nitrogen and phosphorus.

Such scenario leads Adacto Ottoni, coordinator of the Postgraduate Course in Sanitary and Environmental Engineering UERJ to state that "the Guanabara Bay is slowly dying over time":

> The accelerated siltation rate of its waters is reducing its regular water surface, increasing the water's turbidity and dramatically affecting its biodiversity. The regimes of the rivers that flow into the Guanabara Bay are currently completely irregular.[59]

BRL 27 billion to universalize sanitation

According to data provided by Instituto Trata Brasil, the discrepancy between the population growth and the sanitary sewerage advances rules the sanitation matter nearby the Bay. There is no less than 624 thousand houses that do not have access to treated water, and 1.61 million that have no sanitary sewer system. It is estimated that the universalization of sanitation in the region would require an investment of BRL 27.7 billion. As Trata Brasil points out, from 2000 to 2012, there was an improvement of 55% in the deficit of houses with no sanitary sewer. And just 6% of improvement in the evolution of the number of houses with access to the regular treatment system[60].

The aforementioned data is reflected on the poor quality of Guanabara beaches. Only two of the 35 beaches of the Bay is most of the time suitable for bathing and playing sports: Vermelha (in Urca, southern zone of Rio) and Adão e Eva (Niterói). The Icaraí and Jurujuba beaches, both in Niterói, even get to be suitable for some periods, but it depends very much

58. Biochemical oxygen demand (BOD) is the oxygen amount required for the oxidation of biodegradable organic matter under aerobic conditions.

59. Interview with the author, September 2015.

60. Grael, 2015.

on the lack of precipitations. Botafogo Beach, a postcard of the capital, has never been suitable for bathing ever since Inea started publishing the historical series in the state government website, in 2007.

The former state secretary for the environment (from 2007 to 2008 and then from 2010 to 2014) and current state deputy (without party affiliation) Carlos Minc maintains that there were "several improvements" in the last eight years of environmental management[61], but recognizes that the situation of Guanabara is far from the acceptable:

> If you ask me if the sanitation issue in Rio is good, I would say it is not. If you ask me how the environment started interfering with this matter, I would say that the situation has changed completely. The State Fund for Environmental Conservation (Fundo Estadual de Conservação Ambiental – Fecam) started investing solely on environmental measures. In 2007, BRL 220 million were invested, and in 2013, BRL 140 million.
>
> Firstly, the resources would go to all sectors but sanitation. Sérgio Cabral (former governor) undertook to fully invest the resources. At the first secretariat meeting, there was an attempt of breaking the agreement, so I said I would not take it (the office), he called Lula. Formerly, the environment did not participate in the sanitation policy.
>
> Seven years ago, in the surroundings of Guanabara Bay, it was of 13% (the domestic sewage treatment rate). Now we have 40%[62]. One might ask: is 40% ok? That means that 60% of the poop of 9 million people is disposed in the Guanabara Bay. It is obviously bad. But we have to compare it with the past. We had a lot of advance. The current sanitation status in Rio is unacceptable and very backward. But now it is a priority.

61. *Interview with the author, July 2015.*

62. *The information provided by Minc conflicts with the forecasts made by the engineer Adacto Ottoni (Uerj). The deputy speaks of 40% of treatment rate, but Ottoni's forecast indicates 25%.*

Fisherman at Guapi-Mirim APA.
PHOTOGRAPH BY CUSTODIO COIMBRA

MUNICIPALITIES NEARBY THE BAY. SEWAGE TREATMENT AND WATER SUPPLY DATA

MUNICIPALITY	TOTAL POPULATION SUPPLIED WITH SANITARY SEWERAGE (CITY DWELLERS)	VOLUME OF TREATED SEWAGE (1.000 M³/ YEAR)	SEWAGE TREATMENT RATE (%)	RATE OF URBAN SUPPLY IN SEWERAGE REGARDING THE MUNICIPALITIES (%)	RATE OF TOTAL WATER SUPPLY (%)
RIO DE JANEIRO	5,363,621	334,572.81	71.29%	83.11	91.62%
DUQUE DE CAIXIAS	389,657	2,934.00	13.38%	44.51	86.27%
MAGÉ	99,496	0	0	44.98	79.31%
GUAPI-MIRIM	-	-	-	-	67.72%
ITABORAÍ	96,884	216	4.72%	43.16	81.07%
SÃO GONÇALO	400,976	7,863.00	17.6%	38.89	84.68%
NITERÓI	460,790	42,920.40	100%	93	100%
NILÓPOLIS	157,972	0	0	99.79	99.79%
SÃO JOÃO DE MERITI	225,040	0	0	48.85	92.72%
BELFORD ROXO	196,024	10,775.00	88.74%	40.89	80.05%
NOVA IGUAÇU	363,748	36	0.15%	45.62	93.76%
MESQUITA	74,641	675	21.91%	43.78	96.47%
PETRÓPOLIS	248,342	9,943.00	80.2%	86.67	93.49%
CACHOEIRAS DE MACACU	32,000	0	0	53.5	87.52%
RIO BONITO	-	-	-	0	86.84%
TANGUÁ	10,126	0	0	35.3	67.78%

SOURCE: SNIS – Série Histórica/ Sistema Nacional de Informações sobre Saneamento – Secretaria Nacional de Saneamento Ambiental [SNSA]/ Ministério das Cidades – Ano de referência: 2014. Available at <http://app.cidades.gov.br/serieHistorica/municipio/index>. Accessed April 10th, 2015.

High ammonium amounts

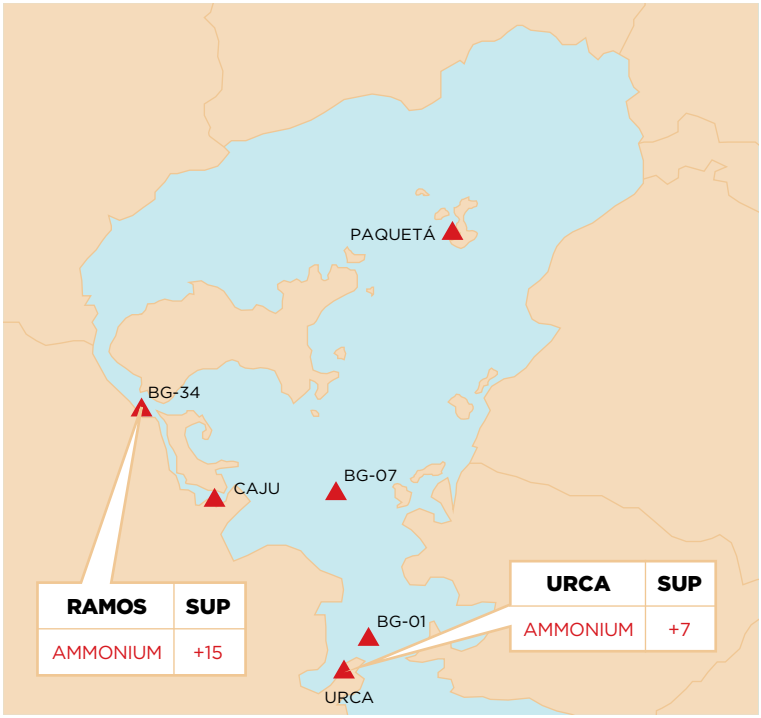
Carlos Minc maintains that sewage treatment has become a priority nearby the Bay, however, that perception is not supported by the quality indicators of such waters. The biologist Rodolfo Paranhos, head of the Hydrobiology Laboratory of the Biology Institute of UFRJ, monitors six areas of the Bay since 1997. Monthly samples are collected and temperature, oxygen, bacterial, virus, carbon, nitrogen and phosphorus analyses are made. The tide influence was not accounted in the outcome. He ensures that is not possible to say that there was any advance towards clean-up:

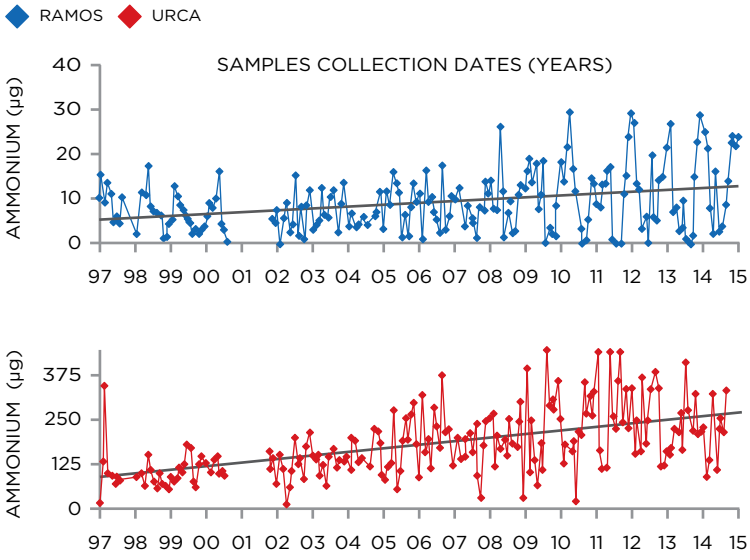
> In general, the water quality is decreasing. My only hope is that we use the 2016 Olympics to start a solid sewage treatment and basic sanitation program. Pollution clean-up concerns several other actions. Sydney Harbour (Australia) was not clean in 2000, but the clean-up project was effectively in course. We will not have any advance until we invest in tertiary treatment plants (of sewage) that ensure an effective removal of nitrogen and phosphorus.[63]

To reinforce his point of view, Paranhos presented at first hand the results of ammonia concentration, a good indicator of recent sewage disposal. In the collect spot in the surroundings of Ilha de Paquetá, the amounts have increased since 2002. The same trend can be seen in Urca (increase of 7%) and Ramos (increase of 15%) since 1999. But the biologist has observed that the increase rates vary over the year, being higher in periods of El Niño (phenomenon characterized by the abnormal warming of surface waters of the Pacific Ocean).

63. Inteview with the author, July 2015.

ANNUAL INCREASE (%)





SOURCE: Hydrobiology Laboratory of the Biology Institute of UFRJ.

The impact of 18 thousand liters of sewage per second on the biodiversity is devastating. Formerly a pleasant bathing coastal area, deserving to be on magazines and newspapers advertisings, a third of the year, Ramos Beach is "anoxic" – i.e. it has no oxygen, fundamental for the aquatic life development, at all. During such period, the dissolved oxygen rate falls to less than 2 mg/liter.

However, not all is lost. The same region of Ramos, that is almost dead for most of the time, is oddly where the greatest rates of oxygen are registered for some periods. The researcher explains that the phenomenon is caused by the highest biological activity of microorganisms that take part on photosynthesis degrading the organic matter, and constitutes a thread of hope:

> Oddly, the very same spots where we verify zero oxygen, during some periods in the year, present the highest amounts in the bay. The high biological activity, promoted by the nutrients concentration, is responsible for this feature that shows Guanabara Bay's vitality. It is a sign that yes, the bay may recover.[64]

64. Interview with the author, July 2015.

Urca Beach, one of the ammonium measurement spots of the Hydrobiology Laboratory of the Biology Institute of UFRJ.
PHOTOGRAPH BY MARCELO PIU

Industrial pollution, a black box

Surrounded by municipalities of intense industrial activity, the Guanabara Bay watershed has a history of large facilities, such as Reduc, Eletroquímica Pan-Americana, Curtume Carioca, in addition to ports and marine terminals and several small-size industries that range from garages, industrial laundries and small chlorine factories.

There is no doubt that the industrial pollution, which had its peak in the 1970's, is now more controlled. However, it does not prevent tons of pollutants from still reaching its waters. According to the Guanaraba Bay Commission of the Rio de Janeiro State Legislative Assembly (Assembleia Legislativa do Rio de Janeiro – ALERJ)[65], 14 thousand companies and industries are located in the watershed. In a Public Hearing at Alerj, in August 28th, 2015, the Sanitation Program for Municipalities Surrounding Guanabara Bay (Programa de Saneamento Ambiental da Baía de Guanabara dos Municípios do Entorno – PSAM) consultant Guido Gelli stated that the surveillance work is still insufficient:

> The industries surveillance by Inea does not work sufficiently yet. However, it is an action of easier control. The environmental agency is now focused on the 200 most polluting ones in the bay. The purpose is to assess if such industries are performing the control and monitoring of their effluents.[66]

The Labaqua/Aqualogy consortium was contracted by Inea in June 2015, within the framework of PSAM, to perform a scan of the situation of the 200 most potentially pollutant industries of Guanabara. The site work counts with 16 engineers and is not concluded yet – the forecast is that it will be finished in October 2016. Consultants of this sector estimate that industrial pollution represents only 15% of the total pollutants disposed in the marine ecosystem. The larger part of it (85%) is related to the lack of treatment of domestic sewage.

65. *Established in July 2015 and having its final report forecasted to April 2016, the Commission has the purpose of identifying all players involved in the discussion regarding the Guanabara Bay situation and its environmental effects. Available at: <http://www.alerj.rj.gov.br/common/noticia_corpo.asp?num=49106#sthash.ZOFLWs3Q.dpuf>. Accessed September 20th, 2015.*

66. *Statement during Public Hearing, August 28th, 2015.*

Main potentially pollutant industries in the Guanabara Bay watershed region[67]

- **REFINARIA DUQUE DE CAXIAS (REDUC):** At the left bank of Iguaçu River, next to the mouth, Reduc has probably destroyed great part of the primeval mangrove forest, causing impacts by the disposal of oil and other debris.
- **BAYER DO BRASIL:** Large-sized Chemical industry, fabricates biocides, veterinary and polyurethane products, pigments, chromium salts. Located in Belford Roxo, disposes of its effluents in Sarapuí River. One of the purposes of its production units is to minimize the effluents generation.
- **REFINARIA DE PETRÓLEO DE MANGUINHOS:** Is the third oldest refinery of Brazil (inaugurated in 1954) and is located in the northern zone of Rio. It uses the Cunha Channel, close to its outfall into the Guanabara Bay, as its effluents receiver water body. Its main products are gasoline and other oil products, liquefied petroleum gas, fuel oil and diesel.
- **ELETROQUÍMICA PAN-AMERICANA** (CURRENT KATRIUM INDÚSTRIAS QUÍMICAS S/A): Second company in chlorine production in Brazil, sells inputs to the Rio de Janeiro Water and Sewage State Company (Companhia Estadual de Águas e Esgotos – Cedae). Is located in the district of Honório Gurgel. Uses as receiver water body the Acari River, a tributary of the Meriti River. For a long time, the main problem of Pan-Americana was the disposal of mercury in the Acari and Meriti rivers.
- **PETROFLEX INDÚSTRIA DE COMÉRCIO LTDA:** Duque de Caxias rubber factory. Estrela River is the receptor of its effluents and flows into the Guanabara Bay. However, Petroflex does not use its waters for refrigeration anymore.
- **COMPANHIA PROGRESSO INDUSTRIAL DO BRASIL – BANGU FACTORY:** Regarded as one of the oldest polluting industries of Guanabara Bay, used to produce fabrics and

67. Soares, 2010, p. 5.

did not have any kind of environmental concern. Rio Sarapuí main river is even today known as "*rio das tintas*" (paint river) due to having for years received the colorful effluents of the dying processes of their fabrics. The factory is currently deactivated. It was replaced by the Bangu Shopping mall.

- **COMPANHIA BRASILEIRA DE ANTIBIÓTICOS (CIBRAN):** Located in the municipality of Tanguá, contributes to the disposal of liquid contaminants with high concentrations of BOD (biochemical oxygen demand) and COD (chemical oxygen demand). For disposing of its effluents in the Caceribu River, it was charged for the death of animals nearby its waste dumping point.

- **ATLANTIC INDÚSTRIAS DE CONSERVAS:** Medium-sized factory of food located in Niterói. Its main offenders are the high concentrations of BOD and COD, oils and greases. Once such industry has never implemented any treatment system, Guanabara Bay is its receiver water body.

The assurance of impunity opens a breach for harmful practices by companies, especially the small-sized ones. Researches indicates greatest concentrations of pollutants derived from industries in the western side of the Bay, associated with the city of Rio, the Rio port, the embankment controlled by Jardim Gramacho (the ineffective leachate treatment remains as a liability in the region) and the limited water circulation due to the presence of Ilha do Fundão and Ilha do Governador islands.

As one goes further north in Bay, nearby the Guapi-Mirim APA, the concentrations decrease. Although located under the metropolis pressure, the mangrove still helps to preserve the healthy condition of such area's waters. If the trip goes further, heading to Niterói, the concentrations rise again due to the absurd population density of the municipality of São Gonçalo, to the shipyards and industries of Ilha da Conceição and due to the also very dense occupation of the city of Niterói.

Some establishments that should be the example are failing the sustainability test as well. The navy yard Arsenal de Marinha, located at Ilha das Cobras, in the city centre of Rio, has not complied with the deadline for connecting to the collecting system of Cedae[68], which takes the sewage to be treated at the treatment plant ETE Alegria. The initial deadline determined that the construction works should be concluded in December 2014. In April 2016, however, in accordance with information provided by the Cedae, the naval base was not totally connected to the regular sanitation system.

According to the president of Cedae, Jorge Briard, 90% of the Arsenal sewage volume started being effectively treated, but 10%[69] hasn't yet. It receives ten thousand people on daily basis. Each citizen produces 50 liters of sewage per day, Ilha das Cobras produces approximately 500 thousand liters of waste, from which 50 thousand liters per day have not the proper treatment yet, contributing to the Bay's pollution. The prospect is that all the system shall be connected with the treatment plant ETE Alegria until July 2016.

Ninety daily tons of trash

The floating trash, carried by the 143 rivers, channels and streams that outfall into the Bay, is another matter that remains unsolved. Forecasts of the Brazilian Association of Public Cleaning and Special Waste Companies (Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais – Abrelpe)[70] are not encouraging: on daily basis, approximately 90 tons of waste are disposed of in the Bay's water. Such volume is pretty much higher than the collection capacity of ecobarriers and ecoboats, palliative projects that are currently viewed as the state government bet for minimizing the negative effect on the ecosystem.

The ecobarriers are structures made of plastic drums tied to a steel cord that aim at catching the waste at the rivers' mouth,

68. The Rio de Janeiro Water and Sewage State Company (Companhia Estadual de Águas e Esgotos – Cedae) was established in 1975. It is responsible for operating and maintaining the collection, treatment, supply, and distribution of water systems, besides collection, transport, treatment and the final destination of sewage produced by 62 municipalities associated to the Rio State. For 40 years, it was not supervised by any regulatory agency. In August 2015, the Regulatory Agency for Energy and Basic Sanitation of the State of Rio de Janeiro (Agência Reguladora de Energia e Saneamento Basico do Estado do Rio – Agenersa) started assessing the company, in accordance with the dispositions of the Federal Sanitation Law (11.445/2007).

69. Information provided to the author by Cedae.

70. Information provided to the author in August 2015.

before they get to Guanabara. There are currently nine of them installed in the Bay's surrounding. Inea has informed that the structures remove a monthly average of 238 tons of floating trash, which means 8.8% of the total volume that gets to the Bay. In January 2016, the ten ecoboats currently in operation have collected 36.9 tons of floating waste – which means just 1.3% of the total. In brief, such activities are like flogging a dead horse. Interrupted in February 23rd, 2015, the ecoboats program has a monthly cost of circa BRL 300 thousand, afforded by the State Fund for Environmental Conservation (Fundo Estadual de Conservação Ambiental – Fecam), and was resumed in July 1st, 2015.

The Abrelpe president Carlos Silva Filho calculated the floating trash in the bay taking in account that 296 tons of waste aren't even daily collected in seven cities surrounding the Bay (Rio, Caxias, Magé, Guapi-Mirim, Itaboraí, São Gonçalo and Niterói). According to a research conducted by the entity, the sum represents 2.2% of the amount produced in such municipalities. It is estimated that 30% of the 296 tons get to the Bay's waters.

Ecobarrier located at Meriti River.
PHOTOGRAPH BY CUSTODIO COIMBRA

Leachate: a persisting problem

The disposal of leachate in the Guanabara waters is also continuously happening, despite of the recent actions of closing open-air dumps. The leachate is a highly pollutant dark liquid resulting from the degradation of the organic matter present in solid waste. Some controlled dumps and landfills (in which there is some engineering control, though not the most appropriate) direct their leachate straightly to the Bay. Complaints addressed to the Department of Environment in the second semester of 2015 reports that the controlled landfill of Bongaba, in Magé, pollutes the Inhomirim River, which flows directly into Estrela River that, in its turn, outfalls into Guanabara.

In a public hearing on October 23rd, 2015, a fisherman residing in Duque de Caxias has denounced the Gás Verde S/A consortium, that runs the Jardim Gramacho landfill after it was shut down, stating that there was an illegal system that would lead directly to Iguaço River, even showing a footage. Besides, according to the filed complaint, the leachate contention reservoirs (*"piscinões"*, in free translation "big pools") are about to overflow.

Such chaotic scenario is added to the poor life quality of most part of the 8.4 million people living in Guanabara watershed. Jardim Gramacho, district in Duque de Caxias that for 36 years housed the biggest waste dump in Latin America[71], is the symbol if such unacceptable discrepancy. According to data surveyed by the Institute for Labor and Society Studies (Instituto de Estudos do Trabalho e Sociedade – IETS), with the deactivation of the controlled waste dump, the per capita income by domicile of waste picker families of Jardim Gramacho has drop from monthly BRL 311 to BRL 101. The poverty level with the dump was 49.3%. With the end of its activities, it rose to 86.7%. For Iets, are necessary BRL 6.7 million to eradicate the poverty in the area within a year.

Roberta Alves, known as Docinho, is a former waste picker. Nowadays she coordinates the Recycling Center of Jardim Gramacho. She summarizes the dramatic situation of the waste pickers:

71. The metropolitan waste dump of Jardim Gramacho was closed in June 2012.

> The waste pickers' lives have changed, and the difficulties have increased. It is being difficult to communicate with the city governments and state governor, which does not really care about the waste pickers. The throat has lots of work, but hands have little. There's a lack of public interest and structuring policies. I'd rather be at the dump than talking to the state and municipal governments.

Based on interviews with engineers that work in the sector, inspectors of Rio surveillance body – which preferred to remain anonymous – and professors, I have drawn up a table to present the situation of the trash around the Bay. There are six cases where the pollution by leachate is alarming. However, there are significant advances in the last ten years, especially due to the work performed by companies that found a great niche in running landfills. Modern treatment system has been implemented in landfills, such as the reverse osmosis model, capable of converting part of the pollutants in clean water. Currently, 611 cubic meters of leachate produced in the surroundings of the Bay per day receive some kind of treatment.

WASTE DUMPS IN THE SURROUNDINGS OF THE BAY

	CITIES FROM WHICH IT RECEIVES WASTE	AMOUNT OF WASTE PER DAY	IS IT OPERATIONAL?	DOES IT PRODUCES AND TREATS LEACHATE?	LEACHATE AMOUNT PER DAY (M^3/DAY)	WHEN WAS IT CLOSED?
BABI (BELFORD ROXO)	-	-	NO	PRODUCES, BUT DOES NOT TREAT	N/A	MARCH, 2012
JAPERI	-	-	NO	PRODUCES, BUT DOES NOT TREAT	N/A	JULY, 2014
GUAPI-MIRIM	-	-	NO	PRODUCES, BUT DOES NOT TREAT	N/A	SEPTEMBER, 2012
PARACAMBI	-	-	NO	NO (IT IS REMEDIED)		2011
CAJU	-	-	NO	NO		30 YEARS AGO
KENNEDY WASTE DUMP (CAXIAS)	-	-	NO	NO		25 YEARS AGO

CONTROLLED LANDFILLS						
	CITIES FROM WHICH IT RECEIVES WASTE	AMOUNT OF WASTE PER DAY	IS IT OPERA-TIONAL?	DOES IT PRODUCES AND TREATS LEACHATE?	LEACHATE AMOUNT PER DAY (M^3/DAY)	WHEN WAS IT CLOSED?
MORRO DO CÉU (NITERÓI)	NITERÓI	200 TONS (STREETS SWEEPING)	YES	NO	-	-
GERICINÓ	RIO DE JANEIRO (RUBBLE AND SWEEPING)	700 TONS	YES	THERE ARE COMPLAINTS THAT THE LIQUID SPILLS, WITH NO TREATMENT, INTO THE SARAPUÍ RIVER	N/A	-
BONGABA (MAGÉ)	-	-	NO	YES	N/A	-
JARDIM GRAMACHO (CAXIAS)	-	-	NO	THERE ARE COMPLAINTS THAT THE LEACHATE IS NOT BEING TREATED AND DISPOSED OF IN THE IGUAÇU RIVER	N/A	JUNE, 2012
ITAOCA (SÃO GONÇALO)	-	-	NO	INEA INSPECTORS CAN NOT REACH THE AREA, CONTROLLED BY THE DRUG TRAFFICKING	N/A	FEBRUARY, 2012
KENNEDY WASTE DUMP (CAXIAS)	-	-	NO	NO	N/A	25 YEARS AGO

SANITARY LANDFILLS						
	CITIES FROM WHICH IT RECEIVES WASTE	AMOUNT OF WASTE PER DAY	IS IT OPERATIONAL?	DOES IT PRODUCES AND TREATS LEACHATE?	LEACHATE AMOUNT PER DAY (M^3/DAY)	WHEN WAS IT CLOSED?
NOVA IGUAÇU	NOVA IGUAÇU, (PART OF) DUQUE DE CAXIAS, QUEIMADOS, MESQUITA, NILÓPOLIS, AND SÃO JOÃO DE MERITI	3,400 TONS	YES	YES, REVERSE OSMOSIS SYTEMS	315	-
SÃO GONÇALO (ANAIA)	SÃO GONÇALO, NITERÓI AND MARICÁ	1,900 TON	YES	YES, REVERSE OSMOSIS SYSTEM	120	-
ITABORAÍ	ITABORAÍ, MAGÉ, CACHOEIRAS DE MACACU, GUAPI-MIRIM, TANGUÁ, RIO BONITO, PATY DO ALFERES, AND CASIMIRO DE ABREU	1,130 TON	YES	YES. DIRECTS IT TO TREATMENT AT THE PROLAGOS PLANT	86	-
SANITATION CELL IN CTR PARACAMBI	PARACAMBI	29 TONS	YES	RECIRCULATES THE LEACHATE OVER THE MASS	10	
BELFORD ROXO (BOB AMBIENTAL)	(PART OF) DUQUE DE CAXIAS, AND BELFORD ROXO	800 TONS	YES	YES. WILL IMPLEMENT THE REVERSE OSMOSIS SYSTEM	90	-
TOTAL		**7,100 TONS**			**621**	

Mercury in the sediments

One of the biggest researchers of the heavy metals pollution in the Bay, the oceanographer Juio Cesar Wasserman, professor at the Federal Fluminense University (Universidade Federal Fluminense – UFF), states that no part of the Bay has such elements concentrations considered natural. Yes, it is possible to find mercury in bays' bottom, even without pollution – Amazonian rivers, for example, have high natural rates of mercury.

> Even the cleaner locations present concentrations four to six times the amounts regarded as natural. We found some places with mercury contamination (in the sediments) of 200 times the amounts regarded as natural. The contamination by metals is increasing in the food chain and primarily affects carnivore species of the ichthyofauna, the ones with higher economic value, and, eventually, also affects the fishermen.[72]

Mercury is a toxic pollutant that is characterized for its high environmental risk, causing ecological imbalance and harms to the human health, especially due to its high potential of bioaccumulation and bioamplification over the food chain. And, as Wasserman adds, that is an issue when trying to remediate its effects:

> There is no remediation measure for the contamination by heavy metals in the sediment, because they could not be physically or chemically separated. In addition, they do not degrade over the years.
>
> In an environment contaminated by metals, the silting over the years ends up burying contaminated sediments and, if the contamination was stopped,

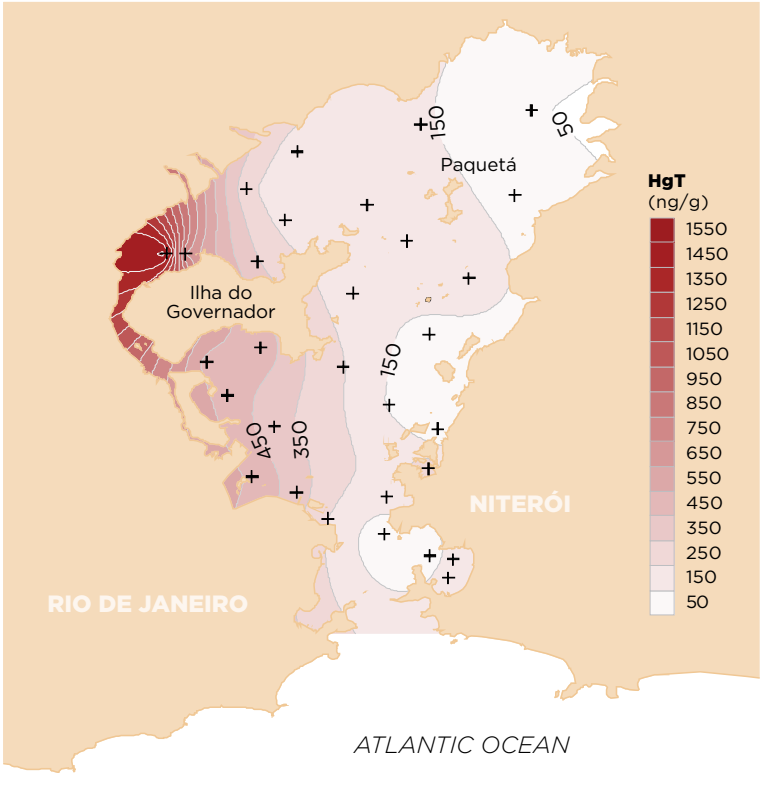
72. Interview with the author, in July 2015.

the sediment coming atop is decontaminated, causing the environment and, particularly, the fishes not to have any contact with the former sediment anymore.

Unfortunately, such process may take too long. Minamata Bay, in Japan, that was contaminated by mercury, was almost completely embanked by men and the fishes' contamination was only reduced 60 years after the interruption of the contamination.[73]

73. Interview with the author, in July 2015.

DISTRIBUTION OF TOTAL MERCURY CONCENTRATIONS IN THE SUPERFICIAL SEDIMENTS OF GUANABARA BAY (%)



SOURCE: OLIVEIRA; WASSERMAN; CAMPOS, 2010.

January 2000's hell

The biggest environmental accident in the Bay took place in March 26, 1975, when the Iraqi ship Tarik Ibn Ziyad had a hull breach and spilt 6 million liter of oil into the Bay's waters. Several beaches were affected in the city of Rio de Janeiro and Niterói, both at the inner bay and at the oceanic coast, and the contamination had a significant impact on the animal communities of the intertidal zone[74]. In Rio, the oil has reached the beaches of Ilha do Governador and Ilha do Fundão.

The Jequiá River was seriously struck by a thick layer of oil that caught fire and burnt circa 2 hectare of mangrove down. The two main emergency methods used were spreading dispersant and using straw as absorbing material. After the oil absorbance, the straw was manually removed. The clean-up operations lasted until April 6 of that year.

The second biggest environmental disaster in the Bay's recent history took place in January 2000. A photograph by the photojournalist Domingos Peixoto, from the newspaper *O Globo*, summarized all the tragedy and got global attention: a Neotropic Cormorant, in Portuguese, *biguá*, entirely covered by a thick layer of oil, with red eyes and a agony expression, as if asking for help. A technical report conducted by the Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering of the Federal University of Rio de Janeiro (Instituto Alberto Luiz Coimbra de Pós-Graduação e Pesquisa de Engenharia – Coppe/UFRJ) indicated Petrobras neglect as the main cause of the tragedy: a Petrobras pipe that connected the Refinaria Duque de Caxias (Reduc) to the Ilha d'Água terminal, in Ilha do Governador, broke before the dawn of January 18th, causing the spill of 1.3 million liters of fuel oil in the Bay's waters. The oil slick spread for 40 km², what means 12% of the water surface.

In March of that year, the Rio de Janeiro State Federation of Fishermen (Federação dos Pescadores do Rio de Janeiro – Feperj) filed a class action of pain and suffering charging amounts between

74. Calixto, 2011.

Neotropic Cormorant covered by oil agonizes at Mauá Beach, in Magé, struck by the 2000 oil spill in Guanabara Bay.
PHOTOGRAPH BY DOMINGOS PEIXOTO / *O GLOBO*

BRL 60 thousand and 90 thousand per aggrieved party to 12 thousand fishermen. Even though it was convicted, Petrobras did not pay damages.

In an interview in February 2014, Ronaldo Moreno, member of the Fórum de Pescadores e Amigos do Mar (in free translation, Fishermen and Sea's Friends Forum), states that:

> The surface oil was cleaned-up, but a lot of it has sunk to the bottom. It was not just the spill; fishermen are being impaired by the sailing oil tankers and pipes that have being installed. Many people ceased fishing.[75]

The fisherman Isaac Alves de Oliveira, 52 years old, reported in the same context of Ronaldos's statement that fishing is an activity less and less frequent in the Bay:

> There is no way of doing it anymore, there is a lot of pollution, heavy metal and oil spills by ships. We are fishing very low fish amounts.

75. Available at <http://www.oeco.org.br/reportagens/28021-baia-de-guanabara-vazamento-da-petrobras-completa-14-anos/>. Accessed October 20th, 2015.

Sludge in the mouth of the bay

According to the Baía Viva movement, in the last 15 years, the number of artisanal fishermen had a 66% decrease in Guanabara Bay. The environmentalist Sérgio Ricardo Lima criticizes the disposal of tons of dredging waste, from shipyards' construction works, in the Bay's entrance:

> Such dredgings, from nine companies at the inner bay, are producing a forecasted volume of three to four Maracanã stadiums of sludge contaminated by heavy metals arising from the Rio, Niterói and Beira Beach ports, in São Gonçalo, in addition to the Cunha Channel. Besides, the ships are daily throwing such contaminated sediments in the entrance of Guanabara Bay, polluting Niterói beaches and preventing the fishing and diving activities.[76]

Warned by the Department of Public Prosecution, on April 2014, the judge Roseli Nalin of the 5th Public Treasury Court determined the suspension of the disposal in an area of 15 kilometers of the Itaipu Beach, in Niterói. However, a month later, the High Court judge Lúcio Durante from the 19th Civil Chamber granted a supersedeas in favor of the Rio de Janeiro State Environmental Institute (Instituto Estadual do Ambiente – Inea), which had previously authorized the disposal[77]. In his vote, the High Court judge considered that the disposal interruption "could cause a draught reduction in the access channels and evolution basins of Rio de Janeiro and Niterói ports, of the maritime and port operation of such ports, in addition to the loss of the Rio de Janeiro state competiveness in relation to other coastal states".

According to the diver Otto Sobral, that was the wrong decision:

> Such wastes are burying an area that is attractive to fish shoals. The fishermen reports of trash catches indicate that it is not the best place for the disposal.[78]

76. Report provided by the environmentalist Sérgio Ricardo. Published in the Portal EcoDebate, in December 17th, 2014. Available at <http://www.ecodebate.com.br/2014/12/17/rj-ibama-podera-rever-licenciamentos-ambientais-de-empreendimentos-poluidores/>. Accessed October 20th, 2015.

77. Consultation of the lawsuit numbered 0022842-81.2014.8.19.0000 at the Rio Court of Justice (TJRJ) website.

78. Interview with the author, April 2014.

Indeed, the continuous dredging for Rio port activities is causing huge effects to the ecosystem. In 2015, according to data from the Guanabara Bay Commission in ALERJ), more than BRL 220 million have been addressed to the Rio port dredging works. There are approximately 19 anchorage areas in the Guanabara Bay, and plans to create more. That means more dredging, more effects, and hydrodynamic changes.

The increase of ships movement in the Bay is impressive. In 2009, the port of Rio received 1,568 ships. In 2010, the number rose to 2,374. According to statistics of Companhia Docas, in 2011, there were 3,861 berthings. In 2012, the number of vessels was 4,745, in 2013, 4,897, and in 2014, 5,198. In other words, in five years, there was circa 231% of increase in the number of vessels. This information was disclosed in Guanabara Bay Commission's public hearings, chaired by Flávio Serafini (PSOL party).

Comperj: licensing with omissions and inconsistencies

Initiated in 2006, the licensing process of the Rio de Janeiro Petrochemical Complex (Complexo Petroquímico do Estado do Rio de Janeiro – Comperj) is an example of the scale of ecosystem transformations in the recent history of Guanabara. Fifty-two permits were granted for the implementation of work sites, which resulted in 816 obligations to fulfill. Comperj, budgeted in impressive USD 8.38 billion in 2007[79], would be a turning point for making possible the control of refining operations, overall with the production of polyethylene (PE), polypropylene (PP) and polyethylene terephthalate (PET) aiming at the national and international markets. The state government and Union forecast was to open the refinery in 2012 – but, up to the present, the construction is not concluded yet. Despite of the amount of the environmental constraints and compensations, unprecedented in the state's recent history, the project still rises controversies and deadlocks.

79. Available at <http://www.observatoriodopresal.com.br/wp-content/uploads/2011/08/Apresenta%C3%A7%C3%A3o-EIA-EM-TODOS-OS-VOLUMES.pdf>. Accessed October 20th, 2015

The 2nd District Attorney's Office of Itaboraí and Magé, where nine investigations on Comperj are being conducted, understands that the complex licensing process had "omissions, inconsistencies and inaccuracies" that prevent the correct assessment of the environmental effects[80]. According to Carlos Minc, the licensing process required the uncommon compensation of BRL 900 million for the environment and surrounding cities: BRL 100 million for Itaboraí sanitation, BRL 60 million for Maricá sanitation, BRL 80 million for São Gonçalo sanitation, and BRL 250 million for water supply[81].

The transfers are still in await status, report the city governments. Besides, the planting of seven million seedlings and the construction of a port for fishing workers were not performed yet. However, what could be the effects of Comperj on the Guanabara ecosystem? The truth is that the country's economic crisis, initiated in 2015, along with the devaluation of the oil barrel, has struck Comperj, and nobody knows when or even if the project is really leaving the drawing board anymore. The "El Dorado" of Itaboraí has turned into dust. From the environmental perspective, this is not necessarily bad news.

80. Alencar and Galdo, 2014, p.14.

81. Information provided to the author, in July 2015.

82. Puff, 2015. Available at <http://economia.uol.com.br/noticias/bbc/2015/02/13/impasse-na-petrobras-traz-demissoes-e-fome-a-cidade-eldorado-do-petroleo.htm>. Accessed October 20th, 2015.

THE "EL DORADO" THAT HAS TURNED INTO DUST

Whoever would walk by the city centre of Itaboraí eight years ago could notice an effervescent atmosphere. The federal government promise was to transform the city, creating thousands of job positions related to Comperj. The promise of an El Dorado in the eastern side of the Rio state has shortly turned to dust. As reported by an article of BBC Brazil released by the website of UOL in February 13, 2015[82], according to Sintramon (the union representing Itaboraí workers), until June 2014, there were 18 thousand workers in the work site. With the financial and political crisis initiated in 2015, there are less than 6 thousand, an expressive drop of 66% in less than two years. The project of constructing a major refining complex that should be completed in 2014, according to Petrobras, is being redesigned.

Among the companies that remain in the project, according to the article, 15 are mentioned in the list of Lava Jato (Car Wash) Operation, the Attorney General's Office investigation that discovered a wide corruption scheme in Petrobras, involving politicians of several parties and the largest contractors in the country. Besides, some of the companies still related to Comperj are facing problems, partly due to the suspension of amendment payments and renewal of contracts.

Dolphins, seahorses and turtles try to resist

Present in the coat of arms of the city of Rio de Janeiro, the Guiana dolphins (*Sotalia guianensis*) have a history of resistance in the Guanabara Bay. Living in the inner waters, especially in the area between Ilha de Paquetá and Magé, they were 800 in the 1970's decade. Nowadays, they are just 34, according to the Aquatic Mammals and Bioindicators Laboratory of the State University of Rio de Janeiro (Laboratório de Mamíferos Aquáticos e Bioindicadores – Maqua/UERJ). The mammals are monitored by the university since 1995. Biologists already know that the dredgings change the environment features and are a significant stress factors, which contributes to the death of dolphins, as well as the noise pollution. In the last 21 years, 67 deaths of animals were registered.

Albeit resistant, the Guanabara Bay dolphins are among the most contaminated animals in the world, and may cease to exist in this ecosystem. In a public hearing at the Legislative Assembly of Rio, in August 2015, the coordinator of the aquatic mammals' activities in Uerj, José Lailson Brito, stated that compounds originated in industries, some of them already banned in the country, can be seen in the animals' tissues:

> The dolphins' contaminations are the picture of what is the Guanabara Bay, which has turned into a ship's park; there are more than 80 of them anchored. The underwater noise in the anchorage areas is absurd and scare the fauna away.[83]

The cetaceans live approximately 30 years, and most of them spend their entire lives in Guanabara. The dolphins' presence is known since 1874. According to the Chico Mendes Institute for Biodiversity Conservation (Instituto Chico Mendes de Conservação da Biodiversidade – ICMBio), the *sotalia guianensis* is a vulnerable species. The females' low fertility rates contributes to the dolphins vanish threat: they have only one offspring in a period of three to four years.

83. Villela, 2015. Available at <http://agenciabrasil.ebc.com.br/geral/noticia/2015-08/botos-da-baia-de-guanabara-estao-entre-os-animais-mais-contaminado-do-mundo>. Accessed November 21st, 2015.

One of the remaining dolphins in Guanabara Bay.
PHOTOGRAPH BY CUSTODIO COIMBRA

A research conducted in 2014 by oceanographers of the State University of Rio de Janeiro (Uerj)[84] reveals that the noise pollution rates in Guanabara Bay are the worst in the world, and may affect the survival of the dolphins, which are guided and communicates by sounds. Any alteration or noise increase may kill them. The measurements registered circa 108 decibels. In natural conditions, the expected rate is 90 decibels. At Guapi-Mirim APA were registered the lowest decibels levels, closer to the expected 90 decibels.

Other two species of dolphins (general name for such kind of cetaceans) have also being seen in the inner bay, like the rough-toothed-dolphin and the common bottlenose dolphin. Differently from the Guiana dolphins, these mammals are not permanent residents of the Bay, but get in it attracted by large-head hairtail shoals.

There are other "residents" of Guanabara bravely resisting. The biologist César Bernardo Ferreira has researched the seahorses' population in the Bay. In weekly dives at the coast of Ilha do Governador, he observed 297 animals in 2014. In 2015, however, until August, only 14 were catalogued in the same area of studies. The seahorse importance goes far beyond the beauty and exotic nature of such animals: they are bioindicators, once they cannot survive in too polluted waters.

84. Kugler, 2014.

In April 2015, during an expedition, Ferreira was surprised by a dark, stinky an oily water on the surroundings of Engenhoca Beach. That was the outcome of the spill of products from the lubricant factory Cosan. The Department of Environment imposed the company a fine of BLR 35 million. Such case helps explaining the reason why the biologist found less seahorses.

> I had to hurry out of water, because it was intoxicating me. I lost all my equipment. The industries count on the impunity assurance. After this event, the State Environmental Institute [Instituto Estadual do Ambiente – Inea], made measurements on the water quality and registered pollutants parameters nine times above the allowed limit.[85]

The presence of sea turtles may also reinforce the hope that not all is lost. The coordinator of the Aruanã project Cassiano Monteiro-Neto, professor at the Fluminense Federal University (UFF), reports the presence of green sea turtles (*Chelonia mydas*) in several spots of the Bay. Once more, a threat case. Considered as vulnerable species by ICMBio, such reptiles face relentless opponents: ship propellers, virus, micro trash pollution. A recent research conducted by UFF regarding turtles on the Itaipu Beach, in Niterói, pointed out the presence of fibropapillomatosis disease, a type of herpesvirus, in 43% of the animals. The virus causes tumors that may cause vision impairment, and compromise they ability to feed and swim, causing the death of sea turtles.

Many turtles get in the Bay without the virus, but end up infected after the contact with the pollution. The ingestion of micro trash is also a very common problem. Another problem is the clash against vessels and the capture of turtles with fishing nets. Throughout the coast of Rio, there were 1,075 turtles captured in a year.[86]

85. *Interview with the author, in August 2015.*

86. *Interview with the author, in August 2015.*

Social movements: the Bay on the spotlight

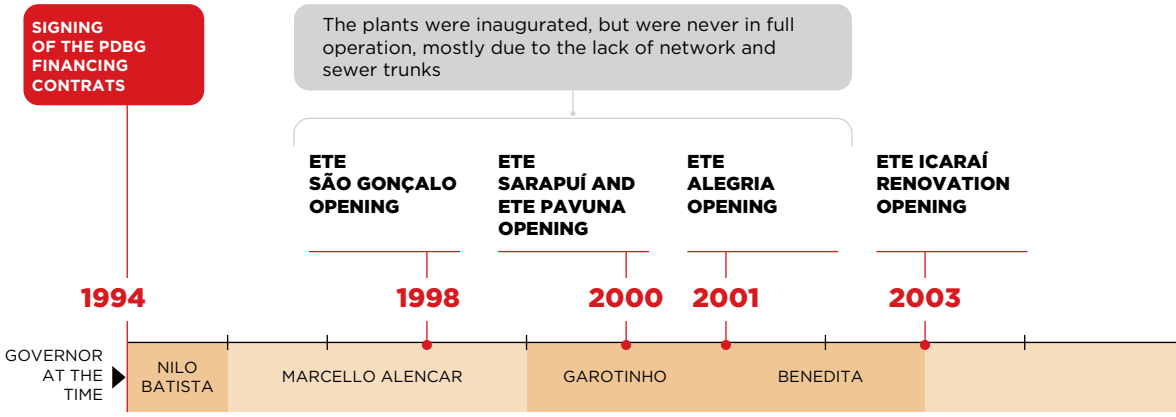
In the wake of Rio-92, the United Nations conference that brought 178 heads of state to Rio de Janeiro to discuss the planet's future, a series of environmentalist movements started to work defending the Guanabara Bay. One of them had its ideas recalled in 2015, when they promoted a *barqueata* (a demonstration in sailing boats) repudiating the degrading situation of Guanabara: the Baía Viva movement, that unites amateur and professional athletes such as the sailor Isabel Swan, medal winner at the 2008 Beijing Olympic Games, fishermen, environmentalists, NGO's, people that live in the surroundings of the Bay and those who were already involved with the cause.

Another entity that was highlighted in recent years is the Association of Men and Women of the Guanabara Bay Sea (Associação Homens e Mulheres do Mar da Baía de Guanabara – AHOMAR), with headquarters in Magé and headed by Alexandre Anderson. In June 2012, two association members were found dead nearby the Bay's fishing corrals. Alexandre, who was included in the National Protection Program for Human Rights Defenders in 2009 and started counting on police escort, denounced the action of death squads controlling the fishing activity in the Bay.

Four months after the murder of João Luiz Telles Penetra, 40 years old, and Almir Nogueira de Amorim, 45 years old, the Homicide Division announced the arrest of Fabiano Augusto da Costa, 31 years old. He confessed the murders of the Ahomar fishermen. According to the police chief of the specialized department Rivaldo Barbosa, Fabiano claimed that the fishermen were stealing fishes from his "corrals" for five years, and that he decided to take the law into his own hands. The police chief said he was relieved with the case's conclusion, case which was very publicized by the media, and affirmed that yes, it was a territory dispute between fishermen.

On the other hand, Alexandre Anderson had never agreed with the investigation's outcome. For him, the groups related to the oil industry power are taking actions to constrain the fishermen, or, ultimately, even prevent the activity.

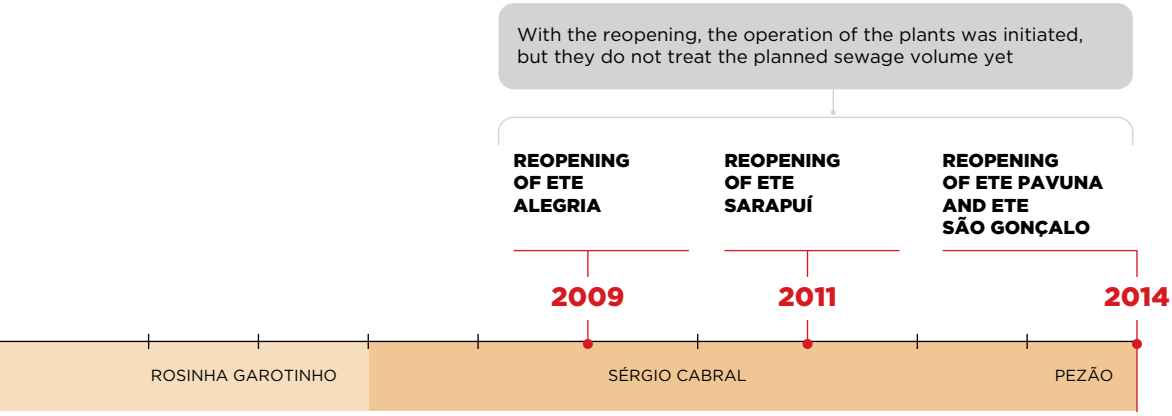
ENVIRONMENTAL CRISIS AND POLITICS:



THE TRAGIC STORY OF PUBLIC WORKS IN BRAZIL, has fantasy promises, poor execution, bid riggings, countless postponements and melancholic conclusion, maybe has in Guanabara Bay its most symbolic case. In the last 20 years, there were investments of USD 1.2 billion for the ecosystem recovery by the Guanabara Bay Pollution Clean-up Program (PDBG)[87], which aimed at significantly improving its waters aspect. By the way, by the naming of the project, coordinated by the state government, many experts have already identified the first big failure: even if it was fully executed in the established term, PDBG would not be capable of effectively clean that ecosystem.

87. *Values corrected by inflation considering 2015 as reference year.*

EMPTY PROMISESS



One way or another, the fact is that the program was never concluded, lasting seven state government terms of office with no significant outcomes in the Bay environmental quality improvement. Officially, however, the contracts were terminated in 2006, seven years after the established deadline for the conclusion of the first stage. Approved by the Inter-American Development Bank (IDB) in 1993 and signed a year later, PDBG had five guidelines as basis, encompassing sanitation, drainage, solid waste, environmental projects, and digital mapping.

Few people know so deeply the details of the Bay largest environmental program as the architect and sociologist Manuel

Sanches. From 1990 to 1993, during the term of office of Leonel Brizola, he coordinated the Executive Group for the Clean-up of Guanabara Bay (Grupo Executivo da Despoluição da Baía de Guanabara – Gedeg), and was responsible for the government's co-operation with the main financing sources: the Inter-American Development Bank (IDB) and Jica (Japan International Cooperation Agency), Japanese organization for development promotion.

"Brizola circumvented the rules of IDB"

Sanches reports that the political deadlocks emerged really quickly. In April 1993, even before the first sewage pipe make it out the drawing board, governor Brizola's employees reached him to say that the governor asked for an exemption of public tender in benefit of Promon Engenharia, an important company that would manage the program's funds. The deadlock ended up with the architect's exoneration.

> I explained to them that the governor did not speak to me in person. And justified that it was not possible to make a tender exemption for a value of USD 5 million. I handed over a comprehensive report on the reasons why I could not exempt the public tender to Brizola's chief of staff, Siqueira Castro. On the following day, in the afternoon of April 12th, 1993, I received from a journalist of *O Globo* the information that I would be exonerated, and that Jayme Lerner would supersede me. Then I called Fernando Brito, Communications secretary at the time, and he did not answer the telephone. Minutes later, I managed to confirm, with another government source, that I was indeed out.[88]

On the following day, April 13th, 1993, the front page of the newspaper *O Globo* highlighted in its headline the news of Sanches' exoneration. Pressured by the civil society and groups

88. Interview with the author, in June 2015.

of environmentalists that demanded public tenders for Guanabara Bay sanitation works, Brizola started defending the tender exemption in benefit of Promon – responsible for the projects of the Integrated Centres for Public Education (Centros Integrados de Educação Pública – Cieps) and the construction works of Linha Vermelha (Red Line, officially named Via Expressa Presidente João Gourlart, expressway that connects Rio de Janeiro and São João de Meriti) – with a lot of arguments. According to Sanches, he used to say that "public tenders are like physicians: you have to choose the one you regard as the best"[89]. In the end, Promon was out, but the program was already sullied since its birth.

Manuel Sanches emphasizes that PDBG was never regarded as a priority by Brizola. In fact, the "caudillo old man" always made it clear that his priority was to invest in educational projects, as the implementation of Cieps.

> In the first place, Brizola didn't want the project. He used to say to me: "But Mr. Manuel, look, with this money I can do 113 Cieps". And I would tell him: "Such money comes with very low interest rates, governor. This is a key project, of worldwide repercussion".[90]

In São Gonçalo, three openings and not a liter of treated sewage

Although the contracts were signed in 1994, the PDBG construction works only really began a year later, when Marcello Alencar was the state governor of Rio (January 1995 to December 1998). In December 1998, the first large sewage plant was opened: the one in São Gonçalo, with capacity to treat 750 liters per second. Up to the present, it does not even receive half of it, albeit being opened in three different occasions. In all the eight constructed or renovated plants, it is "just" the networks that connect houses, commercial establishments and industries to the plants that are missing.

89. Interview with the author, June 2015.

90. Interview with the author, June 2015.

It was like the constructing a magnificent house, but forgetting its foundations: there was a lack of state counterpart, which would be used for the implementation of the sanitary sewer system. The conclusion of the first stage of PDBG was defined in 1999, but had at least five postponements. Seven years later, the program was concluded in a melancholic way for Rio, being up to the present harshly criticized by the Japanese development bank. By the end of the contracts, the program was classified as "poorly effective", "ineffective", "scarcely relevant" and "poorly reliable" by IDB itself.

On the other side of the Bay, in Caju, half of the treatment plant ETE Alegria is still non-operational. The construction works that would make the sewer networks connecting main regions, like Complexo do Alemão and Maré, were not initiated yet. Opened in July 2001, the treatment plant was reactivated seven years and six months later, in the term of office of Sérgio Cabral. Designed two decades ago to treat 5 thousand liters of sewage per second, the unit only effectively treats an average of 1,950 liters per second (i.e. 39% of the forecasted). The authorities postponed the deadlines for delivering the 8 fully operational plants for sewage treatment in the Bay's surroundings countless times.

After all, even with all the problems that still persist, did PDBG work? Manuel Sanches states that, from a technical perspective, yes, it did. What he did not expect was that politicians would "grab 30% of the funds". He emphasized that he has no evidences, but did the math, and argues that such misappropriation of public funds "have being the history of Brazil":

> The problem is not the program itself. It is its managers and politicians that have not faced it as a priority. They had no interest or competence in spending a totally recoverable money. There was not political will in doing it, whether because the program was related to other previous politicians, or because it wouldn't render votes.

> Anyhow if the project was not created, how worse it (the bay) would be nowadays? How much do you think was spent in the construction of the sewer networks of Rio and the cities nearby the bay? A lot more, in terms of current values, than the BRL 10 billion that are said to be necessary for the clean-up. However, we are talking about more than 80 years of investments. If PDBG was correctly performed, and within the deadline, we would certainly have enough funds to pay for the new investments.[91]

In the evaluation of the PDBG pioneer manager, the lack of a proper collection system by the municipalities was the greatest failure. To ensure IDB would approve the next stages of sanitary sewer works, it was required to pay for the interventions. For this purpose, municipalities should increase the property tax (IPTU) without changing the aliquot, although raising the base of collection. The point is that the digital mapping project to ensure the collection control was never implemented.

> If it was implemented, and with part of the funds invested in environmental measures, today we would be in a better situation. How much more do you think a property in São Francisco (Niterói), or in the Rio neighborhoods of Ramos, Botafogo, would be worth if people could enjoy its beaches? The bay's environmental improvement is a continuous process. It is a water flow that naturally recovers over the years. I have no doubt of it.[92]

PDBG's bad reputation

"This project is not regarded as reputable by the bank", recognizes Yvon Mellinger, representative for the Inter-American Development Bank (IDB), in March 2012[93]. In his assessment, the project was relatively successful, but "took too long" to be implemented.

91. Interview with the author, June 2015.

92. Interview with the author, June 2015.

93. Werneck, 2012. Available at <http://sustentabilidade.estadao.com.br/noticias/geral,nao-e-um-projeto-quetevе-boa-reputacao-diz-bid,852029>. Accessed October 20th, 2015.

Mellinger considers the failures in the application of Rio government's counterparts as the major difficulty. "The state has gone through difficult times. It was not the Rio de Janeiro we know today, with economic growth and a good relationship with the federal government", evaluated Mellinger, considering the pre-2015 economic crisis moment.

The sanitary engineer José Stelberto Porto Soares monitored all Rio sanitation works ever since the 1960's decade. In the evaluation of the former director of Cedae, PDBG failed when it opened too many work fronts and did not see the bay as sectors. And agrees with Manuel - "political matters" were the greatest villains:

> If they opted working on some sub basins and not so many as they did, PDBG could have sanitized entire regions. Mainly for political matters, they opened it too much and up to present, 20 years later, they were not even able to sanitize a single sub basin of the huge Guanabara Bay.
>
> The sub basin of Mangue Channel is an example. It has five rivers that flow into the channel, which, in its turn, outfalls into the Guanabara Bay. Papa Couve, Comprido, Trapicheiros, Maracanã and Joana are sewage rivers, although the sewage treatment plant ETE Alegria in Caju is constructed, but not its sewer system for collecting the sewage of several neighborhoods.
>
> The neighborhood Vila Isabel, located in such sub basin, is still supplied by a sewer system constructed through the second contract D. Pedro II signed with an English company in circa 1870. Such system works, but is saturated and full of ways out for drainage that take all to the river.[94]

94. Interview with the author, in August 2015.

In 2003, PDBG was the target of a Congressional Investigative Commission at the Legislative Assembly of state of Rio de Janeiro. The Commission discovered several misconducts: it concluded that there was the contract of companies without public tender, paralysation of construction works before their conclusion, delays in the conclusion of sewer trunks and networks, fraudulent overpricing in workforce invoices, error in invoices issuance, among others.

PSAM, the successor

In 2011, even before the full conclusion of all the PDBG actions, the state government, headed by Sérgio Cabral, approved the financing of the Sanitation Program for Municipalities Surrounding Guanabara Bay (Programa de Saneamento dos Municípios do Entorno da Baía de Guanabara – PSAM). It was a vote of confidence by the Inter-American Development Bank (IDB).

To persuade international investors that this time everything would be different was not an easy task. Still in 2010, the Board of Audit of Japan was about to publish a statement of repudiation against the Rio government for the complete fiasco of PDBG. Worried, the managers of the environment area warned Cabral that the effect of such statement would be terrible for Rio. Something should be done. Then, the government convinced IDB to send a document to Japan certifying it would finance new investments in sanitation.

The new alphabet soup of letters succeeding PDBG had its financing contracted signed in March 2012 and envisaged investments of USD 452 million (IDB) and state counterpart of USD 188 million: in values of October 25th, 2015, more than BRL 2.26 billion.

In several occasions, the former executive manager of PSAM Gelson Serva agreed in contributing to this book. Serva says it was needed to start from scratch to confer credibility to this

project. Then, the State Department of Environment contributed in drafting, along with the Bay surroundings municipalities, Municipal Plans of Sanitation (water and sewage) and Technical Planning Researches. This time, the major part of water and sewage networks was finally detailed, geo-referenced, and made publicly available at the State Department of Environment website[95]. With a delay of at least 15 years.

Gelson Serva states that PSAM had a lot of challenges:

> The first challenge to the program formulation was the lack of information on the real situation of the collection systems of sanitary sewers of the fifteen municipalities comprised by the Guanabara Bay watershed. How to propose a long-term program, with infrastructure projects, if it wasn't possible to make a comprehensive diagnosis? Cedae itself did not have such data in an organized and consolidated manner. There was no integrated planning on the sanitary sewer system, but few isolated projects.
>
> Then, in this very same period (2012-2013), we contracted draughtsmen and formulated the engineering projects for the selected undertakings, and shortly contracted two important works: the construction of the Alcântara/São Gonçalo Sanitary Sewer System, in 2014, and the construction of the sewer trunk Cidade Nova, for the clean-up of Mangue Channel, in Rio centre.[96]

Serva adds that the goal of treating 80% of the Bay' sewage – as defined by the state government and the International Olympic Committee (IOC), as we have seen – does not seems to be something feasible in short term yet:

95. Read more at <http://psam.maps.arcgis.com/home>. Accessed October 20th, 2015.

96. Interview with the author, July 2015.

> Upon the completion of these two and the construction works for the complementation of the sewer network of ETE Pavuna, undertaken in PSAM, be concluded, as well as the other works scheduled by the state government, of amplifying ETE Alegria and constructing the Faria-Timbó and Manguinhos trunks and the sewage collection network in Complexo da Maré, then we will reach circa 60% of the sewage collection and treatment in relation to all the surroundings of Guanabara Bay.[97]

Distant goals, construction works behind schedule

The purpose is still far away from being reached. After a long period of suspensions by the Justice – the contractor that lost the tender filed and action contesting the result –, the construction works of Cidade Nova sewer trunks only had its contracts signed on March 2015, in the amount of BRL 81.4 million. And the Alcântara sewage treatment plant still is in its initial stage of construction, although the contract of BRL 354.96 million was signed in June 2015, with an enormous delay.

The country's economic crisis that worsened in 2015 undermined the already scarce resources for sanitation works. The state counterparts' funds decreased, a direct effect of the drop in the price of the oil barrel from 2014 to 2015. The State Fund for Environmental Conservation (Fundo Estadual de Conservação Ambiental – Fecam), the state main funding source for sanitation works since 2008, is in its worst phase in this period due to the crisis scenario. In 2015, Fecam's investments had a decrease of approximately 30% in relation to the same period of the previous year, according to data provided by the Legislative Assembly of Rio.

Gelson Serva left the PSAM coordination after André Corrêa (DEM party) was assigned for heading the State Department of Environment, in 2015. According to him, it is not feasible to talk

97. Interview with the author, July 2015.

about Guanabara clean-up in a term shorter than 15 years. The still required investments in sanitation amount approximately BRL 12 billion. As an example of the huge liability, he mentions the cases of the sewage collected in the neighborhood of Madureira, that flows through Acari River, which, in its turn, flows to the Miriti River and outfalls into the Guanabara Bay. Another example is the sewage collection system of the surroundings of Irajá River, which sewage should be treated at the treatment plant ETE Penha that still needs to be recovered. Working as director in the Energy Research Office (Empresa de Pesquisa Energética – EPE) since 2015, bound to the Ministry of Mines and Energy, Serva reinforces that the deficit in the domestic sewer connections is still enormous:

> In addition to the amplification of the sewer treatment plants, many areas of Baixada Fluminense, São Gonçalo, and municipalities in Guanabara Bay background still require sanitary sewer collection system projects and construction works, as well as the municipality of Rio. Approximately one million domestic connections must be implemented.[98]

The option for privatization: the AP-5 case

The many delays and the slowness in the programs dedicated to the environmental improvement of the Bay caused the mayor of Rio Eduardo Paes (whose term of office ends in December 2016) to defend the concession of sanitary sewer services in some areas of the city. In Niterói, the privatization of the water and sewer services that took place in 1999 has been pointed out as a success case for the ones arguing that the concession of services is the best way to go. In 2015, the city nearby Rio was ranked in the 6th position in the ranking published by the Trata Brasil Institute[99], an entity that assesses the sanitation and water supply actions in the hundred largest Brazilian municipalities. The capital had the modest 56th position, behind all the southeast capitals.

98. *Interview with the author, in July 2015.*

99. *Ranking available at <http://www.tratabrasil.org.br/datafiles/estudos/ranking/tabela-100cidades-2015.pdf>. Accessed October 20th, 2015.*

In May 2012, Paes signed a contract transferring to Foz Águas 5 the responsibility for collecting and treating the sewage of 21 neighborhoods of the western side of the city – or the Planning Area 5 (AP-5). The concessionaire is composed by the companies Odebrecht Ambiental and Grupo Águas do Brasil. Fundação Rio-Águas, a city government body, is responsible for the contract regulation. According to the city government, ever since it assumed part of the sanitation work that was once assigned to the Rio de Janeiro Water and Sewage State Company (Companhia Estadual de Águas e Esgotos – Cedae) – the water supply of AP-5 remains under the state company responsibility –, the group formed by Odebrecht Ambiental and Águas do Brasil has a turnover of circa BRL 50 million per month[100]. And that regardless of the high levels of default: it is estimated that circa 850 thousand, in the total population of 1.7 million dwellers in the western zone of city, monthly pay the sewer bill.

Foz Águas 5 sanitation works started in January 2014. The promises for 2017 were bold: with BRL 640 million – funded by the Brazilian public financial institution Caixa Econômica Federal through the program Saneamento para Todos (Sanitation for All) – to change the poor situation of sanitation in ten neighborhoods, from Deodoro to Senador Camará, in the basins of Marangá and Sarapuí rivers. Both rivers outfall into the Guanabara Bay. Therefore, it is planned the implementation of 376 kilometers of networks (among new and renovated ones) and the construction of 11 large-sized new pumping stations, which shall pump the sewage to two large plants: Deodoro and Bangu.

Foz Águas 5 informed[101] that, until April 2016, were invested BRL 350 million of the BRL 640 million foreseen for the project's first stage (which means 54.6%). Besides, 200 kilometers of sewer networks were constructed (i.e. 53.1% of the target). The concessionaire also ensured that the new sewage treatment plant (ETE) Constantino Arruda, in Deodoro, shall be opened in May 2016, with capacity to treat up to 1 thousand liters of sewage per second. When it comes to the treatment plant ETE Bangu, there

100. Information provided to the author in December 2013. The concession contract is available at <http://www.rio.rj.gov.br/dlstatic/10112/4290214/4105676/00.CONTRATODECONCESSAON001_2012.pdf>. Accessed January 20th, 2015.

101. Information provided to the author on April 20th, 2016.

was a schedule change: the plant shall no longer be constructed, but replaced by the amplification of the ETE Deodoro project. The term is not over yet – it expires in May 2017 –, but the rates indicate that the schedule is tight. Upon the full conclusion of the first stage of construction works and investments, 65 million liters of sewage per day shall stop being disposed of into the Guanabara Bay (1 thousand per second). Foz Águas 5's challenge is to reach, in 26 years, 85% of collection and 100% of treatment of sewage in the western zone of the capital.

The government of the city of Rio de Janeiro affirms to be satisfied with the concession's progress and defends the replication of the model at AP-4 (Jacarepaguá, Barra da Tijuca and Recreio dos Bandeirantes) – neighborhoods that do not drain their sewage into the Guanabara Bay. The governor Luiz Fernando Pezão already demonstrated interest in privatizing the sewer systems of the eastern region of the state, which comprises cities like São Gonçalo and Itaboraí.

The Justice disservice and the lack of transparency

The Justice also "played against" the Bay when it waived the requirement of targets and deadlines from governors for the conclusion of important sanitation works. In 2012, the judge Ricardo Starling Barcellos, of the 13th Public Treasury Court of Rio, shelved the proceeding that used to make it mandatory for state governors to present a clean-up schedule in a two years term. In his decision, he claimed that the actions were in course and the dismissal of the proceeding without prejudice "don't discharge the state and Cedae from effectively proceeding with the Bay's clean-up"[102].

Such judgment was severely criticized by the public prosecutor Rosani Cunha, author of the action five years earlier. At the time, in an interview to the newspaper *O Globo*[103], she classified the measure as a "disservice to the society". Rosani Cunha used to require to Cedae a hard copy of a schedule with an execution term of no

102. *Consultation of the proceeding numbered 0218928-66.2007.8.19.0001, at the Rio Court of Justice (TJRJ) website.*

103. *Available at <http://oglobo.globo.com/rio/justica-arquiva-processo-que-da-prazo-para-despoluicao-da-baia-de-guanabra-6741240>. Accessed November 20th, 2015.*

longer than two years for all the construction works encompassed by the Clean-up Program, under penalty of a daily fine in the value of BRL 10 thousand. The proceeding is still being processed.

Gelson Serva recognizes that the communication deficiencies between government and society may be a main issue to be improved. In his opinion, the lack of information on what is being done for the environmental recovery of the Guanabara Bay ends up being reverted into a negative evaluation, "that doesn't account the efforts that are being undertaken":

> Once the improvement promises are undermined by history of failures and neglect, it is important to present, at the same time, a complete schedule to be discussed with the population, as well as to demonstrate concrete actions that are being taken, that the works are on course, that environmental education campaigns and participatory practices are being promoted.
>
> The engagement of several sectors and institutions takes a lot of work, but is crucial. The society must reflect, supported by environmental scientists, if there is a tolerable limit for the economic activities in the Guanabara Bay and which compensatory and mitigating actions are required.[104]

One of the pioneer environmentalists in the Bay's defense, the current deputy mayor of Niterói Axel Grael agrees that the lack of cooperation with universities and the population created bigger challenges:

> PDGB as well as PSAM were and are imminently state programs. Compare them with Chesapeake Bay (in United States) and others. In such cases, the initiative has come from the society, despite of counting on a State strong prominence and leadership. And also the civil society and universities.[105]

104. Interview with the author, in July 2015.

105. Interview with the author, September 2015.

The case of the River Treatment Units

A palliative action among the huge liability of sewage treatment. That is how the River Treatment Units (Unidades de Tratamento de Rios – UTRs), process with national technology in which the water is stowed in tanks to receive the chemical products, were presented. With the purpose of improving water quality with no harms to the body of water, such technology started being presented by the public authorities as an important measure to, at least, ensure the removal of harmful pollutants before they get to the Guanabara Bay.

In a document signed in July 17th, 2012 by the then Environment secretary Carlos Minc and the Cedae president Wagner Victer, it was agreed that the River Treatment Unit Irajá (Unidade de Tratamento de Rio - UTR), budgeted in BRL 40 million, would be constructed and become operational in 2013. In 2016, the construction works had not even begin, and the only operational UTRs were of Carioca River, in Flamengo, and Arroio Fundo, in Jacarepaguá. From these two, maintained by the city government, only the first one benefits the Guanabara Bay.

For several times the Rio city mayor Eduardo Paes affirmed that he would not invest resources for the construction of new UTRs. He argues that it is an ineffective measure, an unreasonable expenditure. And he is backed by the engineer Adacto Ottoni:

I am totally against the construction of the river treatment plants. It should be implemented programs of environmental education along with the selective collection and recycling of waste in such poor communities, generating income for this population and significantly reducing the reach of scattered trash into the rivers (which consequently ends up in the Guanabara Bay).

Without soil erosion control construction works, nothing will work. Are also important works to regulate the fluvial flow, reducing floods in the rainy periods and increasing the local rivers' flow in dry periods, therefore allowing the recovery of fluvial water ecosystem.

The only effective way of cleaning-up the Guanabara Bay is to clean-up the rivers that drain its waters to the Guanabara Bay. After the reduction of the sewage, trash and sediment loads, it would be important to carry a dredging work of a considerable amount of the sewage sludge, sediments and trash lying in the bottom of such rivers.[106]

106. Interview with the author, September 2015.

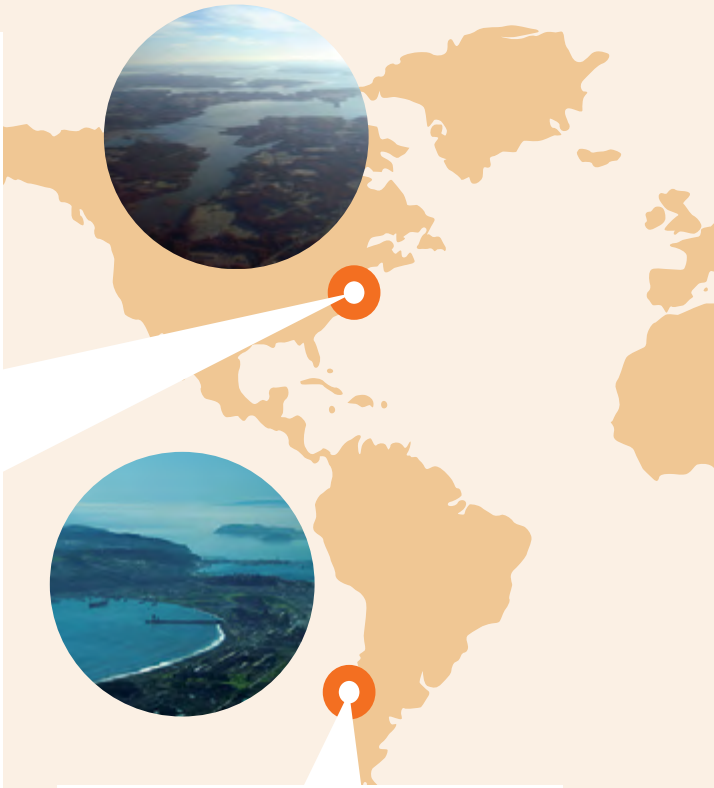
CLEANED-UP BAYS

CLEAN-UP LEVEL : LOW MODERATE

CHESAPEAKE BAY
UNITED STATES

The farming and urban expansion that began in the 19th century led to a great pollution of the bay, arising from farms and sewage treatment plants in the surroundings. As consequence, there was a massive growth of seaweeds, which interfered with the reach of light in sub aquatic areas, preventing the growth of plants that used to serve as food and habitat to the marine life. Billions were spent up to the present and there is a high number of agents involved in the clean-up, among them, the Chesapeake Bay Program (an association of federal, state, and local agencies, NGOs, academic institutions and citizens), the Environmental Protection Agency, the Chesapeake Bay Commission, the District of Columbia, and the state governments of Delaware, Maryland, New York, Pennsylvania, and West Virginia.

- **CLEAN-UP SUCCESS LEVEL:** Low
- **CLEAN-UP DURATION:** More than 30 years (in progress)
- **CLEAN-UP COST:** USD 15 billion (required cost for the full clean-up, as forecasted by an experts commission)[107]
- **USAGE:** Fishing
- **WATER SURFACE EXTENSION:** 11,601 km^2



SÃO VICENTE AND TALCAHUANO BAYS (CHILE)[108]

Fishing, steel mill, metal-mechanical and petrochemical companies, along with the government of the municipality of Talcahuano, are the responsible for the clean-up.

- **CLEAN-UP SUCCESS LEVEL:** Low
- **CLEAN-UP DURATION:** 25 years (in progress)
- **CLEAN-UP COST:** USD 136.3 million (required cost for the clean-up of all water resources of the municipality of Talcahuano between 1990 and 2002. In addition to these two bays, the resources also include the El Morro channel, Bío-Bío and Andalién rivers, and Price, Macera y Verde lagoons).
- **USAGE:** Fishing
- **WATER SURFACE EXTENSION:** 17.5 km^2 and 167.4 km^2, respectively

NOTES

107. *Available at <http://www.npr.org/templates/story/story.php?storyId=5341055>. Accessed March 30th, 2016.*
108. *Available at <http://www.cepal.org/samtac/noticias/documentosdetrabajo/2/23452/inch01903.pdf>. Accessed March 30th, 2016.*
109. *Available at <http://www.fao.org/docrep/005/ac861e/AC861E04.htm>. Accessed March 10th, 2016.*
110. *Available at <http://theconversation.com/sydney-harbours-toxic-legacy-shows-value-of-green-safety-net-11197> >. Accessed March 20th, 2016.*

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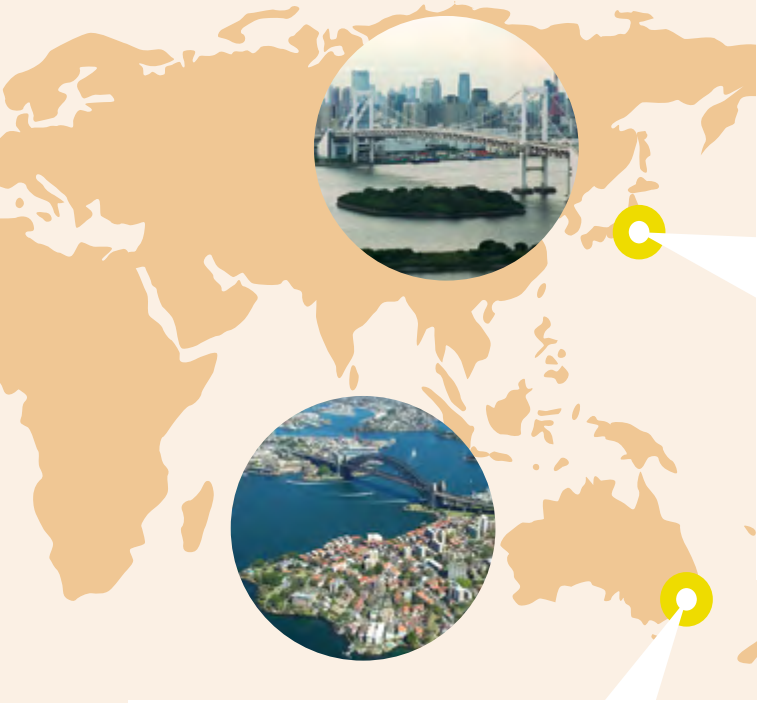


TOKYO BAY
JAPAN

Heart of the Japanese industrialization, the bay was used for a long time as a wastewater tank for industries, farms and sewage treatment plants in its surroundings. The commitment with its clean-up by the national government, metropolitan government of Tokyo, city governments of Chiba and Kanagawa, and agencies of environment, fishing and maritime safety reached the bay recovery. Nowadays approximately 700 fish species live in it, in addition to birds, shellfishes, reptiles, and amphibians.

- **CLEAN-UP SUCCESS LEVEL:** Moderate
- **CLEAN-UP DURATION:** Circa 40 years (in progress)
- **USAGE:** Fishing
- **WATER SURFACE EXTENSION:** [109] Circa 1,000 km²

SYDNEY HARBOR
AUSTRALIA

Severely punished by the several factors that contributed to its pollution, the bay's clean-up only was possible due to the collective efforts of the Sydney Water Corporation, the state government of New South Wales, the Clean Up NGO, the more than 40,000 participants of the Clean Up Sydney Harbor Day in 1989, and the Thiess Services (a leading company in environmental remediation in Australia). The damages caused by the nearby industries, by the sewage treatment plants of North Head, Bondi, and Malabar, by the Fratelli D'Amato (which allowed the spill of circa 250,000 liters of oil from one of its ships in 1999) and by the Sydney streets pollution are now replaced by the habitat of at least 3,600 species of invertebrates, more than 150 species of birds and 580 species of fishes, among many others. Nevertheless, there is still a lot to be done. The commercial fishing, forbidden in 2006, still has not returned to the bay due to the fact that the concentration of dioxins in its fishes and crustaceans are still high.

- **CLEAN-UP SUCCESS LEVEL:** Moderate
- **CLEAN-UP DURATION:** More than 25 years (in progress)
- **CLEAN-UP COST:** At least 544.2 million of American dollars
- **USAGE:** Recreational fishing. The commercial fishing was forbidden in 2006 due to the high concentration levels of dioxins in the bay's fishes and crustaceans[110]
- **WATER SURFACE EXTENSION:** 55 km²

I AM GUANABARA

CARLOS MINC

GEOGRAPHER, RIO DE JANEIRO STATE DEPUTY (WITHOUT PARTY AFFILIATION), FORMER RIO DE JANEIRO STATE SECRETARY FOR THE ENVIRONMENT, AND ENVIRONMENT MINISTER UNDER LULA'S GOVERNMENT

Guanabara's challenge

Since the very beginning of my environment activism, in 1980, we denounced the attacks against the Guanabara Bay, along with environmentalists, fishermen and professors, like Elmo Amador, geographer and mangroves' defender. I was a member of the thesis defense committee of his doctoral dissertation on Guanabara.

Through all the terms of office as state deputy, since 1987, I legislated and fought for the Bay. On the terms of the State Constitution, of which I was the rapporteur, in 1989, I designated its water surface as an historic landmark and created the State Fund for Environmental Conservation (Fecam) to support its clean-up. For several times, I filed actions against Reduc at the Public Prosecution Department for being its greater polluter, a technological scrap, that would not even pay the fines to the (extinct) Feema. As chairman of the Environment Commission of the Legislative Assembly of Rio, I would bring governments to court for not investing the Fecam funds in the basic sanitation of Baixada Fluminense.

Afterwards, I was one the main critics of the PDBG, which used funds from the IDB in four sewage treatment plants (ETEs), but did not invest Fecam's counterpart in networks, connections and

pumping stations. The outcome: for 14 years, the ETEs were dry, not treating a single liter of sewage. Such sewage would reach the rotten Guanabara through the Iguaçu, Sarapuí, Meriti, Irajá, and Alcântara rivers, among 30 others. I visited waste dumps of its surroundings, such as Gramacho and Itaoca (São Gonçalo), a dozen times performing inspections, and listening to and supporting the waste pickers, with whom I established a strong partnership. I created several laws to support them and to promote recycling.

In the State Department for Environment, as of 2007, we set the basis for the closing of waste dumps, and the effective use of Fecam's funds in sanitation and in the performance of an environment audit in the Reduc refinery, followed by the Conduct Adjustment Agreement executed in 2011: the largest in the country, of BRL 1.1 billion, aiming at a 90% reduction in the disposal of oil and chemicals into Guanabara waters, as well as the reduction of air emissions in Caxias, in 6 years. From 2012 to 2015, half of such goal was reached, removing a monthly "Maracanã" of oil of the Bay.

We closed all the large-sized waste dumps: Jardim Gramacho, Itaoca, Babi and others. We licensed and financed great sanitary landfills. However, the municipalities failed in the daily waste collection in the communities and selective collection, which reaches the shameful average mark of 1% at the metropolitan area, as well as regarding environmental education.

In 2006, only 16% of the sewage of the 9 million people living by the Guanabara watershed was treated. In seven years, we tripled that rate to 48%, but, despite of such huge effort, investing Fecam's funds in sewer networks and pumping stations, the raw sewage of 5 million people keeps polluting Guanabara's waters. We fought hard for five years of government term to make Cedae be regulated, which would only take place in September 2015. Despite of our efforts, we did not make it to create and implement a bay or watershed authority. But there was an accumulation of awareness and the conditions are matured now for this to happen.

We also defended the private-public partnerships (PPP) in sanitation and implemented the first one in Paraty. And now the political

conditions allow this complementary option to be developed in Guanabara. A lot was done and there is even more to be done. With a lot of failures and some successes, I see possible real advances towards the much-dreamed-of clean-up of Guanabara Bay.

DORA HEES DE NEGREIROS
PRESIDENT OF THE INSTITUTO BAÍA DE GUANABARA

I am an optimist: the Bay will get better

I was born a hundred meters away from Icaraí Beach, which was the backyard of my childhood. Catching crabs and sand crabs, helping to pull fishermen's nets and catching seahorses is what I would do together with my brothers and friends. A little older, I would dive from springboards, play volleyball and walk by the shoreline dreaming of a ride in one of the many sailing boats coming from the nearby Sailing Club and Brazilian Yacht Club. Later, to study at the Vermelha Beach, I would daily cross the Bay, by ferry, observing the dolphins that still were many at that time.

In the beginning of the 1970's decade, I learned about the Guanabara Bay's problems. I was the co-author of a research work, presented at the Congress, about the waste disposed of by the eleven industries of sardine processing in operation at its coast. At Feema, I have learned a lot about industrial disposals, then the main source of its waters' pollution. In 1975, I had the opportunity of flying over the oil stain caused by the Tarik Ibn Zyiad ship disaster, which caused a spill six times greater than the Petrobras one, in 2000.

I always believed that only with the mobilization of the dwellers of the Bay's surroundings we could change the situation. Therefore, we founded, in 1993, the Instituto Baía de Guanabara (Guanabara Bay Institute – IBG). We develop partnerships with governments and companies. To think and act in order to commit the society with the Guanabara Bay sustainable

development is the motto of our institution, which is associated to the State Department of Agriculture, and maintains an Environment and Education Centre in its headquarters, located in a beautiful forest area that is the Horto, in Niterói. IBG was one of the catalysts in the creation of the Guanabara Bay Committee, in which it still collaborates up to the present.

In general, the Bay's situation is not good. There are more than a million houses in areas with no sewer systems in the region of Guanabara Bay's watershed, mainly in the municipalities of Baixada Fluminense, were millions of children and young people are hospitalized per year due to gastrointestinal infections. A clean Bay would bring huge benefits to health, education and productiveness. However, in recent years, there were advances as well. Industries, on the whole, do not dispose of their effluents in it anymore, as they used to in previous years, and the state capital is no longer embanking its islands and banks.

Yet I am an optimistic person. I believe the Bay will get better together with the improvement of the sanitation in its surroundings. At Niterói's coast, in the Jurujuba cove, the achieved advances, especially the ones obtained with the removal of sewage and trash, are noticeable. Through the crystal water, one may see fishes and turtles. However, there is a lot more to do.

ALEXANDRE ANDERSON

FISHERMAN AND PRESIDENT OF ASSOCIAÇÃO HOMENS
E MULHERES DO MAR DA BAÍA DE GUANABARA (AHOMAR)

A mother who cries for its children

We officially represent 4,200 families of fishermen, riparian dwellers, and crustacean catchers, all working in the seven municipalities of the metropolitan area of Rio de Janeiro that are bathed by the Guanabara Bay. Even with the proven reduction of 80% in fishery harvesting in the last 20 years, we still have many

communities and families that make their livings exclusively out of this income. Researches and articles point that more than 70% of the fishery consumed in the Metropolitan Region of Rio come from the Guanabara Bay, a proof of its not only social, cultural and environmental significance, but also of its economic importance.

We undertook the duty of denouncing the environmental and social crimes that have been occurring before the society's and public authorities' eyes, being the latter still silent and, many times, conniving with the polluters and offenders in a process that only benefits the large capital.

Obviously, with the success of our complaints and the positive feedbacks we had, we also had reprisals, attempts against our lives, deaths. However, we were not discouraged. We have been going ahead with our cause of resistance for years. We overcame the threats, the attacks, the co-optation attempts. But what we live nowadays is a political and institutional pressure. In short, we live in a forced exile.

A proof thereof is our new project "Patrulha da Pesca" (in literal translation, Fishing Patrol), idealized by Ahomar and with no outside resources. We make routine monitoring work throughout the Bay's waters, including the rivers bathed by it. In such occasions, we visit the riparian communities and make our inquiries, checking the countless complaints from those who are always at the sea: the fishermen.

We collect photographs, testimonials and documents that substantiate our claims and representations in order to defend the legal rights of the artisanal fishermen and perform a real defense of the Guanabara Bay environment.

In the present year we have already had several meetings and assemblies at a range of beaches and communities of Guanabara Bay, except for Magé, were is located our headquarters that is currently closed for safety reasons. However, that does not prevent us from performing our local work in many ways. We made it to close work sites and to embargo waste dumps and other polluting construction works, and public officers are

under investigations thanks to our claims and formal proceedings, i.e. due to our collective monitoring work of Guanabara Bay.

Despite of the failure of Comperj and the recent scandals, we know that Guanabara Bay and its traditional populations, including the Ahomar leaders, are a target. A target to those trying to transform our home into an industrial plant and our lives in a living hell. Indeed, what we really need now is to keep helping our people, our folks, and to defend our Guanabara Bay's life. Because we, artisanal fishermen, see the world differently, we do not see Guanabara Bay as a marine ecosystem, but as a true mother who is seeing its own end. A mother that, for a long time, cries the death of its children: the artisanal fishermen.

BRENO HERRERA
BIOLOGIST, FORMER HEAD OF GUAPI-MIRIM APA

It is up to the people to take the leading role

I remember the late afternoons when, together with other biology students from UFRJ, we would come together to see the sunset at some beach of Ilha do Fundão. Very often, one of us, gazing at the bay surrounding us, would sighing say: "Just imagine if it was clean!". Little by little, that juvenile dream grew in me. By the end of the college, I was already working in a mangrove reforestation project at the banks of the degraded Cidade Universitária's island.

Years later, I took the challenge of running the Guapi-Mirim APA, environment conservation unit responsible for the protection of the most preserved area of the Bay: a thriving mangrove forest, housing several fishes, birds, crabs and alligators. A living symbol of what the Bay once was, and a hope of what it may become again.

Soon I learned that the most devoted keepers of that environment are the people that for generations are making their livings, the daily fish, out of its waters. The environment conservation –

and, consequently, of the fishery stocks – is not a mere affective or ideological issue for them: it is a mean of survival!

After decades of lack of control, corrupted billionaire programs and pollution aggrieving, the Bay's future does not seems to be encouraging. However, Guanabara still lives! I am convinced that the current degradation scenario change is neither to come from governments, nor companies, or scholars. It is up to the people of Rio de Janeiro state and city, guided by the Guanabara populations – fishermen, crab catchers, corral fishermen, seafood catchers – to take the leading role of a comprehensive movement for the Bay's recovery. Let us listen to these people and learn with them about how to live in harmony with nature, a lesson we forgot amid our will of growing not knowing what for.

MARIO MOSCATELLI
BIOLOGIST, COORDINATOR OF PROJETO OLHO VERDE

Targets will not be met

My work with the Bay started facing the worst possible situation aiming at the recovery of a mangrove. A mangrove degraded by leachate. It was 1997, and the mission was to recover and manage the 130 surviving and or dying hectare nearby the then Aterro Metropolitano de Gramacho (in Duque de Caxias). Since then I have followed in a privileged, lonely and distressing way, through the Olho Verde (Green Eye – aerial monitoring service) project, the sequential fiasco of official projects that always propose the Bay's recovery, but, when considering its costs, are having ridiculous environmental outcomes.

Paralyzed or underused treatment plants, while practically all the watershed is transformed into an open air sewer of trash and sewage, urban sprawl, and the lack of permanent and efficient habitation, transport and sanitation policies keep on creating a broad framework of degradation.

The expectation was that, with the Olympic Games, the Brazilian authorities would at least once meet their promises with a minimum sense of responsibility. Unfortunately, as usual, they promised and internationally committed to targets that simply will not be met, because, in my understanding, they never really had the intention of making something structural in the Bay. Once more we were deceived by the local authorities. The Bay's recovery was left for a lost future, in future campaign speeches.

ROBERTA ALVES

KNOWN AS DOCINHO, SOCIAL ACTIVIST AND FORMER WASTE PICKER IN THE JARDIM GRAMACHO LANDFILL

Our leaders make erroneous investments

I was born in São Cristóvão, in northern Rio, and moved to Duque de Caxias, in Baixada Fluminense, when I was three years old. I grew up and survived, despite of the countless difficulties my mother would face to raise the family. She was a single mother, just like me. And taught me that, if you want to make it, you must fight and never mistreat anybody. She would send me and my sister to a boarding school to be able to work at well-to-do ladies' houses.

In 1999, I got to know the waste dump. I had lost my job. At the landfill, until 2012 I survived rain and sun, worms, skin disorders, among other problems.

We have to care for the rivers that outfall into the Guanabara Bay, to teach people to throw trash in the right places, not in the rivers. However, our leaders make high erroneous investments. They need to start sanitation actions by Baixada, where the population is forgotten and erect their houses at rivers' banks due to the total absence of the public authorities. I am against the ones who throw trash in the rivers. They need to educate the

least privileged. To show them that packages and rubbles have its value, they create jobs. However, the government deems it silliness to spend money in education.

Imagine how it would be if more waste pickers could work with rubble. For two years we have a pile of six meters in height by the former landfill, which is the raw product for foundation and sub foundation of construction works, in addition to concrete structures, among other products. There are several usage possibilities. Imagine a thousand dump boxes being throw in Guanabara Bay. To me, education, in a comprehensive sense, is the solution for the clean-up. It is enough of spending millions and not having a solution.

ANDRÉ CORRÊA
RIO DE JANEIRO STATE SECRETARY FOR THE ENVIRONMENT
(SINCE JANUARY 2015)

Diving into the Guanabara Bay

As a result of unfulfilled promises and a misconception in planning at its very origin, today we live a serious deficit in confidence in the government's actions in Guanabara Bay. The truth is that nobody believes in anything a public authority may say regarding the subject anymore.

Negotiated during Brizola's government, under the post-excitement of the largest international meeting on ecology, Rio-92, the Guanabara Bay Pollution Clean-up Program (PDBG) promised it would be feasible to deliver a clean Bay to Rio de Janeiro state and city dwellers with investments around BRL 2 billion.

It is not necessary to be an expert to know we will only have a clean Bay when we take treated sewage supply to all the municipalities of the Bay's surrounding, especially to the largest ones, like Duque de Caxias, Nova Iguaçu and São Gonçalo.

The sanitation plans drafted recently for the 15 surrounding municipalities indicate it would be required BRL 12 billion to universalize the treated sewage supply in all these areas.

Thus 20 years ago it was declared to the society that BRL 2 billion would be sufficient to clean-up the Bay, but actually it will be necessary at least BRL 12 billion to collect and treat the sewage of circa 6 million people living in the Bay's surrounding, and that are not supplied with such service.

Another crucial mistake in the program's origin, besides the mistaken communication, was the planning. Instead of allocating in the same group of tenders the whole sewer system, treatment plants, sewer trunks and smaller networks, the program made individual tenders of such items.

It is obviously easier to construct a treatment plant on a flat land than digging up an entire urbanized city to install a great sewer trunk. The outcome of that: the treatment plant would be concluded, but the sewage would not reach it.

Even with all these mistakes, the program had significant advances, especially in the last years of Sérgio Cabral's term of office, as well as the one of his successor Luiz Fernando Pezão (2015-2018), with the organizational recovery of Cedae, once bankrupted, and four new plants that currently treat approximately seven thousand liters of sewage that would flow *in natura* into the Bay per second. The first step to overcome a problem is to recognize it and, then, to act with transparency. We can only set targets that may be supported by a safety financial engineering.

It is required to transform the Bay's recovery program into a society's – not a government's – program. The Bay has not a managing body to coordinate the actions of all its players, an entity ruling it. Union, state, municipality, Navy, and other bodies work with no coordination. The clean-up programs that were successful over the world were long-term ones and had as manager a bay authority, a coordination agent for the various public spheres with a strong participation of the society in the management.

To be honest, we will not have a 100% clean Bay by the end of my term of office, nor by the end of the term of office of the governor Pezão (2015-2018). But, in addition to circa BRL 3 billion in investments in progress, we want to leave an institutional legacy of a constituted bay authority and the shape of a private-public partnership in progress to allow the provision, through the increase of private sector resources, the investment of BRL 12 billion to universalize the sanitation of the 15 municipalities of the Bay's surrounding, once such amount of resources is not available in the state budget.

The Olympic Games will not be a lost opportunity to the Bay. The society shall not allow that. The proof of it was the repercussion of my polemic dive[111]. The demands on us, public authorities, are only to increase. It is essential that it goes this way.

AXEL GRAEL
DEPUTY MAYOR OF NITERÓI AND FORMER PRESIDENT OF FEEMA

I believe in a clean-up river by river, cove by cove

Born into a family of sailors, ever since I was very young I would join my grandfather on his boat. I got my first boat when I was seven. The Guanabara Bay was pretty much cleaner then. I learned to swim in it. I saw its quick deterioration process, caused by pollution, trash, silting, embanking, overfishing.

Scandalized by what I was seeing and especially touched by the issue of industrial and sardine processing pollution, as a teenager, I started getting involved with the environmental cause. After some individual initiatives – which included the organization of a Protest Regatta against the Bay's pollution, joining more than a hundred vessels of sailors and fishermen in 1980 –, together with some friends, I founded the Movimento Resistência Ecológica (Ecological Resistance Movement – More).

111. *In May 3rd, 2015, in a reportage broadcasted by the television newsmagazine Fantástico, on Rede Globo, André Corrêa dived into Guanabara Bay in an area close to its mouth, as a way of showing that the situation raises no concerns to the 2016 Olympic Games sailors.*

Years later, in 2000, I was nominated president of Feema, being responsible for the coordination of the so-called PDBG Complementary Environmental Programs, whose main action was the industrial pollution control. Afterwards, I presided Feema once again (2007-2008) and nominated undersecretary for the State Department for Environment, keeping my key role in the PDGB management in the industrial pollution area. I was one of the founders of the Instituto Rumo Náutico/Projeto Grael (Nautical Course Institute/Grael Project), which develops environment and educational actions.

PDGB was hindered by the mistakes of being pioneering. There was insufficient experience in structuring and managing environmental projects of such size and significance in Brazil. The bureaucratic obstacles (state and federal government bureaucracy, as well as from IDB) and the peripheral nature of the program in the state public administration caused a lot of difficulties. And it failed in prioritizing large-sized construction works, large collection networks, and large sewage plants (as Alegria, patriotically celebrated as the largest one in Brazil). The outcome of such option was the increase of organic load in the Guanabara Bay.

The project was divided in an erroneous way for its implementation. With different sources of funds, the sewage networks, sewer trunks and treatment plants were put out to tender in an independent way, with no articulation of schedules. Add to that the managerial discontinuity caused by the changes in governments and leaders. The program was strongly influenced in its conception by Cedae) and started prioritizing large work sites rather than the Bay's managerial aspects. Such aspects were simply ignored. In several decisions, our votes were overturned.

Despite of it all, I believe in a clean Bay. We are able to clean it. But therefore we need to advance in the course. Through PDBG, PSAM, Fecam and other sources, we already invested BRL 5 billion. Additional BRL 20 billion are still required. Thus we will not make it only with a state action. We need a new sanitation

model, a model that includes other players, such as the private sector. And we need to set a clear regulation and governance policy, which was the turning point in Portugal, for example, that performed its advance and had an improvement in sanitation in just ten years.

Are required great investments in sanitation and infrastructure to recover the time we lost. But I think we will only establish a clean Guanabara culture with local actions and interventions. I believe in a clean-up process cove by cove, beach by beach, river by river. By that, the action moves from the great amounts that keep the common citizen away to a local scale.

THE OLYMPIC BAY: WHAT TO EXPECT?

IN AUGUST 2016, the Guanabara Bay shall be the venue for the sailing competitions during the Rio Olympic Games. Once again, the whole world shall turn attentions to the Bay's waters, that once say were sang by Caetano Veloso as a "*boca banguela*" (toothless mouth). The controversy arises each and every day on national and international TV, newspaper, and magazines news: can we assure the regattas will take place with no hitches? Can we discard the risk of a plastic bag or a piece of wood influencing in the competitions' results – since the target of 80% of sewage treatment was regarded as unfeasible by the government itself? Can we provide the basic conditions to prevent the competitors returning to their countries with stomach disorders or hepatitis A?

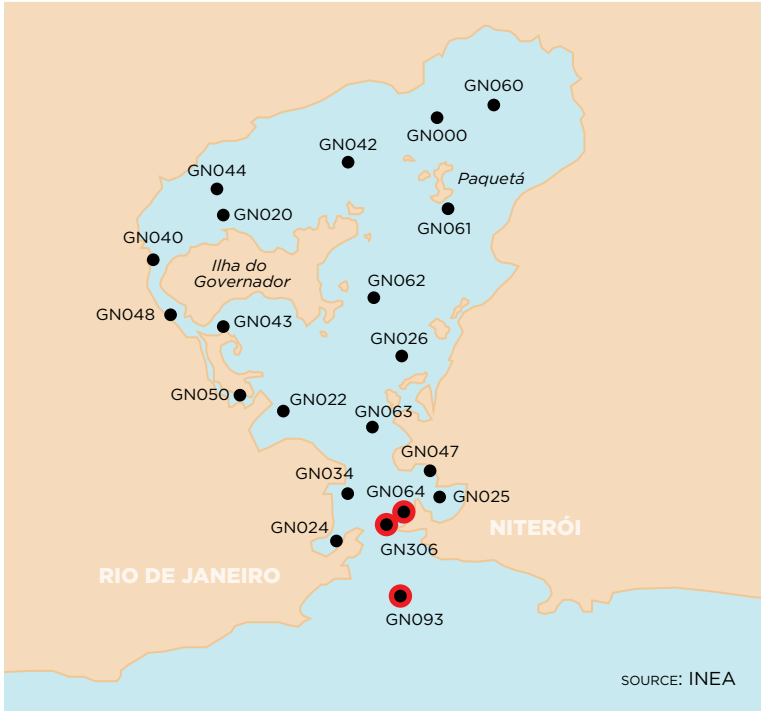
The engineer Adacto Ottoni, from Uerj, fears the answers to such questions to be negative. He criticizes the frequency of the water assessments performed by the Rio de Janeiro State Environmental Institute (Inea) and have reservations on the presented results. In Adacto's opinion, it is surprising and odd that the draining rivers like Irajá, Faria-Timbó, Mangue Channel, Pavuna, Sarapuí and Iguaçu are regarded as in terrible quality (fecal coliforms concentration higher than 4,000 MPN/100 ml – most probable numbers per 100 ml of sample) while the main channel of Guanabara Bay is in great quality, with a fecal coliforms concentration lower than 300 MPN/100 ml of sample. Something in the calculation simply does not match.

If Inea's samples[112], or part of them, were not effectively collected during the ebb tide/low water, they would not be properly representative. Thus they would not represent the real sewage leakage to such regions of the main channel of Guanabara Bay, because there would be a dilution/obstruction effect of sea waters. In case the hypothesis is true, there could be sanitary risks to the athletes' health in case any aquatic sport competition takes place in Guanabara Bay's waters in periods of ebb tide/low water.[113]

112. *Available at <http://www.inea.rj.gov.br/Portal/MegaDropDown/Monitoramento/Qualidadedaagua/index.htm&lang=PT-BR>. Accessed January 30th, 2016.*

113. *Interview with the author, in September 2015.*

GUANABARA BAY MONITORING STATIONS



The historical series of the fecal coliforms rate nearby the points where the Olympics sailing competitions will take place indicates (table at the following page), from January 2012 to December 2014, a pattern of good conditions for bathing and playing sports, in general. However, there were violations of the limits required by the federal legislation in January 2013 (in two points). Another noticeable situation is the lack of data from January to July 2012, and February and November 2013. Inea affirms it always perform the measurements in ebb tides, but does not indicates the time when the collections were made. There is a new proceeding on the subject being in process in the Rio de Janeiro State Public Prosecution Department.

The oceanographer Julio Cesar Wasserman, professor at the Fluminense Federal University (UFF), agrees that there is no way of assuring the absence of risks to the sportsmen/sportswomen's health. He argues that the environmental body's historical series has failures in the collect frequency:

> We cannot not delude ourselves, the homework was not completed. Guanabara Bay is still very contaminated. The heavy metals, the seaweed production (that gives the waters a greenish color), the oil and the floating trash are still intensively reaching the bay, and despite of the marine outfalls constructed under petty perspectives of pipelines economy, they keep on throwing sewage on the beaches. How to present clean waters Rio de Janeiro to the world?
>
> The competitions take place during some hours, which may comprise ebb tides, with the possibility of exposing the competitors. The samples collection for contamination assessment should assume the worst case, that being the ebb tide, ideally on rainy days.

GUANABARA BAY (OLYMPIC VENUES)
MONTHLY RESULTS OF FECAL COLIFORMS COLLECTIONS
AND ANNUAL MEDIANS – 2012/2014

FECAL COLIFORMS RESULTS (MPN/100 THOUSAND) REGARDING 2012									
SAMPLING STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	
GN0064								130	
GN0093									
GN0306								78	

FECAL COLIFORMS RESULTS (MPN/100 THOUSAND) REGARDING 2013									
SAMPLING STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	
GN0064	1300		45	130	130	78	230	78	
GN0093	2800		45		130	230	330		
GN0306	490		78	130	45	230	490	230	

FECAL COLIFORMS RESULTS (MPN/100 THOUSAND) REGARDING 2014									
SAMPLING STATION	JAN	FEB	MAR	APR	MAY	JUN		JUL	
						04/06	14/06	17/07	
GN0064	18	1300	330	78	330	380	130	20	
GN0093	45		18	230	78	190	130	170	
GN0306	20	490	490	78	490	230	78	20	

CONAMA STANDARD 357/2005			
CLASS 01	PRIMARY CONTACT (BATHING)	SALINE/ BRACKISH	
CLASS 02	SECONDAY CONTACT (SAILING COMPETITIONS)		

	SEP	OCT	NOV	DEC	MEDIAN
	33	79	45	68	68
	490	49	1300	18	270
	790	130	220	45	130

	SEP	OCT	NOV	DEC	MEDIAN
	20	170		45	104
	78	18		20	104
	45	230		20	180

	JUL	AUG			SEP	OCT	NOV	DEC	MEDIAN
	21/07	01/08	03/08	19/08					
	330	330	790	790	1000	99	790	780	330
	18	18	45	18	410	18	18	88	78
	45	45	330	330	640	140	130	99	135

	FECAL COLIFORMS 1000 MPN/100 ML
	FECAL COLIFORMS 2500 MPN/100 ML

Wasserman adds that the exposure to contaminants increases precisely on days of heavy rain due to the lack of separation of sewage networks and rainwater in most of Guanabara watershed areas:

> In case of rain, certainly the sailors will be truly exposed to sanitary contamination. When it rains, the channels are "washed" and the coliforms detection shall increase. During high tide or flood tide, the water may even be transparent, providing really low coliforms detection results, but is during the ebb tide that the sewage gets in the bay, and the water is rarely transparent. Although the competitions period is scarce in rainfalls, we cannot just "pray" that it does not rain on the competition days.[114]

Based on data presented by Inea on the environmental conditions of the Olympic competition lanes, Silvana Cutolo, professor of the Environmental Health Department of the University of São Paulo's Public Health School, highlights that more elements would be required to discard the risk exposure, which were not provided by the official bodies yet:

> The historical series indicates a proper water quality. However, more results are required, in addition to other water quality parameters, in order to perform a risk exposure assessment of pathogens such as Escherichia coli, Salmonella, enteric virus and parasites like Cryptosporidium and giardia.[115]

114. Interview with the author, May 2015.

115. Interview with the author, May 2015.

The virus controversy

The news hit the media like a bombshell in July 2015. The virus rates in at least one of the six lanes where the sailing competitions will take place are too high and make the sailing unsafe. In a public hearing in September 2015, the researcher Fernando Spilki, from the Feevale university centre, in Rio Grande do Sul, warned about the lack of virus contamination parameters in the Brazilian legislation.

Contracted by Associated Press to assess the Guanabara Bay water quality in the areas where the Olympics test events were held, the researcher found adenovirus at Marina da Glória[116]. Such viruses are known for causing stomach and breathing disorders, among others, including acute diarrhea and vomits, in addition to brain and heart disorders, the worst cases, but more rare. According to Spilki, the viral load of adenovirus, created from fecal contamination, were very high and "are above the average in such areas".

The Rio de Janeiro State Environmental Institute (Inea), which monitors the waters quality, answered the claims stating it does not recognize the methodology adopted by the university from Novo Hamburgo, and that the Brazilian standards do not require controlling the virus in the water, but only bacteria. In his turn, the physician of the International Olympic Committee Richard Budgett affirms he received assurances from the World Health Organization that there are no significant risks to the athletes' health.

One of the main interventions to ensure better conditions at the Olympic lane of Marina da Glória, the construction of a sewage containment belt (*galeria de cintura de esgotos*) became operational on April 15th, 2016, after setbacks and even the breakage of the soil drilling machine known as "tatuzinho" (in free translation, "little armadillo"). The structure, operated by Cedae, is known as for dry wheater. It means that all the sewage that illegally flows into the rain water networks between Avenida

116. *Available at <https://www.feevale.br/acontece/noticias/feevale-foi-a-universidade-responsavel-por-pesquisa-da-associated-press>. Accessed January 30th, 2016.*

Presidente Antônio Carlos, in the city centre, and Praça Paris, in Glória, is collected and sent to a pumping station, then, it only flows into the marine outfall of Ipanema when there is no rainfall. When it rains, mainly on heavy rain, there is no guarantee that the detritus will be sent to the marine outfall.

The system of one kilometer of new networks along Avenida Beira-Mar plans to conduct, on a whole, 450 liter of sewage per second to the marine outfall of Ipanema. Forecasted at least six years ago, the construction work was budget in a total amount of BRL 14 million and funded by resources from the Rio de Janeiro State Fund for Environmental Conservation (Fundo Estadual de Conservação Ambiental – Fecam). The president of Cedae, Jorge Briard, affirms that the waters of such stretch of Guanabara Bay "shall be significantly improved". But he recognizes that new constructions may occur in the future to ensure the total sewage collection in the region, which is supplied by networks installed circa 80 years ago[117].

Floating trash, the enemy of regattas

The floating trash in the Guanabara Bay emerges as the most important environmental subject to the Olympic agenda of Rio 2016. That is the problem that may affect the regattas' result. One of the most frequent critics of the Bay's conditions is Ricardo Winicki, known as Bimba. He guaranteed place at the Olympic Games in the RS:X class and shall participate of his fifth Olympics. The sailor even defended the transfer of the sport dispute to Búzios – hypothesis strongly refuted by the Rio 2016 Committee. According to him, the Bay clean-up encompasses the population's education:

117. Alencar, Emanuel, 2015. Available at <http://oglobo.globo.com/esportes/rio-2016/tatuzinho-comeca-escavar-rede-na-marina-da-gloria-17290919>. Accessed January 30th, 2016.

Sportsmen and the floating trash coexist on the Bay, and it shall not be different during the Olympics.
PHOTOGRAPH BY MARCELO PIU

> They sold the idea of a cleaned-up Guanabara Bay for the Olympics. That neither happened nor shall happen. There is no use only blaming the Brazilian Olympic Committee or the city government. People that dirty the beach and throw trash on the streets are also responsible. When I went to China in 2006 the Chinese would spit at the restaurant's floor. In 2008, that would not happen anymore. Everything begins with a process of awareness.[118]

Sailing world champion, the *carioca* Jorge Zarif agrees. He emphasizes the importance of the yachting disputes being held in Rio, but believes something must be done at once:

> The foreigners get scared. I never sailed in Europe in a place like here, both regarding beauty and dirty. This is not a thing that can be solved overnight. If they started something any time soon, it would be possible to improve a lot of things, but we know Brazil. It is hard to believe something will happen.[119]

118. *Bertoldo, Sanny. 2014. Available at <http://oglobo.globo.com/esportes/velejadores-criticam-poluicao-da-baia-de-guanabara-11261195>. Accessed September 30th, 2015.*

119. *Interview with the author, in November 2015.*

Strengthened notion of priority

To Axel Grael, depending on what we will be able to show in 2016, Guanabara Bay shall be an international reference in the floating trash subject, whether for having solved the problem or for having not:

> We still need to consolidate the Olympic legacy of Guanabara Bay in this pre-Olympics period. But one thing is certain: the notion of priority and that we need a clean bay is strengthened. Not for the Olympic athletes, but for the population of Greater Rio and Brazil.[120]

A cleaned-up Bay shall require investments of more than BRL 20 billion, calculates Axel. He emphasizes that the clean-up shall require not only investments in sewage treatment, but also in habitation and urban policies:

> A cleaned-up bay changes the economy, geography, and even the daily routine of people. Imagine the Mauá Beach, Luz Beach, Ilha do Governador and other areas cleaned-up and handed back to the people with better conditions of bathing and playing sports. Imagine the change in leisure, tourism, in the valuation of such areas, in the recovery of the self-esteem of such areas' population.
>
> Course it will not be done only with environmental and sanitation actions, but also with social, urban investments. But one thing shall maximize the others. We need to develop a sprint for funds, and not a 100 meters event. Thus the governance and the setting of long-term targets.[121]

120. *Interview with the author, November 2015.*

121. *Interview with the author, November 2015.*

Gelson Serva, coordinator of PSAM from 2010 to 2014, believes that, for the sailing events, the sewage and floating trash issue tend to be overcame:

> Guanabara Bay's pollution mainly affects the Rio de Janeiro population, which loses the opportunity of enjoying the largest environmental, touristic and cultural asset of the city. Its environmental degradation is a consequence of an even greater evil: the habitation precariousness of millions of low-income people. The compromise of transforming this situation must be made with the population.
>
> For the Olympic Games' sailing events, such issue may have no, or almost no, consequences if a good retention and collection of floating waste be performed by the ecobarriers and ecoboats, as was performed during the test event of August 2014 and may be mirrored in the 2016 test event.
>
> As it was exhaustively affirmed by the authorities, the sailing competitions are planned for the central area of the bay, where the interchange of waters with the sea is intense and ensures a good bathing and sports playing condition, as demonstrated by the Inea monitoring of more than ten years ago.
>
> It is not the Guanabara Bay that will spoil the brightness of the 2016 Olympics, conversely, the Olympic Games are going indeed to leave a priceless contribution to our bay's recovery in valuing its beauty and highlighting how this estuary may be even greater if the government and society make each its part on the protection and preservation of its water bodies.[122]

122. Interview with the author, in August 2015.

People do not value the ecosystem

The universalization of treated water and sewage collection supply in the municipalities surrounding the Guanabara Bay may represent a economic gain up to BRL13.8 billion in 30 years, according to the study *Benefícios econômicos da expansão do saneamento à sociedade dos municípios da Baía de Guanabara* (in free translation, "Economic benefits of the sanitation expansion to the society of the Guanabara Bay municipalities"), published in 2014 by Instituto Trata Brasil.

To the Duque de Caxias mayor Alexandre Cardoso (PSD party), the Bay clean-up depends a lot more on habitation programs than on sanitation actions:

> Today, you would have to build 30 to 40 thousand houses just to take people out of the places where it is not possible to treat the sewage. We are talking about BRL 3.2 billion. Just to build a house, for not letting the citizen throw waste in the river or the bay. Meriti River is not a river, it is an open-air sewer. There is no use in making treatment plants if we don't solve the urbanization issue. Municipalities must have autonomy in such management. Why didn't they do a (marine) outfall in Baixada?[123]

Carlos Min, former secretary, notes that the Iguaçu-Sarapuí Project, which won a prize from the Ministry of Cities for implementing actions of prevention of floods and re-urbanization of a complex watershed that gathers 3.5 million people, is an example to be followed. The program received BRL 173.5 million, resources from the federal government Growth Acceleration Program (PAC) since June 2007. That is one more case affected by the crisis that hit Brazil as of 2015.

123. *Interview with the author, November 2015.*

> We removed 42 tires of these rivers. We already reallocated 4,200 families, dredged 65 kilometers of river and removed 6 million cubic meters of detritus. We planted trees, made cycling paths, polders, areas for water accumulation. We created an Environmental Protection Area (APA) of Alto Iguaçu to prevent the soil sealing. Such project must be complemented with an urban policy, support to waste pickers (of recycling material). Without involving the population, it cannot happen. We spent BRL 450 million and want to avoid people reoccupying the river's banks. The city governments must do their part.[124]

A good summary to the historical disconnection between the civil society demands and the realization of public policies in Guanabara may be in this analysis of third sector policies published in the Revista de Sociologia e Política (in free translation, "Politics and Sociology Magazine") of the Social Sciences Department of the Federal University of Paraná (UFPR):

> Guanabara Bay is appreciated as a landscape by those who don't frequent its beaches, for being polluted and/or distant, and because they do not depend on it for making their livings. We can conclude (...) that the general public do not have the perception of the value of such ecosystem as a public asset, and that its preservation requires a more active attitude by the civil society.[125]

124. Interview with the author, in July 2015.

125. Mattos and Drummond, 2005, p. 187.

The Bay we want

We shall not expect a clean Guanabara for the 2016 Olympics. On the contrary, the image that is going to be conveyed all over the world shall be of an environment full of sewage organic matter, really far away from the ideal conditions. A real contrast to the astonishing surrounding scenario that confers Rio the nickname Cidade Maravilhosa (in free translation, Marvelous City). There is indeed the risk of us getting shamed. It is sufficient that it rains a little days before the athletes get on the water. Then it is going to be thousands of packages, plastic bottles, wood and all sort of trash drifted downstream into the Bay. But if everything goes alright it shall be possible to make a good makeup.

Besides the small-sized short-term actions, it is up to the Rio the Janeiro state dwellers to decide if a clean Guanabara is really a social demand, just like improvements in health, education, habitation, public transport and safety. This decision was not made yet. The issue has recently gained shape, that is true. But a great part of it is due to the Olympics and the enormous risk of seeing our image tarnished abroad. The environmental agenda still is relegated to the sidelines.

There are a plenty of examples of succeeded estuaries clean-up cases. The huge Chesapeake Bay[126], surrounded by eight American states managed to get positive outcomes with a common agenda involving states, municipalities, Union, universities, and the civil society. There, an environmental program was initiated in 1983 aiming at the recovery of the biodiversity affected by the use of pesticides that was causing the raise of the nitrogen and phosphorus rates in the water body.

In a long-term action, with established targets and also a lot of critics from the civil society, the public authority and scholars teamed up to ensure that the actions would be closely followed, as well as the allocation of resources. As a result, accessible to the lay public reports are periodically made available[127]

126. *Learn more at http://www.chesapeakebay.net/*

127. *Available at <http://ecoreportcard.org/report-cards/chesapeake-bay/>. Accessed November 30th, 2015.*

in a website maintained by the Maryland University, providing water quality rates. In the website, the city dweller can check, for example, a diagnosis on the salmon or blue crab stocks, good healthy indicators for such waters. And we got to run after transparency and management.

Ten of ten Rio city dwellers agree that we should protect the Guiana dolphin. They are beautiful and docile animals; they are a symbol of resistance. They are in the Rio de Janeiro state flag. However, those very same people never demanded the implementation of a serious government program, audited, transparent, to clean up the Bay. Does Cedae has conditions of having improvements in sanitation? How much shall we pay for having sanitation universalized in Great Rio, and who is going to finance it? How long do we still have to wait to see the Bay in better conditions? Will the social and regulatory control mechanisms, crucial to ensure the meeting of terms, work one day? Such discussions cannot be restricted within the Guanabara Palace walls or the ones of the leaders of the Rio Legislative Assembly offices.

We lost time watching from the front row the profusion of mistakes and few advances, all under the conduction of a tuneless orchestra that is too expensive for the public coffers. It is a minor issue whether the Olympic sailors will be affected by the floating trash during the Olympics or not. The Olympics must pass and we will stay. To clean-up the Bay is an obligation if Rio wants to keep its strength as a global city, as says the economist and environmentalist Sergio Besserman. There is no magic solutions or fanciful innovations. The simple resume of the sewer collection networks is an urgent measure.

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CUSTÓDIO COIMBRA

EMANUEL ALENCAR studied Journalism at the Universidade Federal Fluminense (UFF-RJ), from which he graduated in 2006. He is postgraduate in Environmental Management from the Universidade Federal do Rio de Janeiro (UFRJ), in partnership with the Instituto Brasil PNUMA (United Nations Environment Programme – UNEP). Alencar started his career at the *Revista Ferroviária*. After a brief period at the press relations office of Eletonuclear (Eletrobrás Termonuclear S/A), he joined the team of *O Fluminense* newspaper, from Niteroi (Rio de Janeiro), from May 2004 to February 2007. For seven months, Alencar worked in the research team of the newspaper *O Dia*, going afterwards to the newspaper *O Globo*, where he served for eight years. The author is currently the Content Editor of the Museu do Amanhã (Museum of Tomorrow). He also maintains a column on the portal *O Eco*, specialized in environmental journalism.

When we speak of Guanabara Bay, we speak about a national symbol, internationally known and protected by UN since 2012 as a World Heritage Site. Nevertheless, we also speak of one of the major problems and scandals related to the 2016 Olympic Games. With the industrialization and the great population growth of the city and its surroundings, especially after the 1960s, the environmental issue in the Bay seriously aggrieved. Nowadays, the sewage of 10 million people and 12 thousand industrial facilities in Rio de Janeiro and 14 other municipalities reach the Bay. It is 18,000 liters per second of raw sewage being daily disposed of into the Bay.

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