Technical Cooperation Project:
Overview of the Environmental State of Guanabara Bay

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AGENDA

- Technical Cooperation Project
- Objectives of this workshop
- Experience of Maryland with Chesapeake Bay
- Overview of the Status of Guanabara Bay
- Next steps
Technical Cooperation Project

Objectives

To clearly explain to interested sectors of society of the State of Rio de Janeiro:

• The current state of Guanabara Bay
• The **main threats** impacting the health of the Bay
• A plan of action with **short**, medium and long terms milestones to restore the Bay
Technical Cooperation Project

Approach

Project is a cooperative effort

- KCI
- Guanabara Bay Watershed Committee
- PSAM
- SEA/INEA
- University of Maryland (UMCES)
- FBDS
- Universities and research centers
- IDB
Technical Cooperation Project

Approach

A sua Baía de Guanabara é saudável?

POR INDICADOR

- Overall Health Index
- Dissolved Oxygen
- Nitrogen
- Phosphorus
- Chlorophyll a
- Water Clarity
- Aquatic Grasses
- Benthic Community
- Blue Crab
- Bay Anchovy
- Striped Bass

POR REGIÃO / Região de Guapimirim-Macacu

Região de Guapimirim-Macacu

Bacteria data:
Bacteria score:

Water quality data:
Water quality score:

Biodiversity data:
Biodiversity score:

Transportation data:
Transportation score:

TENDÊNCIAS / Região de Guapimirim-Macacu

Scores (%)
- 80 to 100 (Very Good)
- 60 to <80
- 40 to <60
- 20 to <40
- 0 to <20 (Very Poor)
- Not Scored

Graph showing trends over years.
Technical Cooperation Project Methodology

- These objectives will be accomplished with stakeholder input and incorporation of public comments at each step of the project.

1º Workshop - (TODAY)
Overview of the State of the Bay and initial selection of environmental indicators

2º Workshop
Discussion of the restoration actions needed and their priorities

3º Workshop
Presentation and discussion of the recommended action plan and digital platform
1st workshop objectives

To receive your recommendation and achieve consensus to the extent possible on the current environmental condition and the main factors affecting the health of Guanabara Bay

To identify the most appropriate indicators of environmental conditions that must be monitored to measure and track restoration progress
Why are we here?
Maryland-Rio de Janeiro Sister-State Agreement

1999 – Maryland-Rio de Janeiro Sister-State agreement signed

2011 – Memorandum of Understanding for the establishment of a technical cooperation program

2013 – Technical Cooperation Program for Guanabara Bay and Chesapeake Bay

2014 – Delegation of State and local government officials from Rio de Janeiro to Chesapeake Bay

2014 – Delegation of State, local government, academic, business and NGO representatives from CB to GB
Where is Chesapeake Bay?

Maryland

Estados Unidos
Why Look at Chesapeake Bay?

- Chesapeake Bay shares many of the same challenges as Guanabara Bay.
- Chesapeake Bay is further along in the restoration process and may provide some helpful insights to benefit the Guanabara Bay restoration.
- The watershed is much more densely populated.
- Guanabara Bay is closer to the ocean and is better flushed.
- Guanabara Bay and its watershed are much smaller than Chesapeake Bay.
GB Watershed is also similar to the Baltimore - Washington Metro area (RMBW)

- Drainage area
- Population
- Dense urbanization
- Pollution sources
- Water quality problems
Comparison to Baltimore – Washington Metropolitan Region (RMBW)

- **Population**
  - BWMR – 9.3 million
  - RJMR – 8.6 million (GB Watershed)

- **Political**
  - BWMR – 2 states, 13 counties and 3 major municipalities
  - RJMR – 1 state, 15 municipalities

- **Sanitation problems**
  - BWMR - CSOs & SSOs, $4.8 B sewage/drainage system restoration underway
  - RJMR – 70-80% of sewage untreated, major infrastructure development underway
Uncontrolled population growth and development

Poor land use management

Pollution from:
- Sewage,
- industrial effluents,
- Urban runoff
- Agriculture

Bacterial contamination

Water quality standards violations

Harmful algae blooms and fish kills

Extensive low to no summer dissolved oxygen conditions

“dead zone”

Loss of critical habitat
- Forest, wetlands, submerged aquatic vegetation

Depleted fisheries
- Oysters, striped bass

Invasive species
- MSX and Dermo

Chesapeake Bay Restoration Challenges

Intense farming and development increase nutrients and sediment; nitrogen and phosphorus inputs; and organic matter which promote large algal blooms that consume oxygen and decrease water quality.

Present Conditions

Desired Conditions
Chesapeake Bay Restoration

- Long-term commitment and strong public support
- Started in 1972, with the signing of the US Clean Water Act
- Extensive scientific studies into the causes for the decline of the Bay
- The original 1983 Chesapeake Bay Agreement was a simple, one-page pledge signed by political leaders to establish the governance structure of the Chesapeake Bay Program
- The 2014 Agreement builds upon a long history of restoration efforts
- Our work is still not done.
From Chesapeake Bay experience: Long-term goals alone are not enough...

Two prior commitments for Bay Restoration were not met:

- 1987: 40% nutrient reduction by 2000
- 2000: Water quality restoration to be achieved by 2010 or TMDL would ensue

Decade long commitments don’t seem to be effective, so short-term 2-year milestones have been set to track progress: 2011, 2013, 2015, 2017 ... 2025
2014 Chesapeake Bay Agreement includes specific goals for:

- Pollution reduction, watershed restoration, aquatic habitat, fisheries, land conservation
- Public access, community engagement, environmental education

Implementation teams include government, academic, business, NGO and citizen members working cooperatively

Federal, state and local government, business and NGO funding for staff and implementation
Provide details of the restoration efforts.
Annual “Report Card”

So citizens can follow the restoration progress and ensure actions are being taken.
Education of the next generation is the key to long-term success!
Keys to a Successful Bay Restoration

**Key Factors**

- Federal, state and local government agencies, universities, businesses, NGO’s and public engaged in all aspects of the restoration
- Restoration plan based on good science to achieve shared vision of “The Bay We Want”
- Political leaders’ commitment (Federal, State and local governments involved and committed)
- Dedicated funding
- Measurable commitments and deadlines (Long-term goals and short-term, “2-year Milestones”)
- Transparent, understandable and regular public reporting of key indicators
- Monitoring of restoration actions and water quality
- Everyone held accountable for their actions or lack of action
- Public education at all levels

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Current State of Guanabara Bay

- Rio de Janeiro is world famous for its beautiful subtropical scenery and beaches, but...

Fonte: IAN-UMCES, 2015
Guanabara Bay Watershed: Land Use

- Highly urbanized
- Urban areas close to Bay
- Rapidly growing

Legend:
- Urban
- Agriculture, mining, silviculture, other human uses
- Natural vegetation
Guanabara Bay Watershed: Land conservation areas

Before colonization, Rio de Janeiro State had 97% of its territory covered with vegetation

- Conservation areas, partially or totally included in the Guanabara Bay Watershed:
  - Federal: 5
  - State: 4
  - Municipal: 121
  - Private: 7

Source: INEA, 2016
Guanabara Bay Watershed: Major River Basins

- The five largest rivers contribute 70% of the fresh water flow to the Bay
- Estimated river flow into the Bay is 100-200 m³/second
- Limited information on flow and pollution loading from rivers
Guanabara Bay Watershed: Sanitation

- Over the last 50 years, sewage infrastructure has fallen behind population growth
- Old urban sewage collection systems are not able to handle higher flows
- No system improvements were made between 1980 and 1990
- Since 1990, the pace of sewage system improvements has increased due to PDBG and now PSAM, but sewage system improvements are just barely keeping pace with population growth
- In 2014, PSAM estimates 21% of the population is served by sewage treatment
  - Projects are underway to bring that up to 35% by 2018

Sewage generation and treatment in Guanabara Bay Hydrographic Basin. Source: Coelho, 2007
Guanabara Bay Watershed: Solid Waste

- Poor handling of solid waste
- Illegal dumping
- Visual pollution
- Odors
- Disease vector
- Barrier to recreation and boat traffic
- Hazard to wildlife

- Main sectors: Chemical, petrochemical, non-metallic minerals and metallurgical, food and beverage, textile, transportation material.
- Responsible for ~10% of organic load and almost the entire toxic load.
Heavy Metals

> concentrations: northwest
< concentrations: entrance

**Areas of concern:**
- Northwest portion
  - Outfall of River Meriti
- Rio de Janeiro Port
- Niterói Port
- Mangroves in REDUC area
- Guapimirim mangroves

The areas with significant presence of heavy metals.
Source: ITPA (n.d.).
Guanabara Bay Watershed
2015 Median Water Quality Index

Source: INEA/GEAG, 2016
Guanabara Bay
Physical Characteristics

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<tr>
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<tbody>
<tr>
<td><strong>Surface Area</strong></td>
<td>328 km²</td>
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<tr>
<td><strong>Depth</strong></td>
<td>84% &lt; 10 meters</td>
</tr>
<tr>
<td><strong>Watershed Area</strong></td>
<td>4,080 square kilometers</td>
</tr>
<tr>
<td><strong>Average river inflow</strong></td>
<td>100-200 m³/s</td>
</tr>
<tr>
<td><strong>Population of watershed</strong></td>
<td>8.6 million</td>
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- Water circulation is primarily controlled by tidal currents
- 2-layer circulation with cooler, salty ocean water flowing in at depth and warmer, fresher water flowing out at the surface
- High tidal flows bring sand into the Bay mouth area
- The inner portions of the Bay are silt and clays transported by rivers entering the Bay

Guanabara Bay
2013 Conformity Index

Source: INEA/GEAG, 2014
Guanabara Bay
2014 Coliform Levels (80\textsuperscript{th} percentile)

Source: INEA/GEAG, 2014
Mangroves

- Mangroves filter out pollution and are critical to the health of Guanabara Bay and its ecosystem.

- Estimated 262 km² of mangrove vegetation originally observed before the Portuguese colonization in the 16th century.

- Less than 1/3 of the original is still present in the region.

(Source: Amador, 2012)

Source: Baía de Guanabara: Síntese do Conhecimento Ambiental, 2012)
Guanabara Bay ecosystem is overloaded with organic pollution from untreated sewage, wastewater from industries and ships and other sources, trash and other contamination from the land carried by rainfall runoff to the rivers.

Plants and animals living in the Bay are stressed and populations are not healthy, particularly in the inner parts of the Bay further from the ocean.

A healthy ecosystem is essential to water quality and to support the fisheries in the Bay and the nearby ocean.
Ecosystem Impacts - Benthos

- Plants and animals living in the sandy sediments near the mouth of the Bay are reasonably healthy.

- The inner and intermediate regions of the Bay where bottom sediments are contaminated have low biodiversity and high biomass with a predominance of opportunistic species tolerant to pollution.

- Contamination by petroleum hydrocarbons is pervasive.

- Contamination of some mangroves can be observed in the high concentration of PAHs found in crabs collected in the area.

Source: O Globo – Planeta Terra, 2011
Ecosystem Impacts - Phytoplankton

- Areas near the mouth of the Bay are healthier and have greater biodiversity of phytoplankton communities due to **large marine influence** and greater transparency of the water.

- Lower biodiversity and opportunistic species like the cyanobacteria occur in the internal areas of the Bay under influence of polluted tributaries (Amador, 2012).

- Harmful algal species that produce the neurotoxin demoic acid are present in the system. (Villac and Tenembaum, 2010; Guanabara Bay: Summary of Environmental Knowledge, 2012; Santos et al., 2007)

Source: Fistarol et al., 2015.
Guanabara Bay is an important nursery for many fish species that use the habitat provided by the bay for reproduction.

Shoals of various fish such as mullet, sea bass, true sardines, catfish, yellowtail, sea bass, *paratis* and *aracás* were found in the Bay in a 1979 survey.

Poor water quality and bad ecosystem quality impacts negatively fishing activities in the Bay and adjacent coastal areas.
Many Restoration Needs

- Renovate existing and construct new sewage collection and treatment systems
- Enforce and strengthen industrial pollution laws
- Prevent further expansion of favelas into steep slopes, flood plains, mangroves, etc.
- Correct drainage and flooding by relocating favela residents, restoring flood plains and river channels
- Improve solid waste collection and disposal
- Remove contaminated sediments from canals and Bay
- Protect and restore mangroves, fauna and flora
What’s different this time?

**Shared** public vision for the Bay – “The Bay We Want”

Restoration plan developed with **public input and support**

Short-term milestones to demonstrate **progress**

**Credibility** through simple, highly visible metrics

**Transparency** through regular public reporting

Federal, state and local government, universities and public working together

Museum of Tomorrow
Next Steps

Listen to your comments and suggestions on the:
- Technical Cooperation Project
- State of Guanabara Bay
- Goals for the restoration

2nd Public Workshop:
Discuss key features of a successful restoration plan

3rd Public Workshop
Review proposed restoration plan and Guanabara Bay “scorecard”