



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

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April 29th, 2016



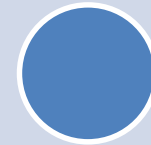
THE MOST INCREDIBLE THING
WE'VE ENGINEERED IS **OUR TEAM**

AGENDA



Next steps

**Experience of
Maryland with
Chesapeake Bay**



**Overview of the
Status of
Guanabara Bay**



**Objectives of
this workshop**



**Technical
Cooperation
Project**



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



Technical Cooperation Project Approach



ecoreportcard.org/report-cards/baía-de-guanabara/saúde

A sua Baía de Guanabara é saudável?

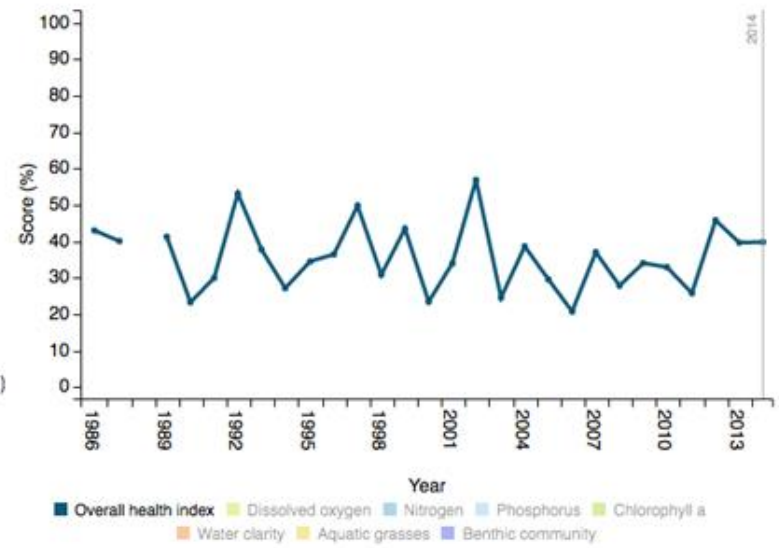
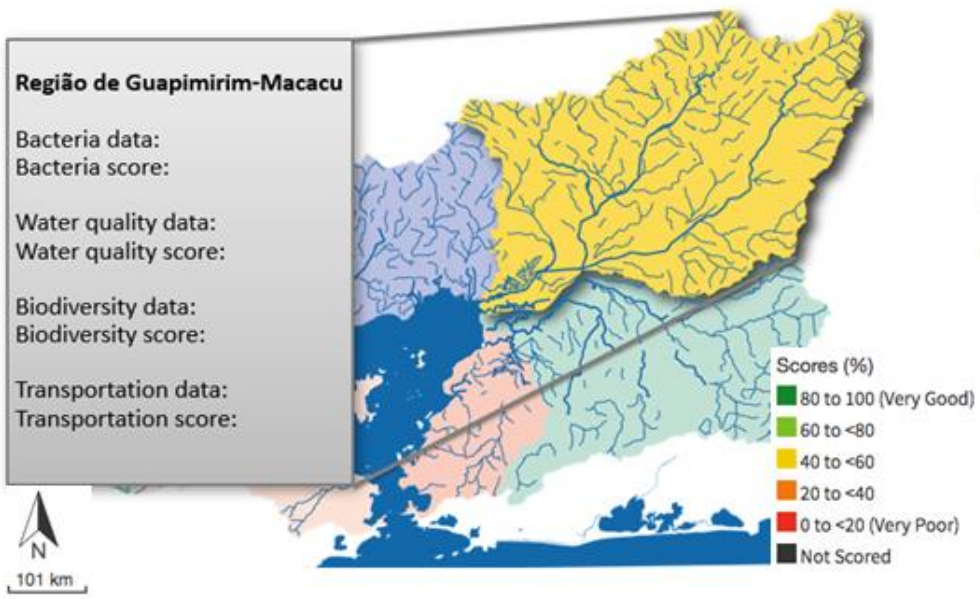
2014

① POR INDICADOR



② POR REGIÃO / Região de Guapimirim-Macacu

TENDÊNCIAS / Região de Guapimirim-Macacu



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

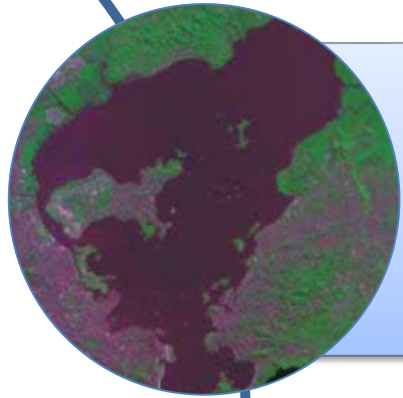
2º Workshop

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



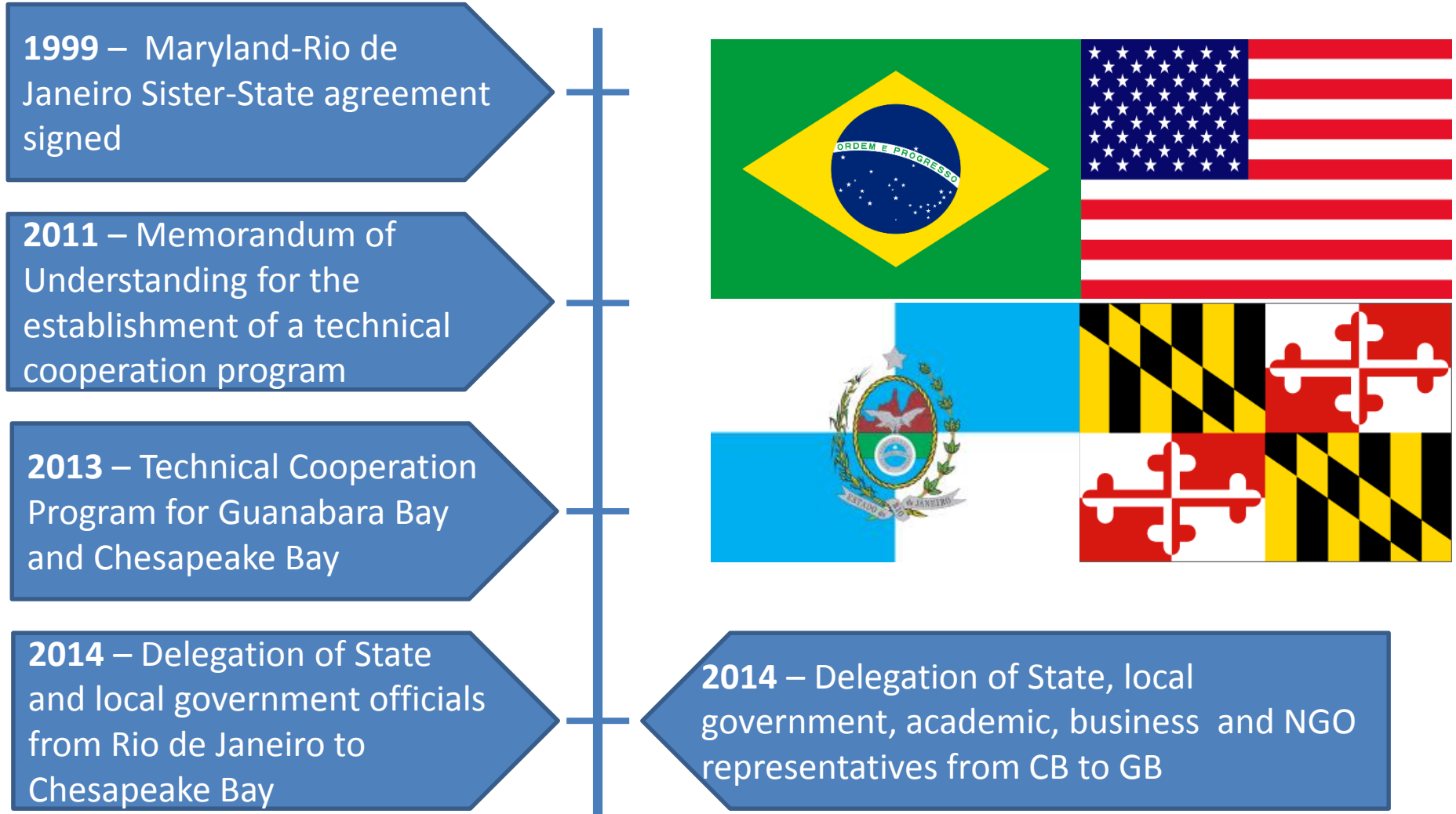
To receive your recommendation and achieve consensus to the extent possible on the current environmental condition and the main factors affecting the health of Guanabara Bay



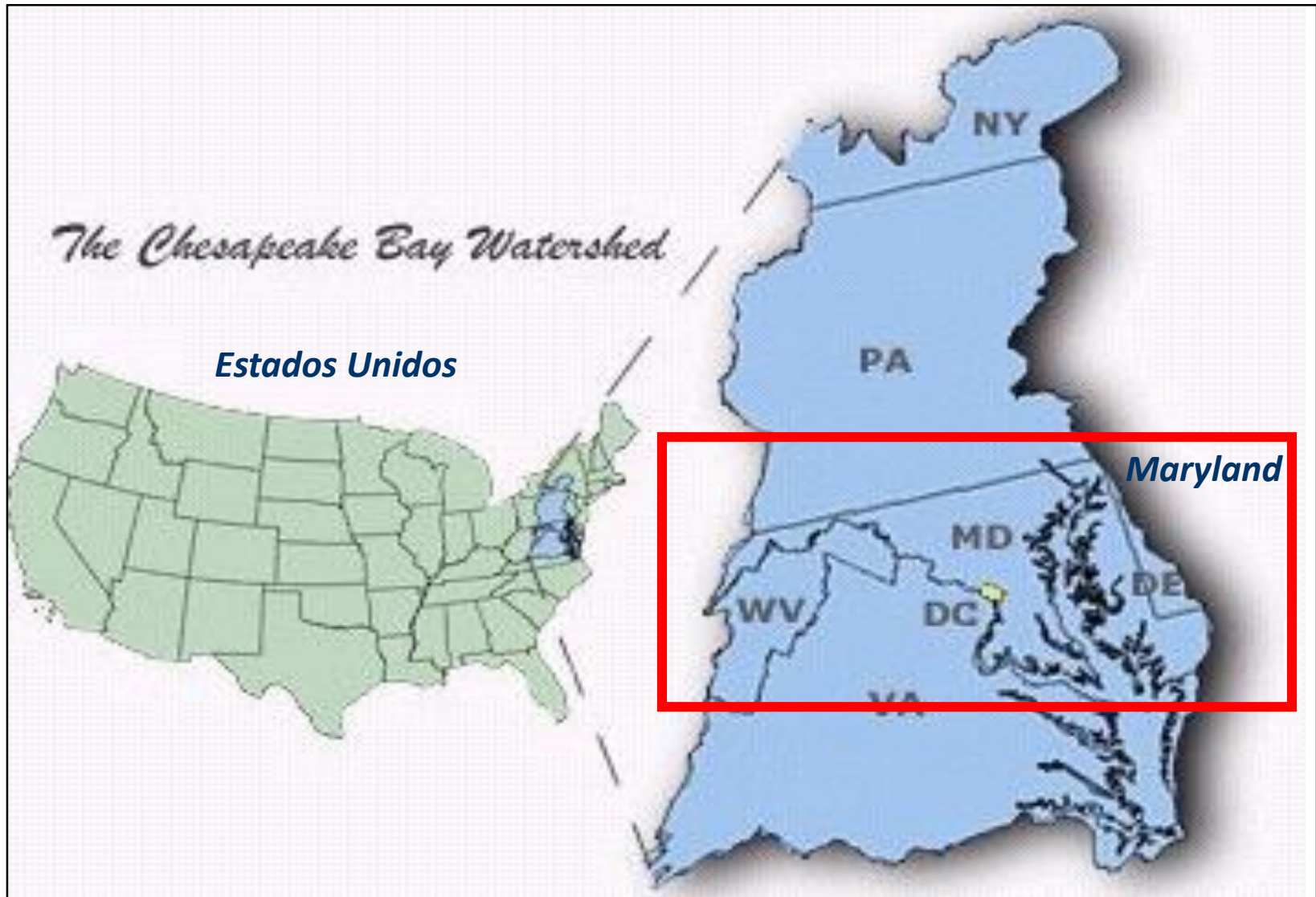
To identify the most appropriate indicators of environmental conditions that must be monitored to measure and track restoration progress

Why are we here?

Maryland-Rio de Janeiro Sister-State Agreement



Where is Chesapeake Bay?



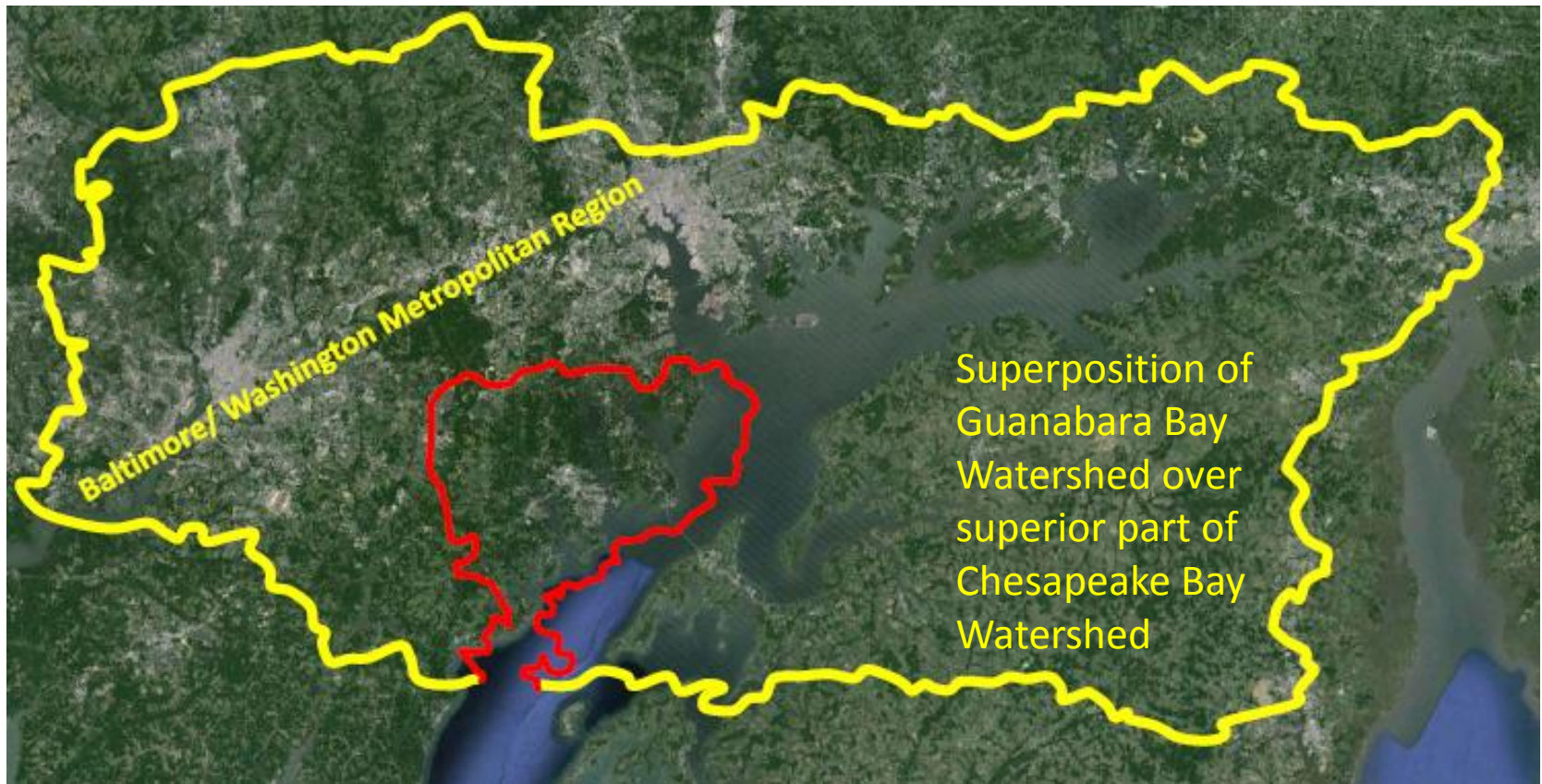
Why Look at Chesapeake Bay?



- 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

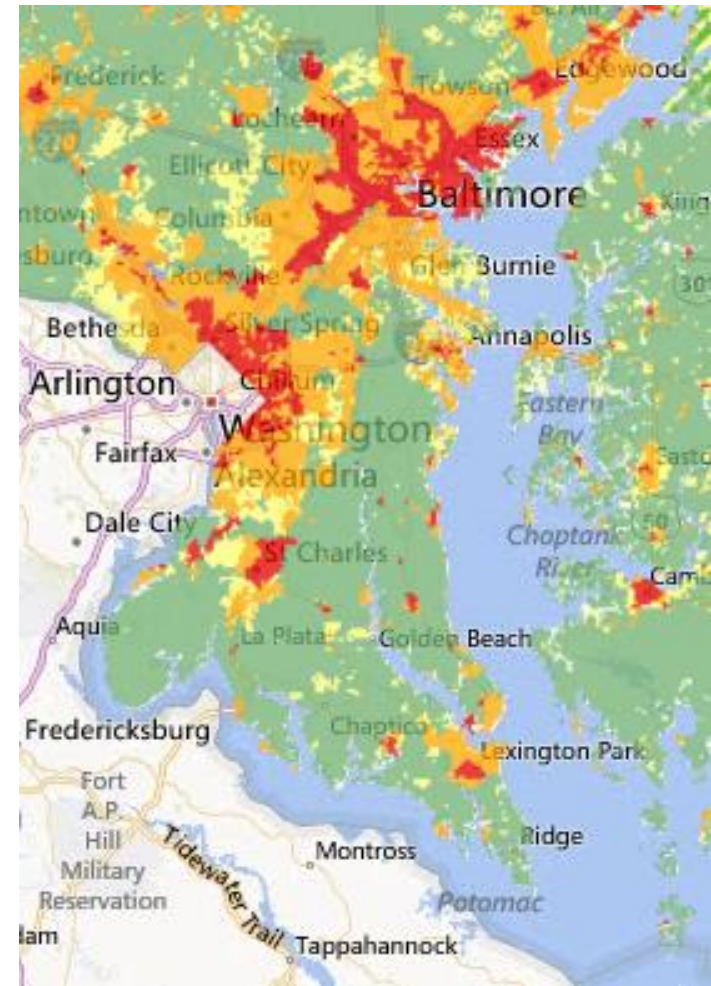
- BWMR – 9.3 million
- RJMR – 8.6 million (GB Watershed)

■ Political

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

■ Sanitation problems

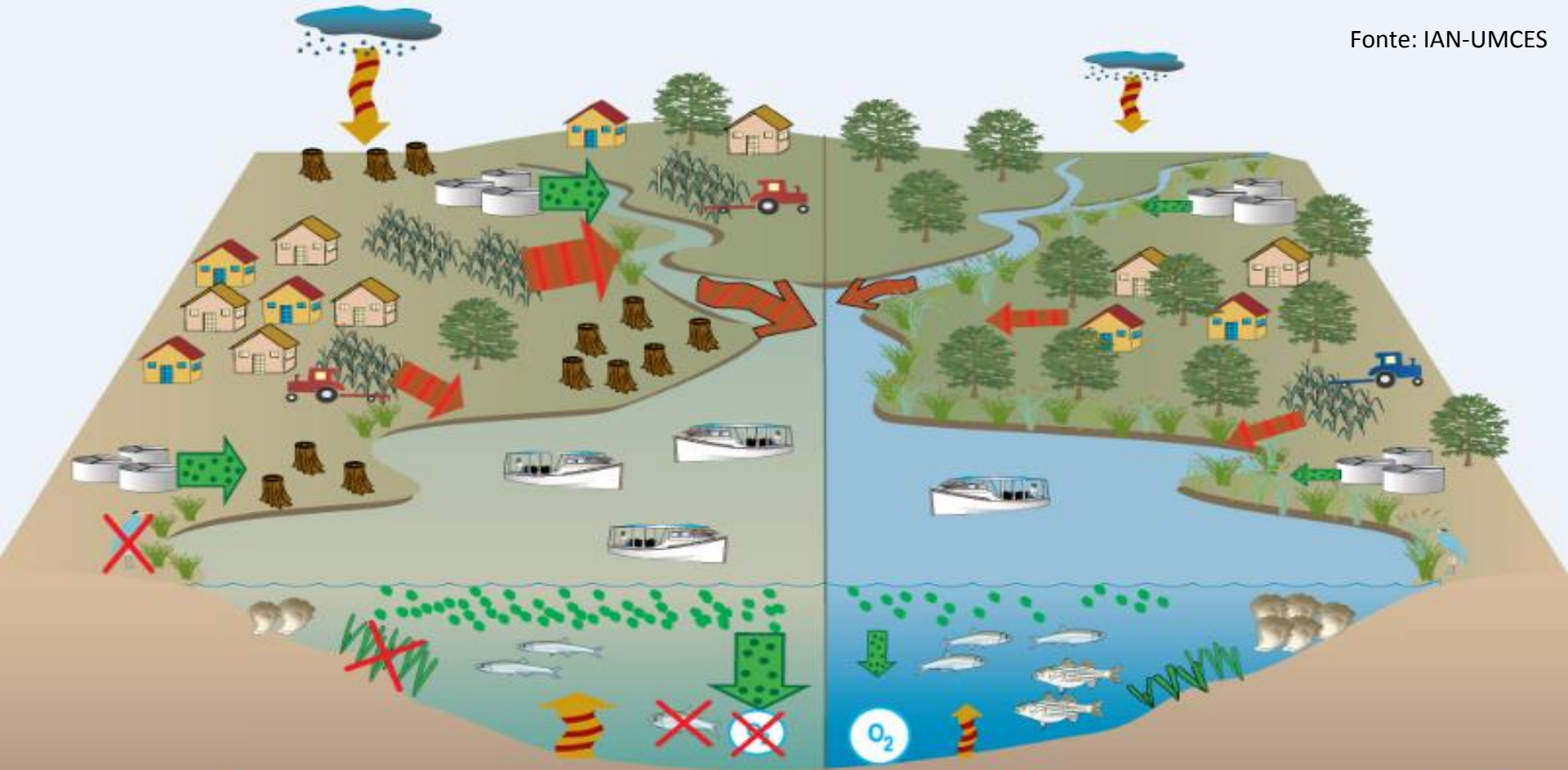
- BWMR - CSOs & SSOs, \$4.8 B sewage/drainage system restoration underway
- RJMR – 70-80% of sewage untreated, major infrastructure development underway



Chesapeake Bay Restoration Challenges



Fonte: IAN-UMCES



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.



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.



Chesapeake Bay Program
A Watershed Partnership

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



Chesapeake Bay: Comprehensive Restoration Plan



2014 Chesapeake Bay Agreement includes specific goals for:

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

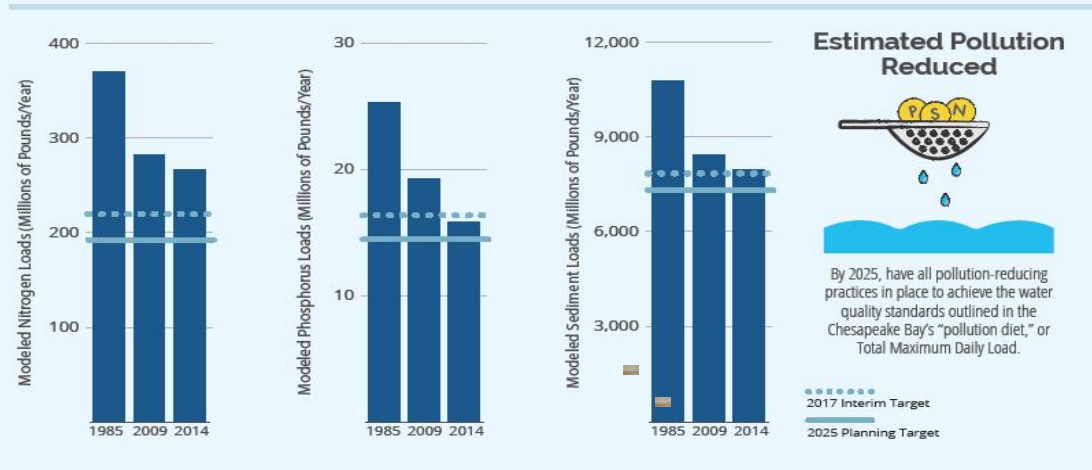
Implementation teams include government, academic, business, NGO and citizen members working cooperatively

Federal, state and local government, business and NGO funding for staff and implementation

Transparent Public Reports Available On-line



BAY BAROMETER 2014-2015

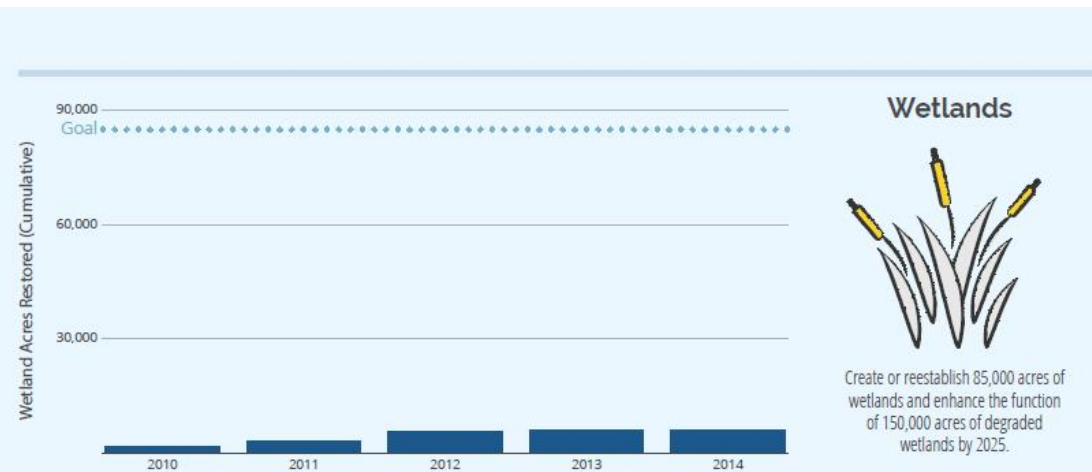


Clean Water

Reduce pollution and restore water quality to support living resources and protect human health.



Provide details of the restoration efforts.



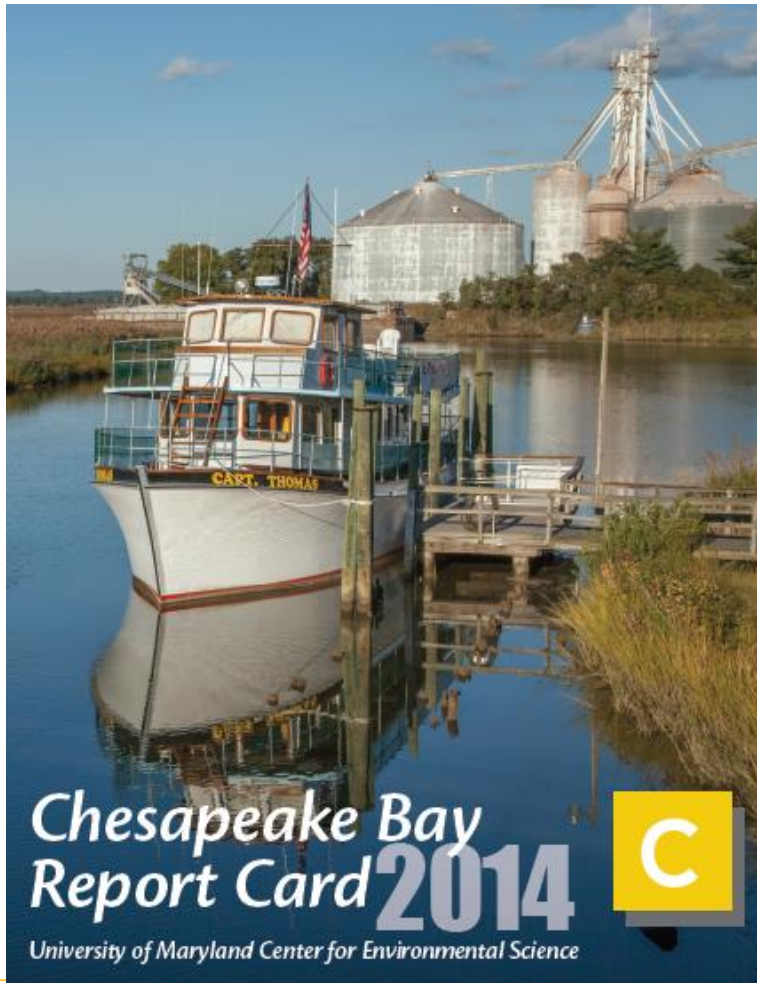
Abundant Life: Habitats

Protect and restore land and water habitats to support fish, wildlife and clean water and offer scenic and recreational benefits.

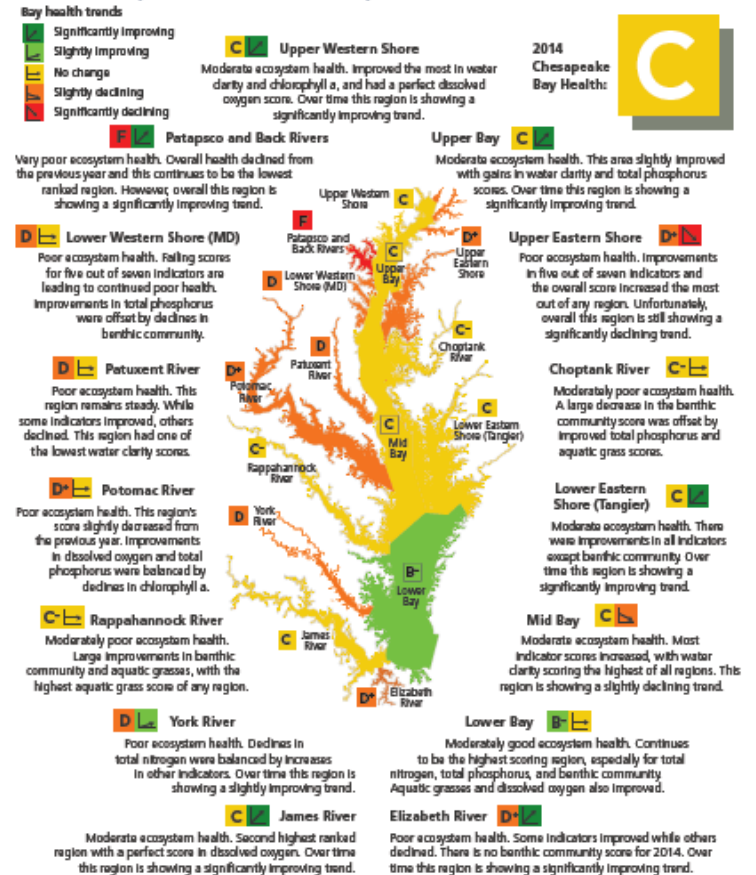
Annual "Report Card"



So citizens can follow the restoration progress and ensure actions are being taken.



Overall improvement but still poor to moderate conditions



Environmental Education Curriculum



Chesapeake Bay Program
SCIENCE • RESTORATION • PARTNERSHIP

chesapeakebay.net/groups/group/education_workgroup

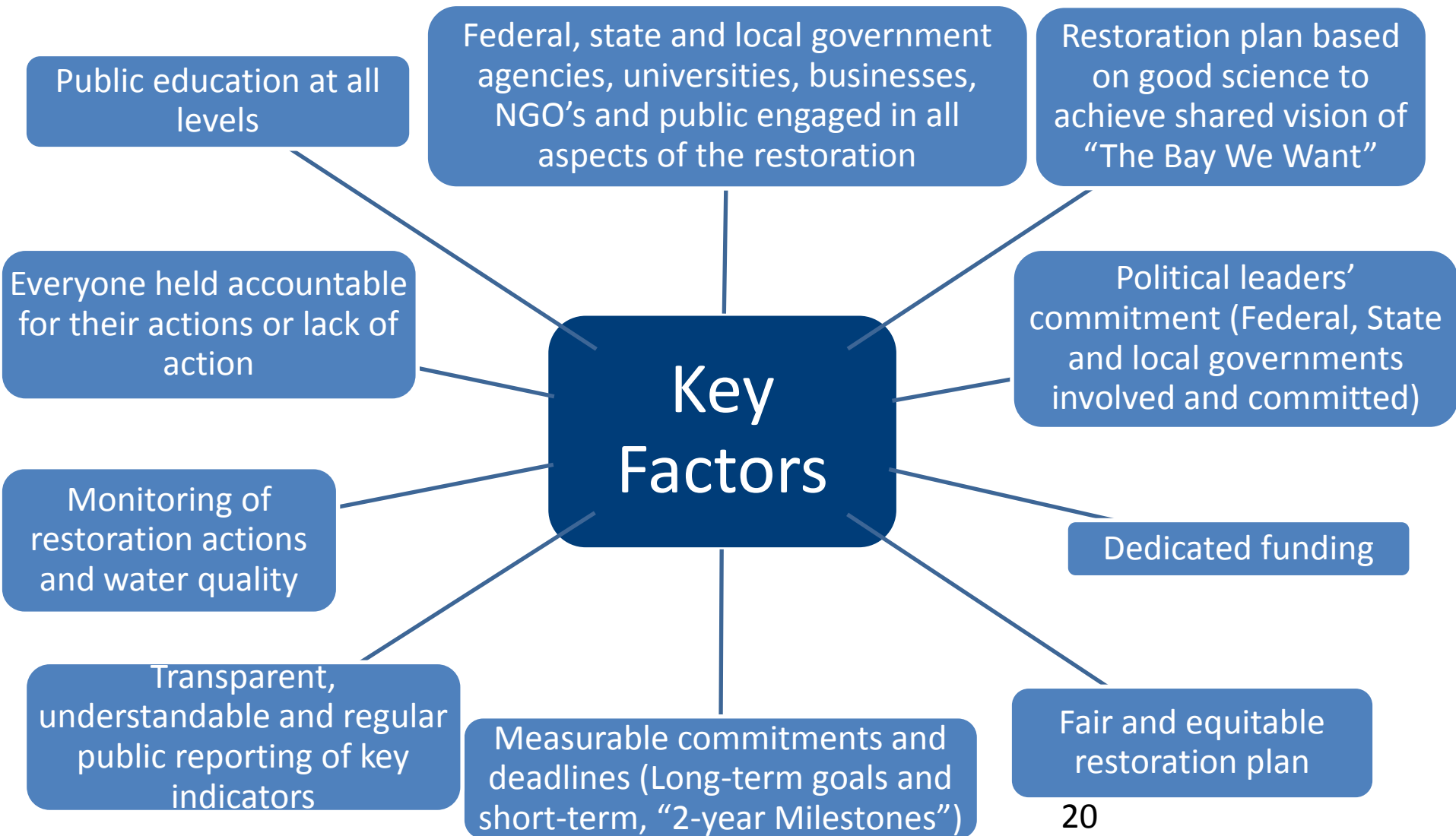
Education of the next generation is the key to long-term success!



MID-ATLANTIC ELEMENTARY AND SECONDARY
ENVIRONMENTAL LITERACY STRATEGY

Executive Summary

Keys to a Successful Bay Restoration



Current State of Guanabara Bay

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

Fonte: IAN-UMCES, 2015

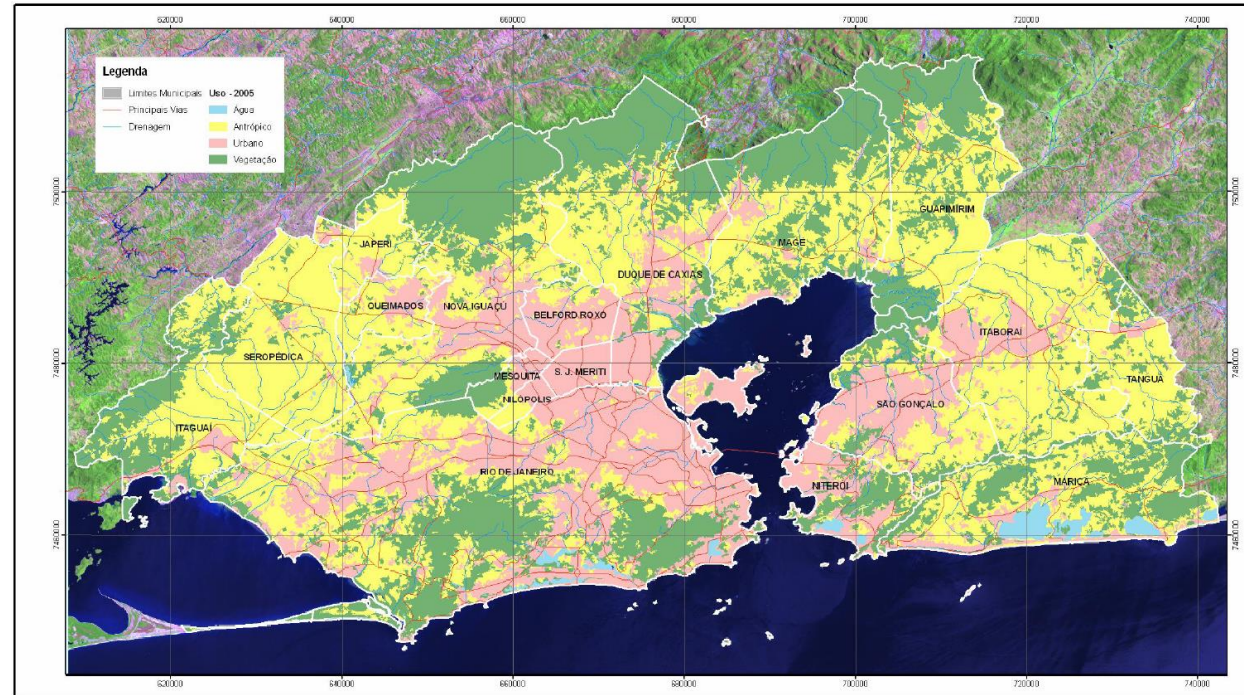


Diagrama conceitual da Baía de Guanabara e sua Bacia Hidrográfica.

Guanabara Bay Watershed: Land Use



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



Urban



Agriculture, mining,
silviculture, other
human uses



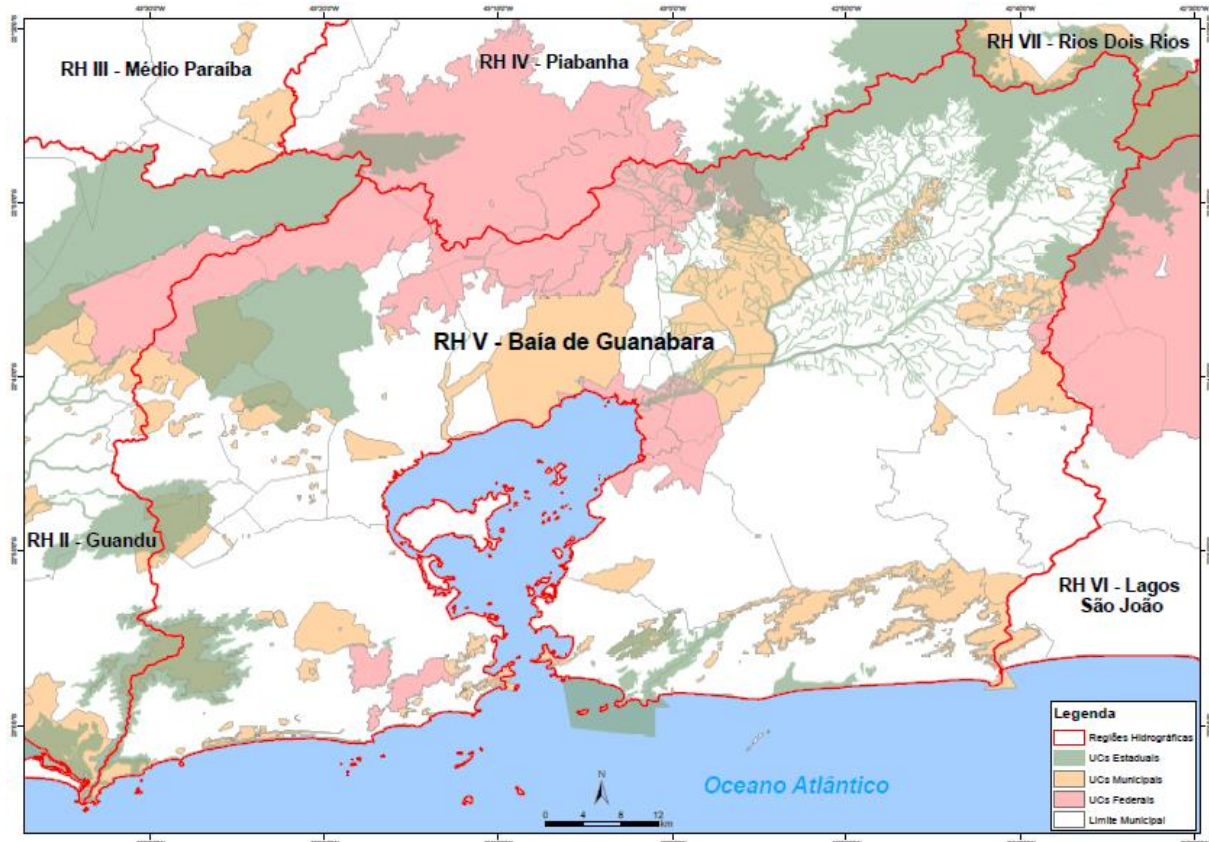
Natural
vegetation

Guanabara Bay Watershed: Land conservation areas

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

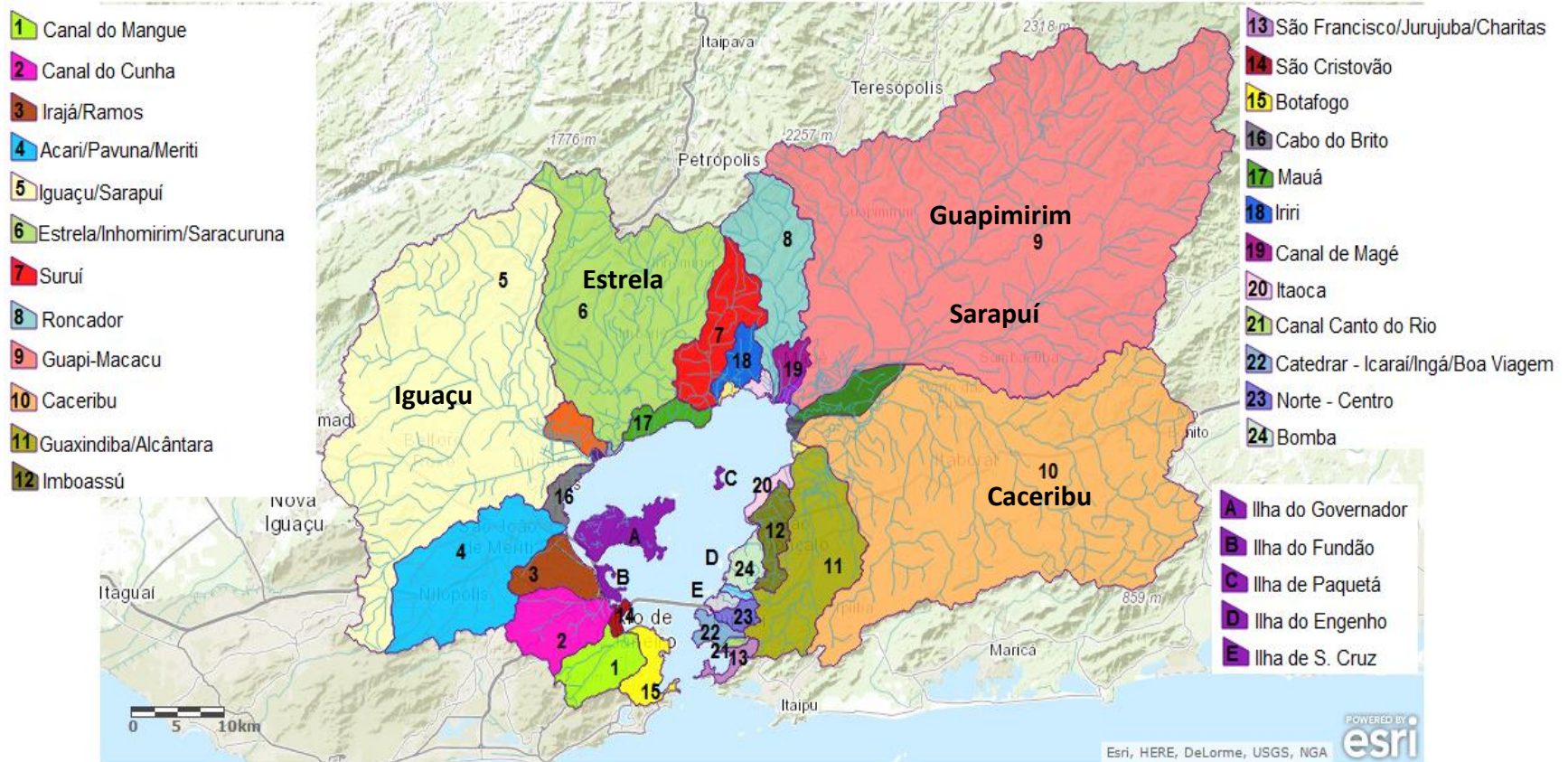
■ Conservation areas, partially or totally included in the Guanabara Bay Watershed:

- Federal: 5
- State: 4
- Municipal: 121
- Private: 7



Source: INEA, 2016

Guanabara Bay Watershed: Major River Basins



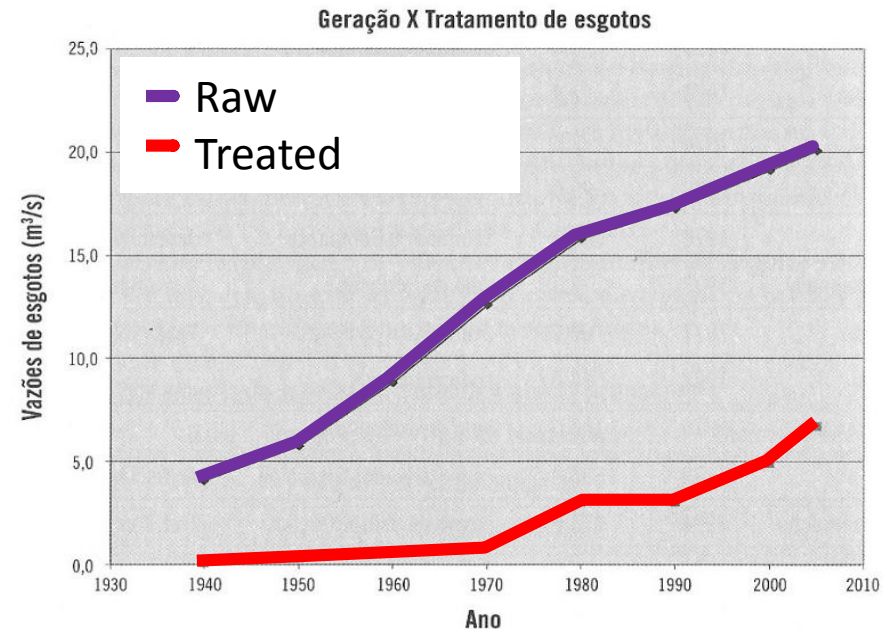
Sub-basins of Guanabara Bay Hydrographic Region. Source: Modified from <http://cbh-bg.maps.arcgis.com>

- 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

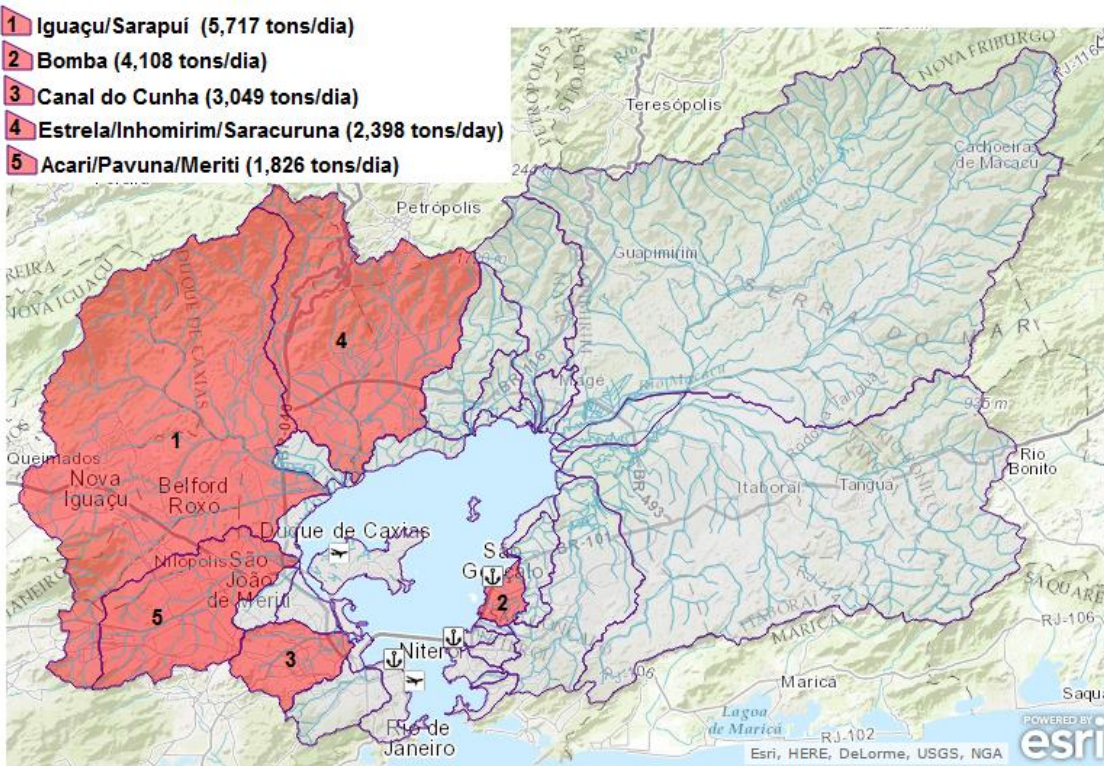
Disease vector

Barrier to recreation and boat traffic

Hazard to wildlife



Guanabara Bay Watershed: Industries

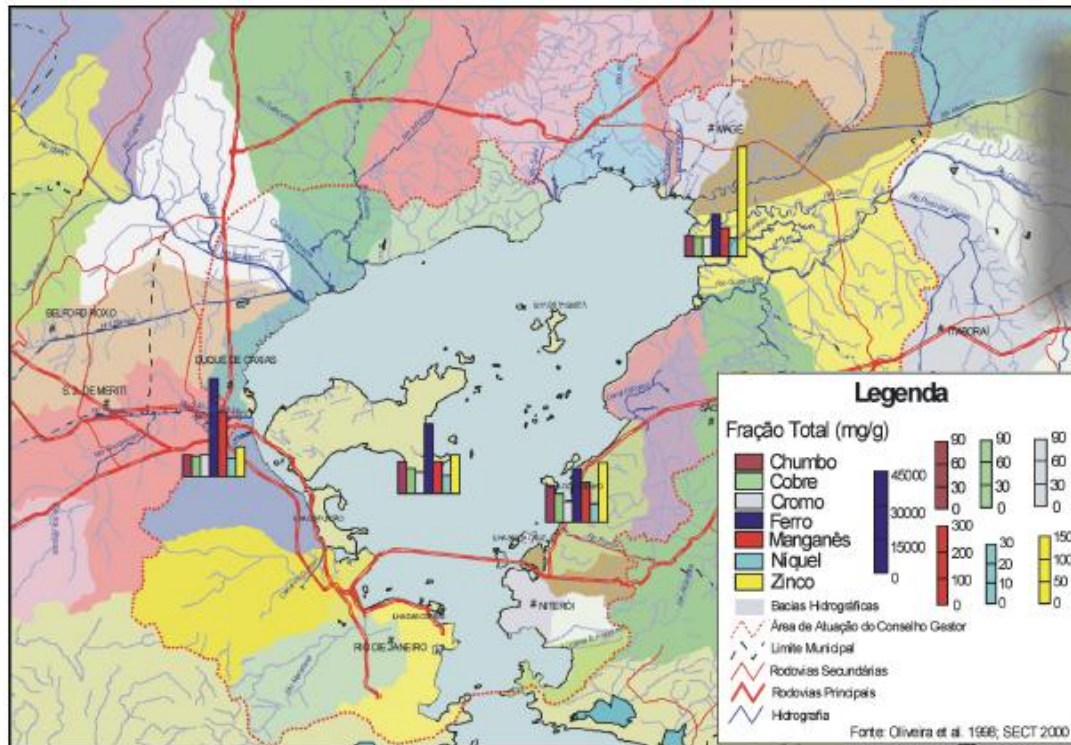


- Main sectors: Chemical, petrochemical, non-metallic minerals and metallurgical, food and beverage, textile, transportation material.
- Responsible for ~10% of organic load and almost the entire toxic load.

The sub-basins that most contribute for industrial organic load according information from 2000. Source: Pacific Consultants International, 2003.

Heavy Metals

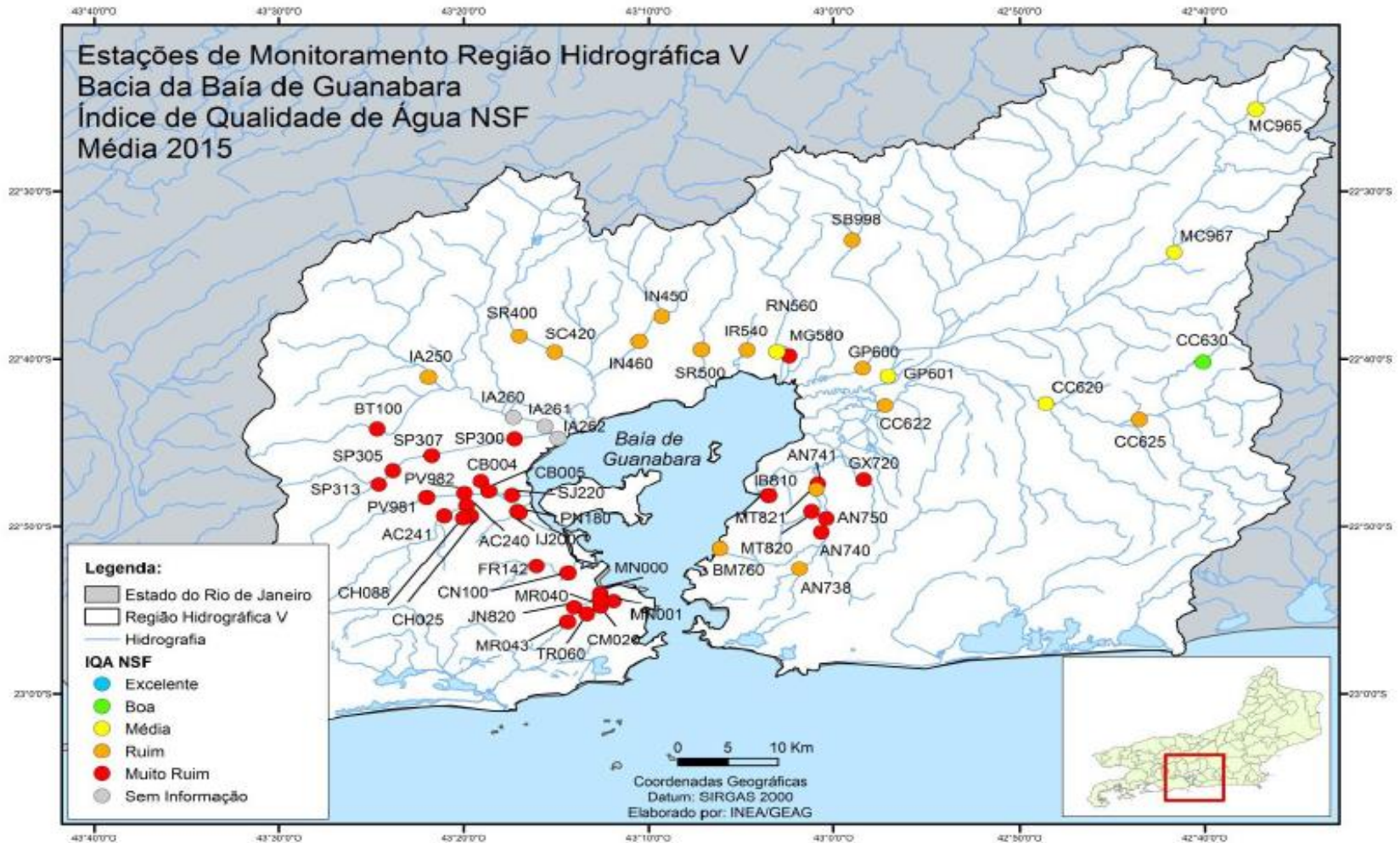
- > concentrations: northwest
- < concentrations: entrance
- **Areas of concern:**
 - Northwest portion
 - Outfall of River Meriti
 - Rio de Janeiro Port
 - Niterói Port
 - Mangroves in REDUC area
 - Guapimirim mangroves



The areas with significant presence of heavy metals.

Source: ITPA (n.d.).

Guanabara Bay Watershed 2015 Median Water Quality Index



Source: INEA/GEAG, 2016

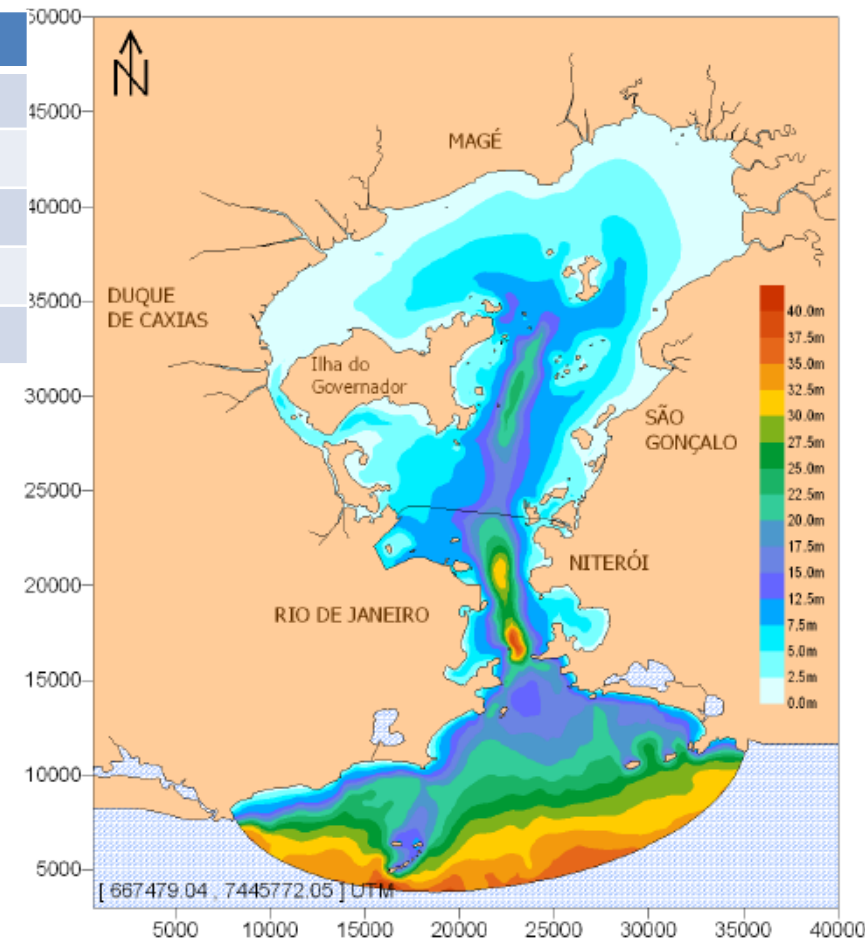
Guanabara Bay

Physical Characteristics



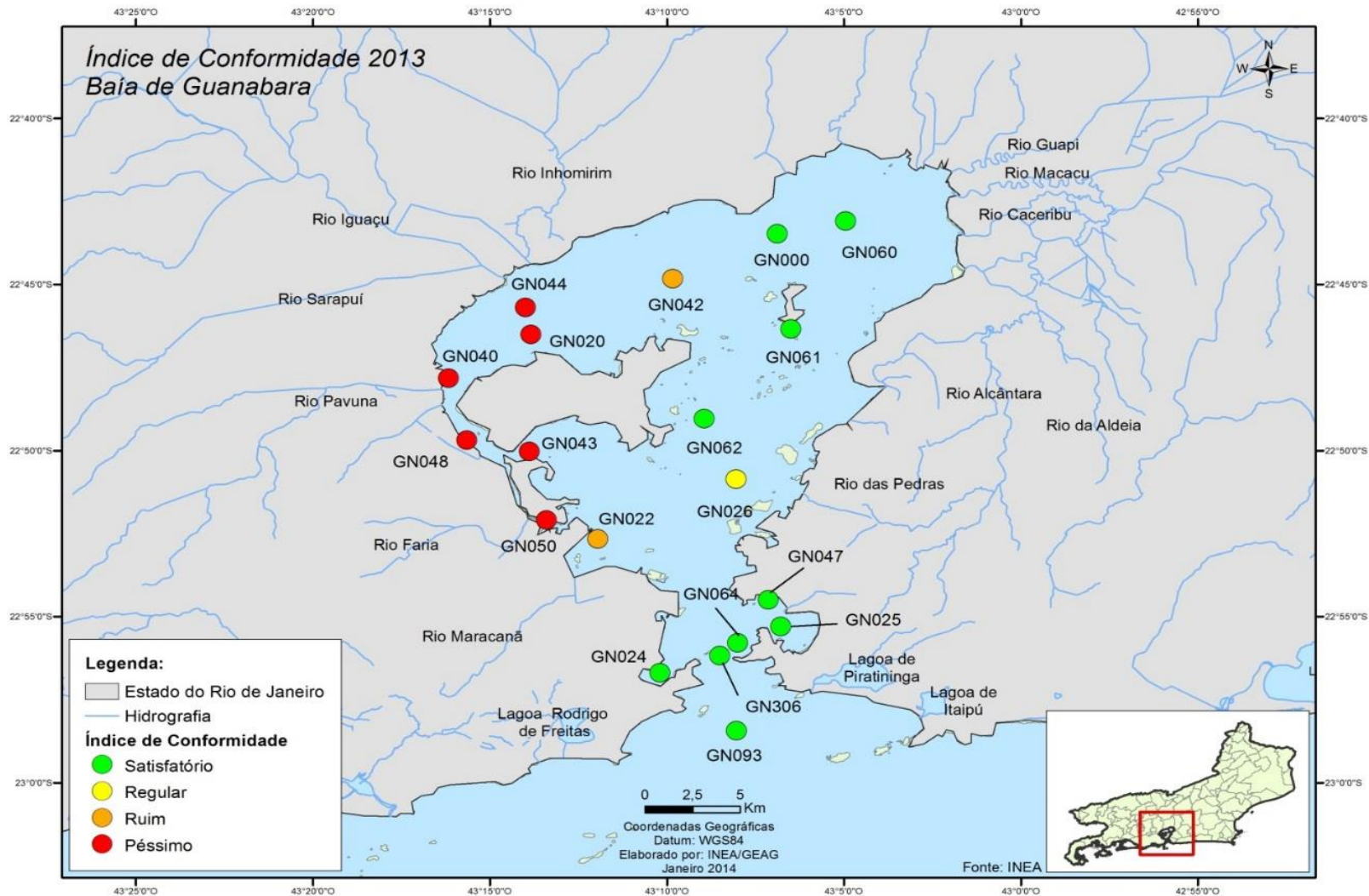
Guanabara Bay	
Surface Area	328 km ²
Depth	84% < 10 meters
Watershed Area	4,080 square kilometers
Average river inflow	100-200 m ³ /s
Population of watershed	8.6 million

- 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 Bathymetry. Source: Sampaio, M. (2003)

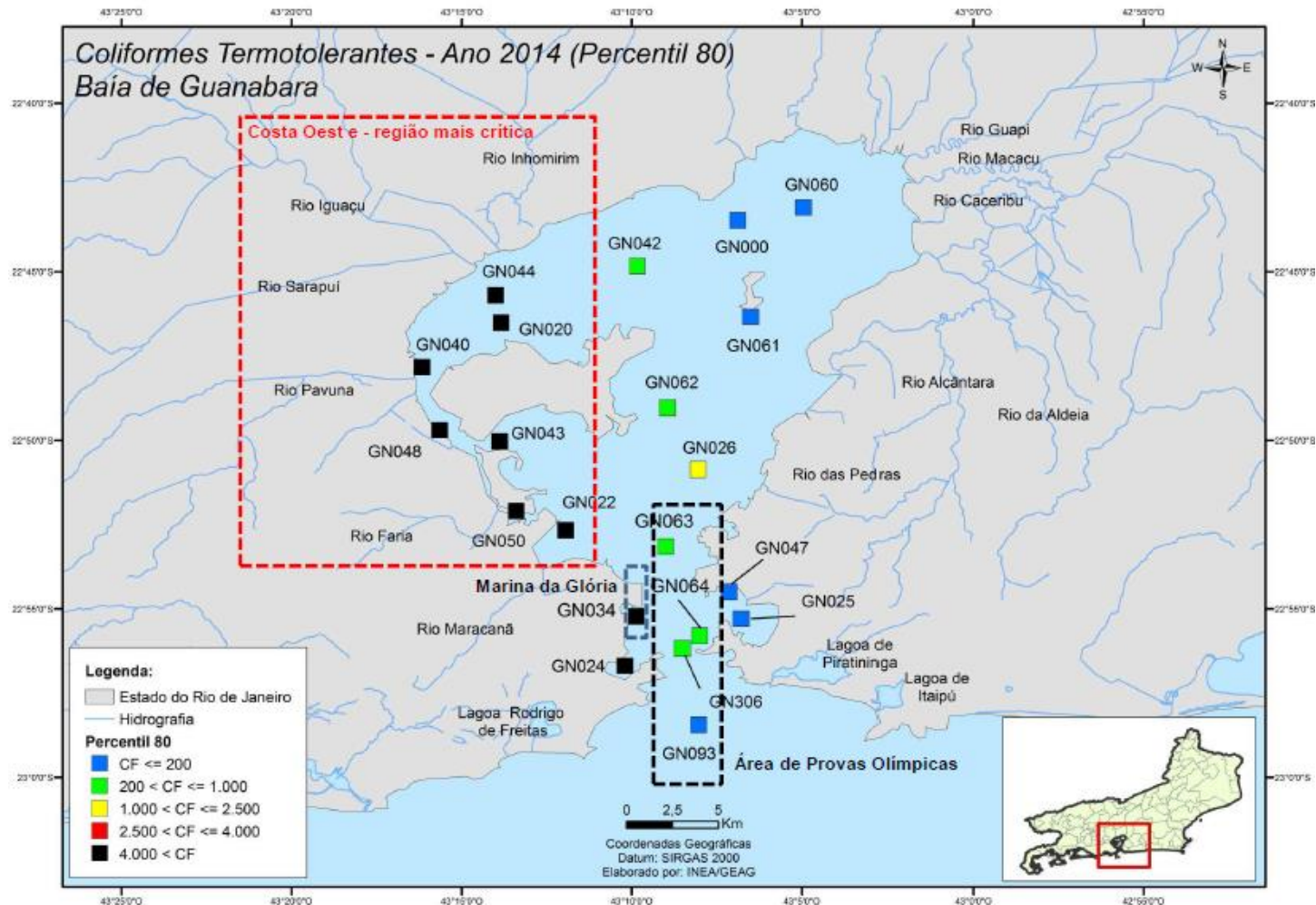
Guanabara Bay 2013 Conformity Index



Source: INEA/GEAG, 2014

Guanabara Bay

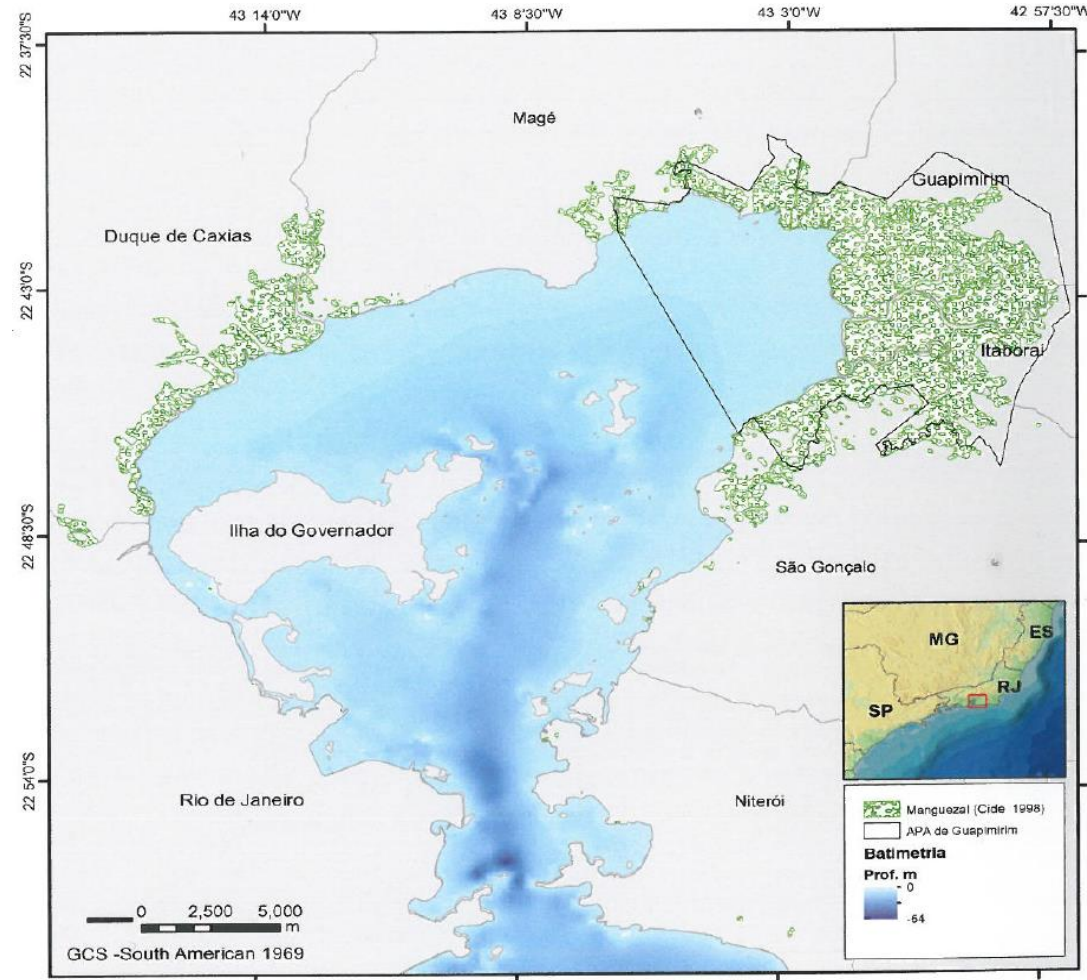
2014 Coliform Levels (80th percentile)



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

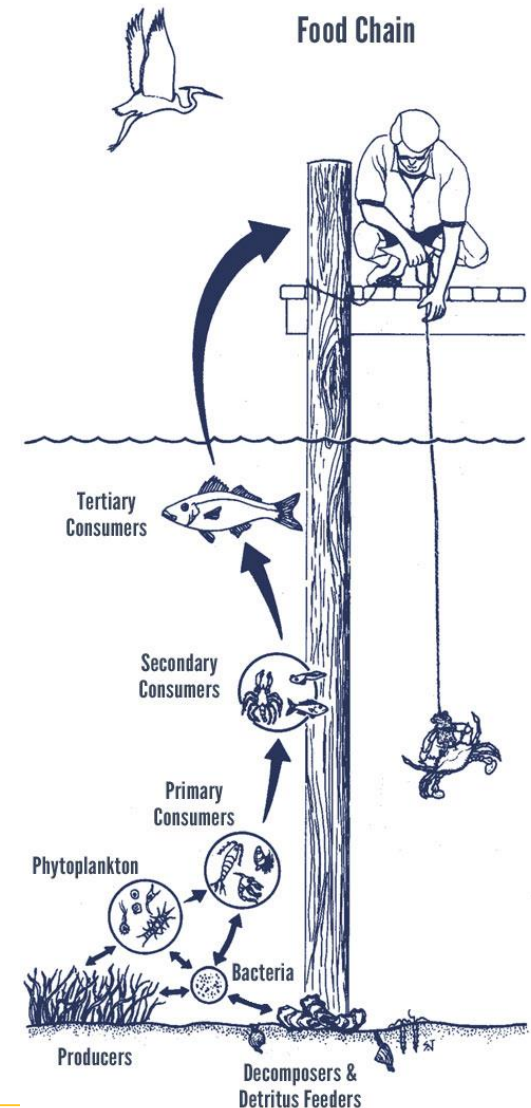


(Source: Amador, 2012)

Source: Baía de Guanabara: Síntese do Conhecimento Ambiental, 2012)

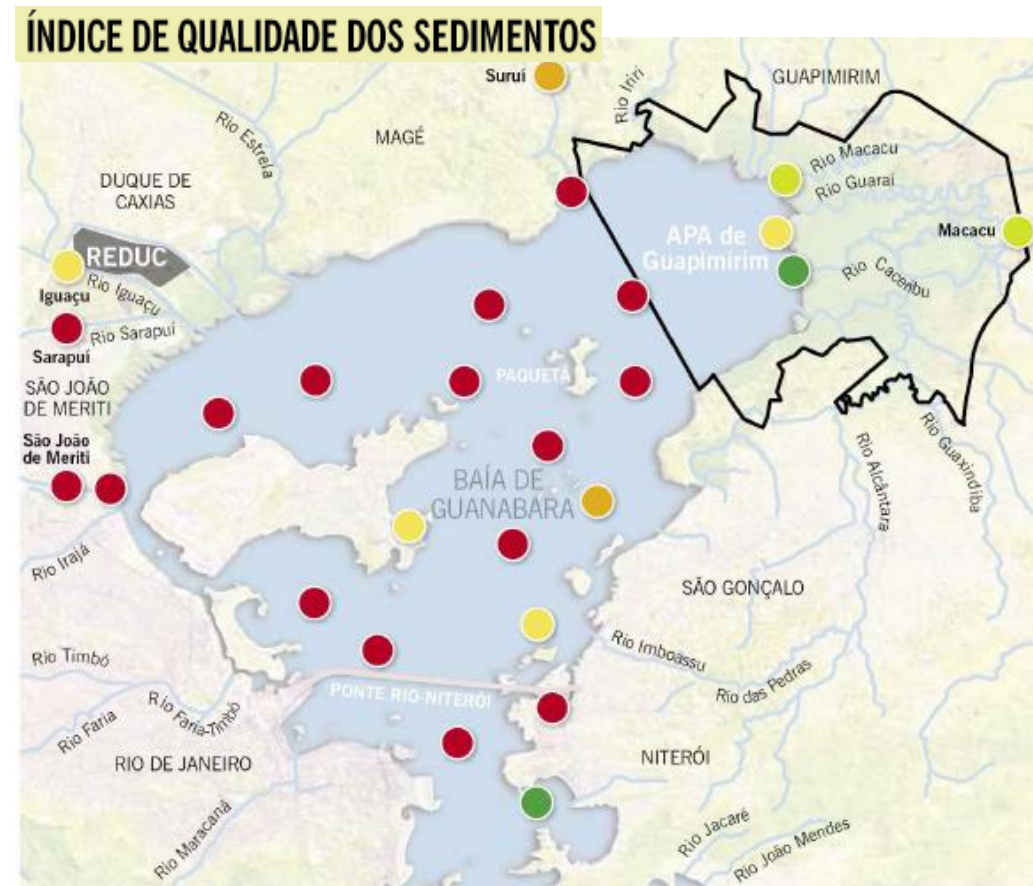
Ecosystem Impacts

- 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

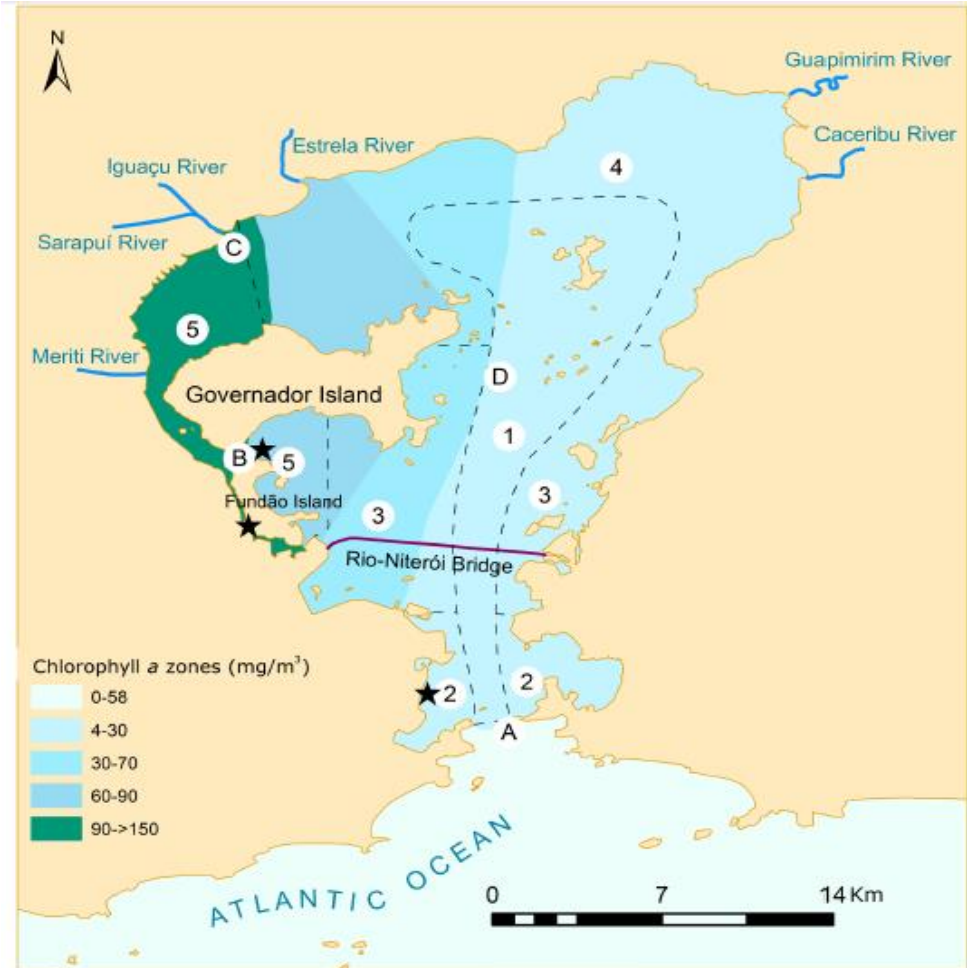
- Areas near the mouth of the Bay are healthier and have greater biodiversity of phytoplankton communities due to **large marine influence** and greater transparency of the water

- 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 domoic acid are present in the system.

(Villac and Tenenbaum, 2010; Guanabara Bay: Summary of Environmental Knowledge, 2012; Santos et al., 2007)



Source: Fistarol et al., 2015.

Ecosystem Impacts - Fisheries

- 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

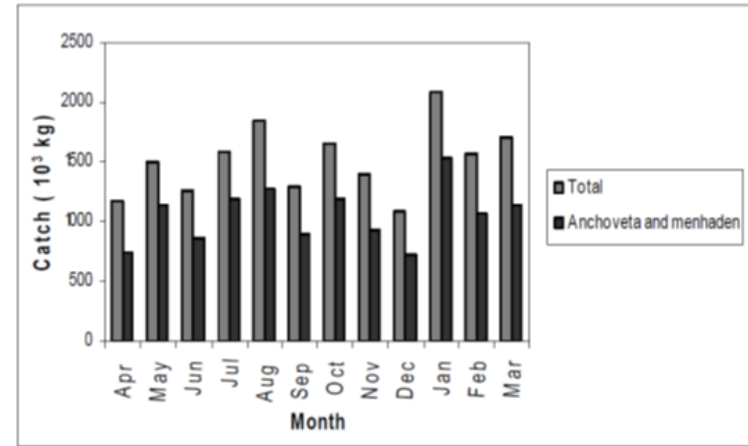


Figure 3 - Monthly variation of total landings when compared to those of Atlantic anchoveta and Brazilian menhaden (*Cetengraulis edentulus* and *Brevoortia* spp.) in Guanabara Bay, between April 2001 and March 2002.



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”