



UNIVERSIDADE ESTADUAL PAULISTA
"JÚLIO DE MESQUITA FILHO"
Câmpus de Registro



INVASIVE SPECIES OF AQUATIC MACROPHYTES AFFECTING MANGROVE FORESTS STRUCTURE AND CONSERVATION IN PROTECTED AREAS

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INTRODUCTION

Invasive species represent strong damage to biodiversity and ecosystem services.

The Cananéia-Iguape Coastal System (São Paulo state, Brazil) was used as study cases to analyze invasive species of aquatic macrophytes affecting mangrove forests structure and conservation in Protected Areas.

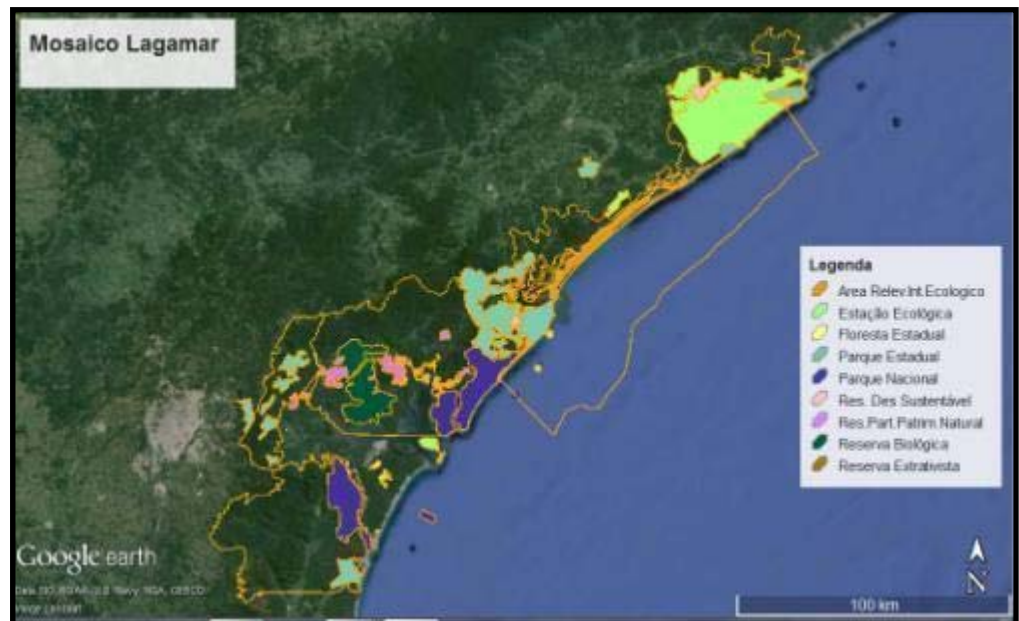


INTRODUCTION

The Cananéia-Iguape Coastal System (São Paulo state, Brazil) is considered the most conserved and wide mangrove area (15.193 ha) along the São Paulo coast.

The Cananéia-Iguape Coastal System (CICS), consists of a complex of lagoon channels, and is part of a World Heritage site by UNESCO.

The Lagamar Mosaic: a continuum of Atlantic rain forest and mangroves in 55 Protected Areas



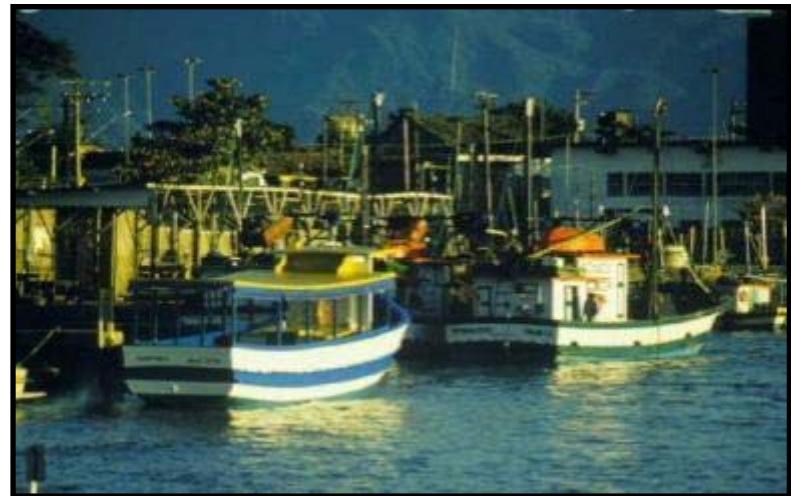
INTRODUCTION

Biodiversity



INTRODUCTION

The conserved mangroves support different sectors of fishery.



MANGROVE SPECIES



Rhizophora mangle



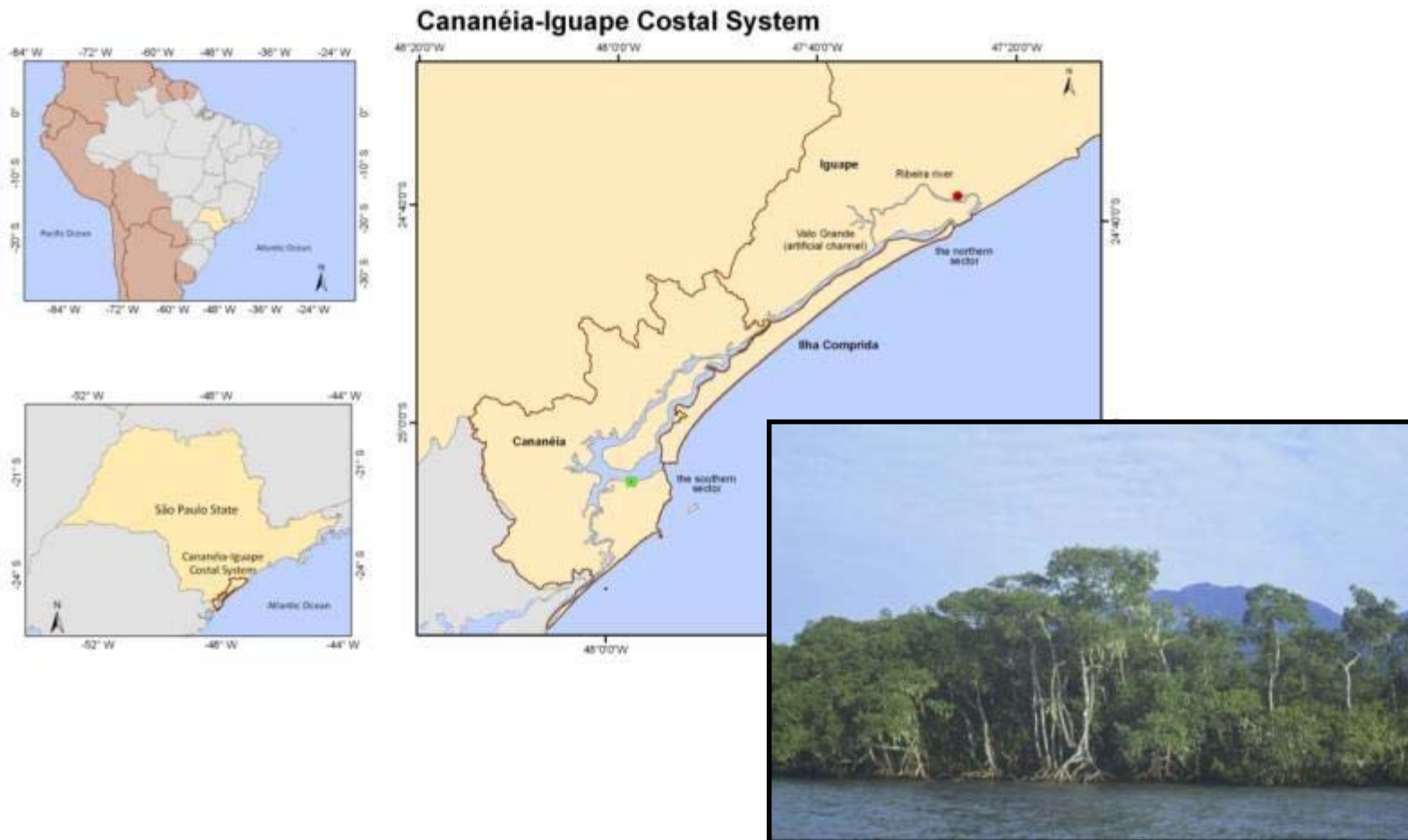
Laguncularia racemosa



Avicennia schaueriana

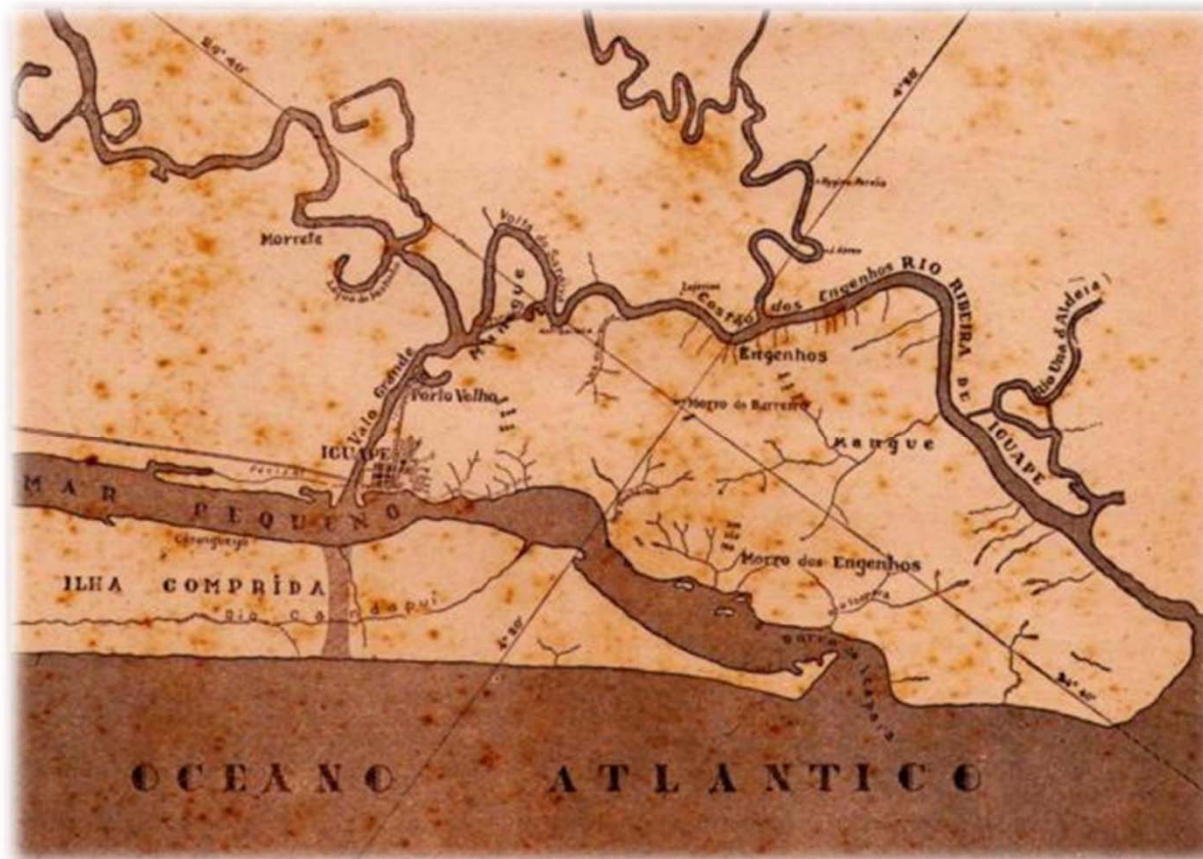
INTRODUCTION

The CICS can be divided in two sectors, the northern and the southern, based on geomorphology and environmental conditions.



INTRODUCTION

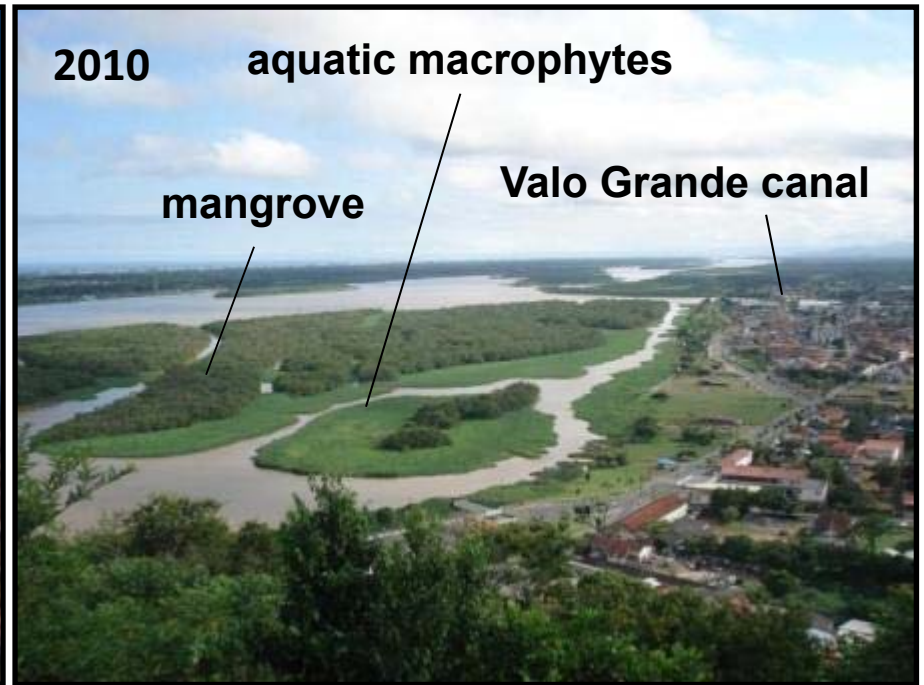
In the northern sector important environmental changes occurred due to an artificial canal producing modifications in salinity and transforming the estuarine conditions.



THE VALO GRANDE CANAL



INTRODUCTION



METHODOLOGY

36 permanent plots were delimited along the northern and southern sectors in the CICS, from 2011 to 2015.

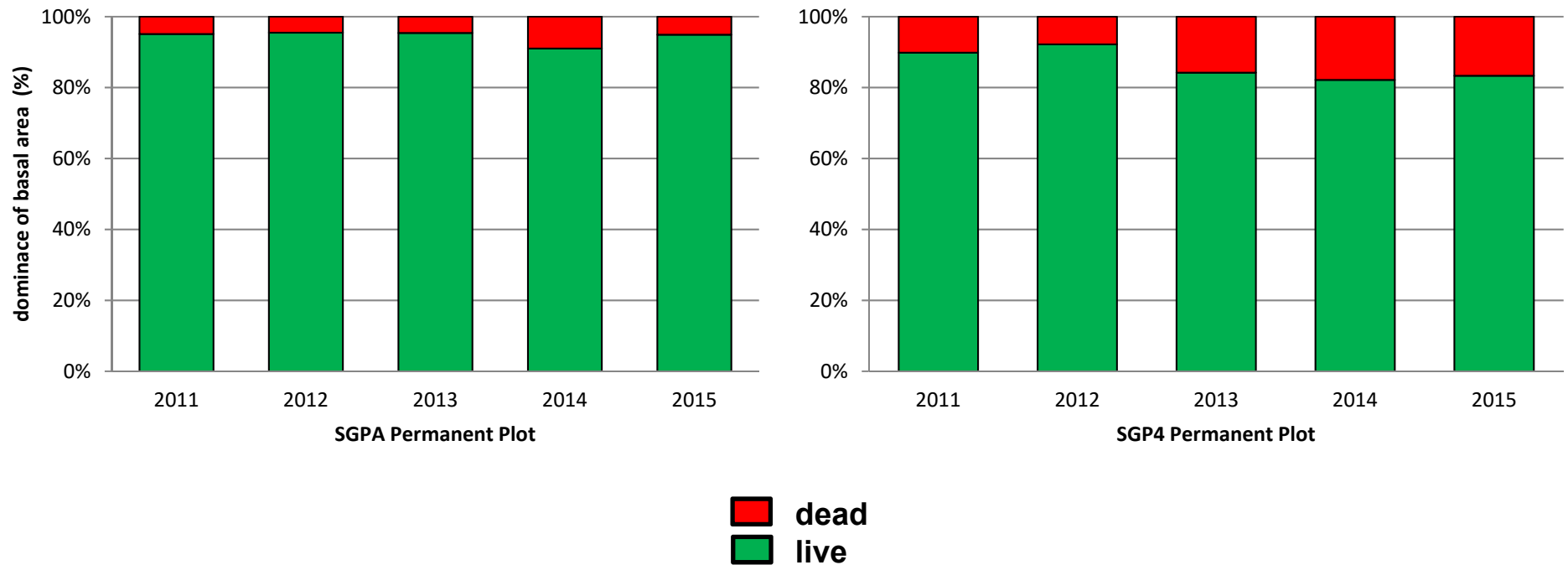
In permanent plots, the characterization of structure forest development followed the methodology suggested by Cintrón and Schaeffer-Novelli (1984).

All plants were identified and tree diameter, height, incidence of associated species, and condition (live or dead) were recorded. Mean height, basal area dominance, and stem density were also assessed.



RESULTS AND DISCUSSION

The conserved mangrove forests (in the southern sector) reached less than 20% of dominance of basal area (BA) of dead trunks, between 2011 and 2015.

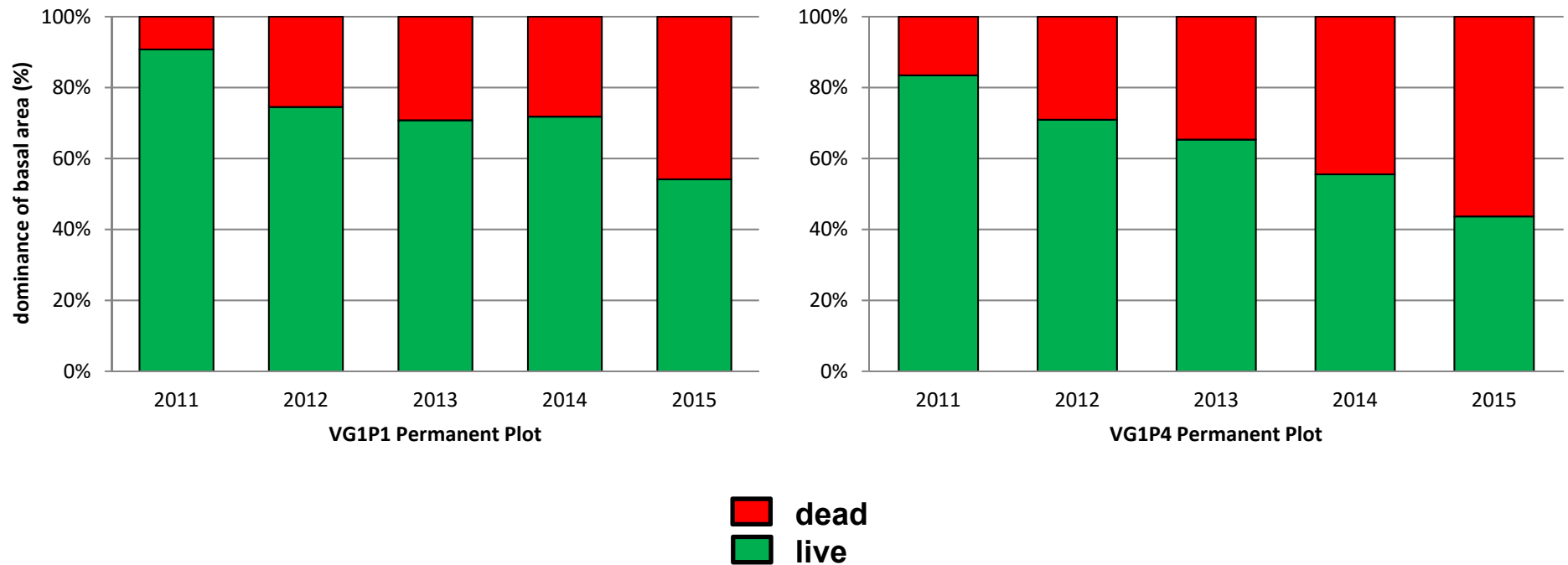


Conserved mangrove forests (the southern sector)

Parcela	Estrutura Vegetal	Visão Geral	Dossel																																	
BAPF	<p>Dominação em área basal (%)</p> <p>■ morto ■ vivo</p> <p>Parcelas Permanentes do longo da transversal BA</p> <table border="1"> <caption>Approximate data from the basal area dominance chart</caption> <thead> <tr> <th>Parcela</th> <th>vivo (%)</th> <th>morto (%)</th> </tr> </thead> <tbody> <tr><td>BAP5</td><td>90</td><td>10</td></tr> <tr><td>gap</td><td>85</td><td>15</td></tr> <tr><td>BAP2</td><td>90</td><td>10</td></tr> <tr><td>BAP1</td><td>95</td><td>5</td></tr> <tr><td>BAPA</td><td>95</td><td>5</td></tr> <tr><td>BAPB</td><td>90</td><td>10</td></tr> <tr><td>BAPC</td><td>95</td><td>5</td></tr> <tr><td>BAPD</td><td>85</td><td>15</td></tr> <tr><td>BAPE</td><td>95</td><td>5</td></tr> <tr><td>BAPF</td><td>95</td><td>5</td></tr> </tbody> </table>	Parcela	vivo (%)	morto (%)	BAP5	90	10	gap	85	15	BAP2	90	10	BAP1	95	5	BAPA	95	5	BAPB	90	10	BAPC	95	5	BAPD	85	15	BAPE	95	5	BAPF	95	5		
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RESULTS AND DISCUSSION

The altered mangrove forests, (on sites under the influence of the waters of the artificial canal) reached 60% of dominance of BA of dead trunks, between 2011 and 2015.

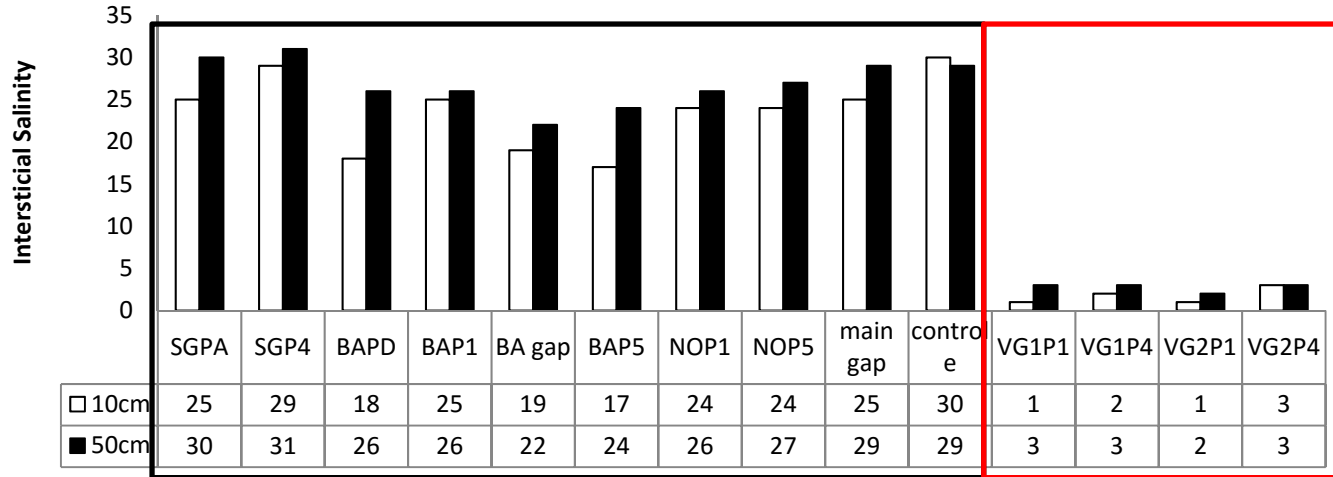


Altered mangrove forests (the northern sector)

Parcela	Estrutura Vegetal	Visão Geral	Dossel															
VG1P1	<p>dominância em área basal (%)</p> <p>parcelas ao longo da transversal VG1</p> <p>■ morto ■ vivo</p> <table border="1"> <caption>Data from the stacked bar chart</caption> <thead> <tr> <th>Parcela</th> <th>vivo (%)</th> <th>morto (%)</th> </tr> </thead> <tbody> <tr> <td>VG1P1</td> <td>88</td> <td>12</td> </tr> <tr> <td>VG1P2</td> <td>58</td> <td>42</td> </tr> <tr> <td>VG1P3</td> <td>60</td> <td>40</td> </tr> <tr> <td>VG1P4</td> <td>75</td> <td>25</td> </tr> </tbody> </table>	Parcela	vivo (%)	morto (%)	VG1P1	88	12	VG1P2	58	42	VG1P3	60	40	VG1P4	75	25		
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RESULTS AND DISCUSSION

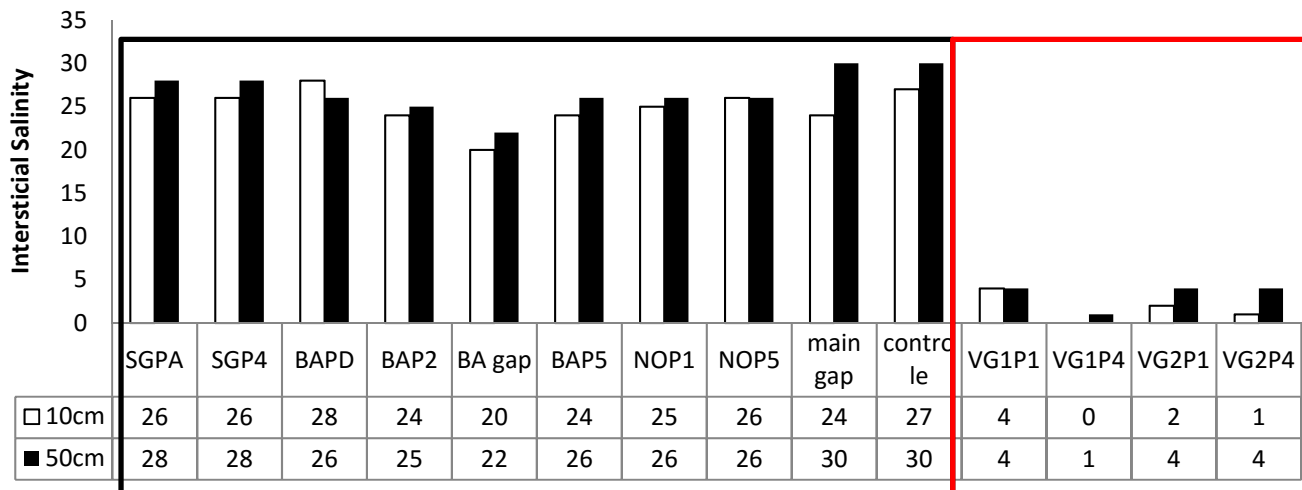
Interstitial Salinity
2011



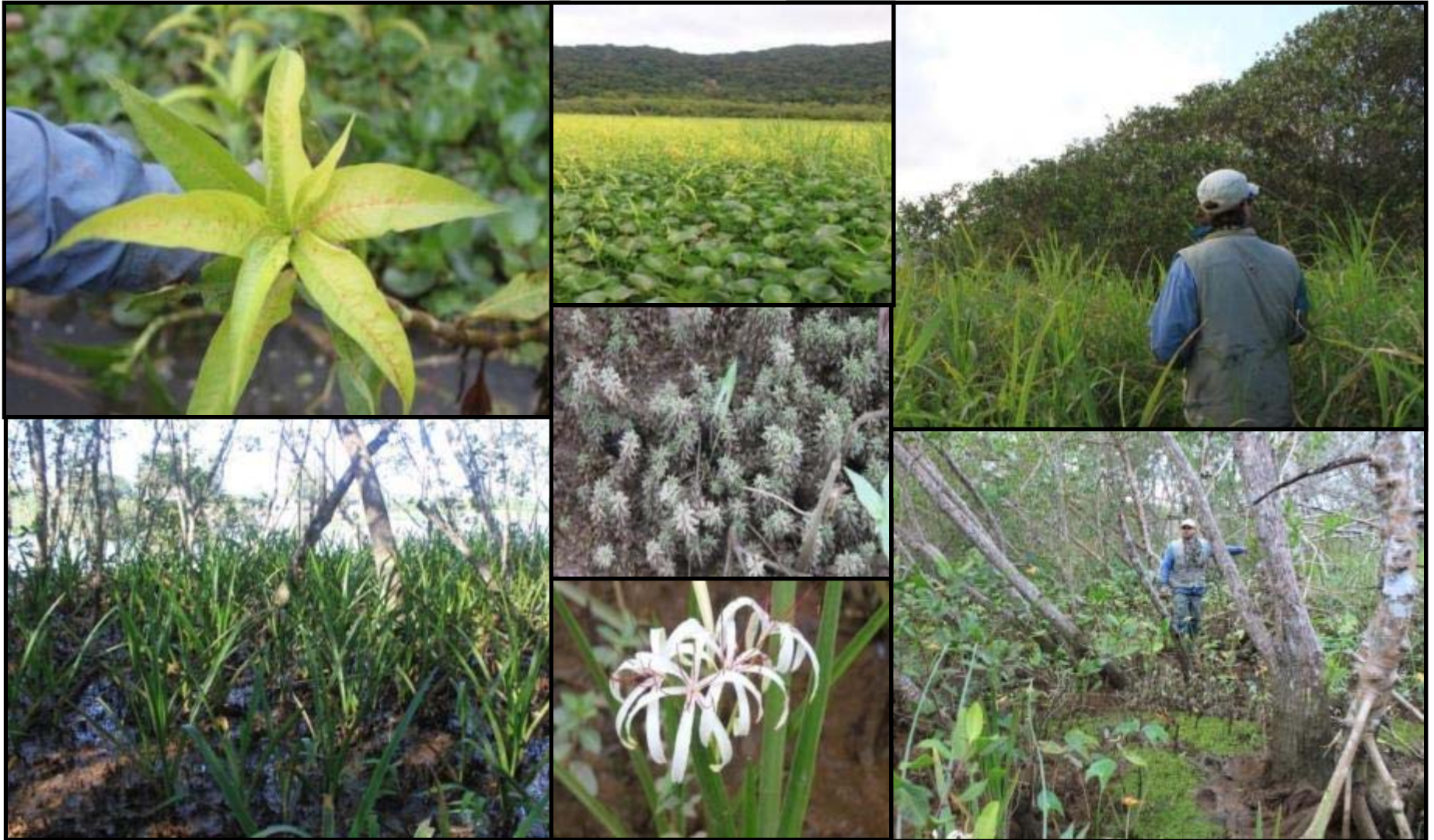
conserved mangroves sites

altered mangroves sites

Interstitial Salinity
2015



Aquatic Macrophytes: about 26 species



RESULTS AND DISCUSSION

Urochloa arrecta, *Scirpus* sp., *Crinum americanum*, *Paspalum repens* and *Eichhornia crassipes* dominated the landscape on sites under the influence of the waters of the artificial canal.

Over time, they are forming large populations in the northern sector of the coastal system.



RESULTS AND DISCUSSION

Aquatic macrophytes species showed different behavior and ecosystem services in relation to mangrove vegetation.

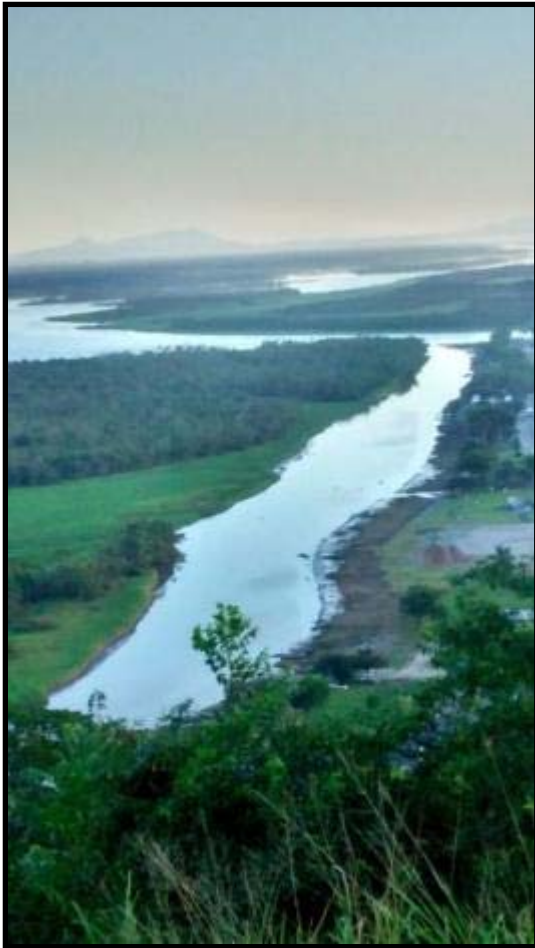
They don't fix sediment and consequently don't control erosion.



2015 / 05



2015 / 09



'Control' of aquatic
macrophytes

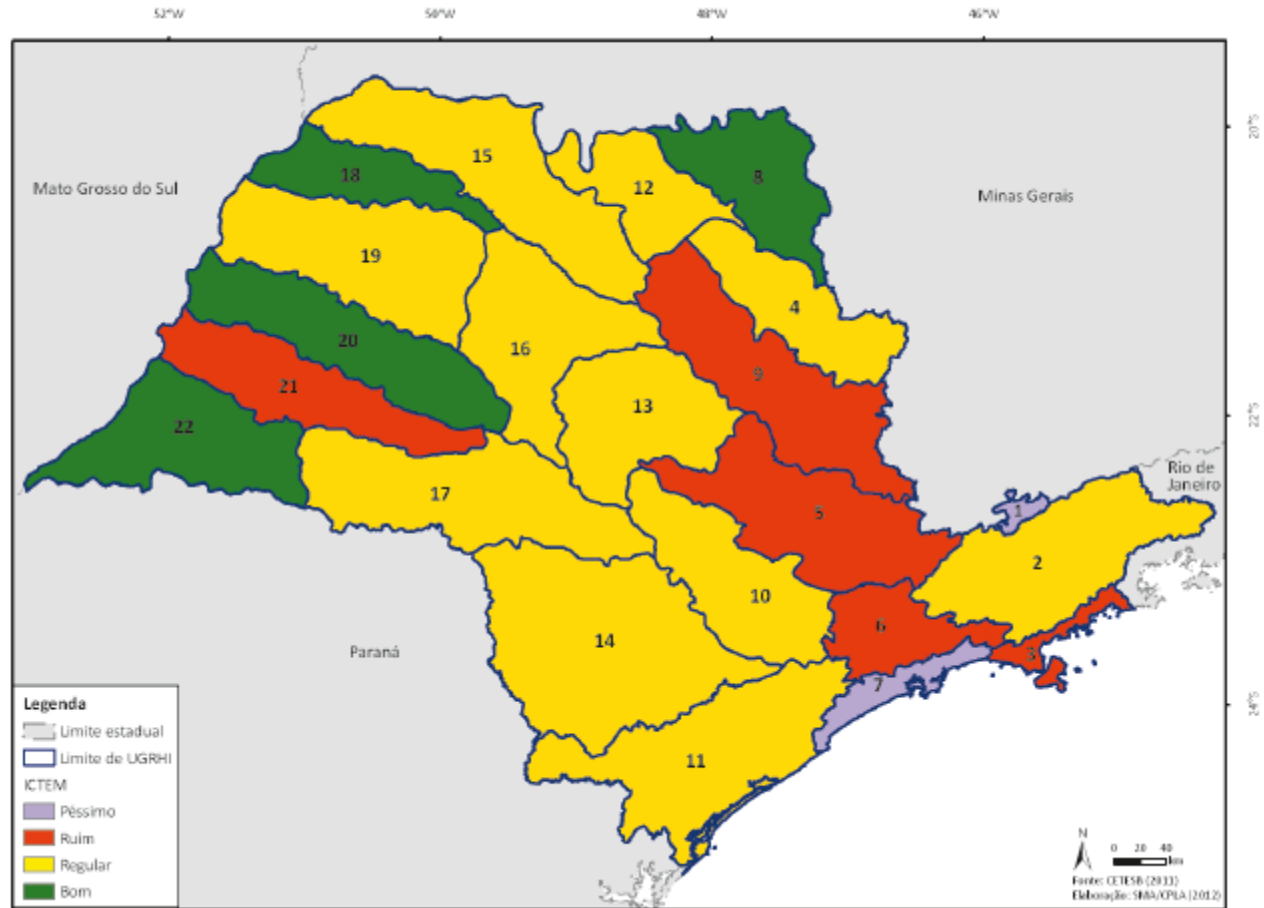
RESULTS AND DISCUSSION

The decrease of mangrove areas in the northern sector highlights the serious transformation of mangrove forest structure submitted to invasive species of aquatic macrophytes, due to the low salinity and the lack of sewage treatment.



RESULTS AND DISCUSSION

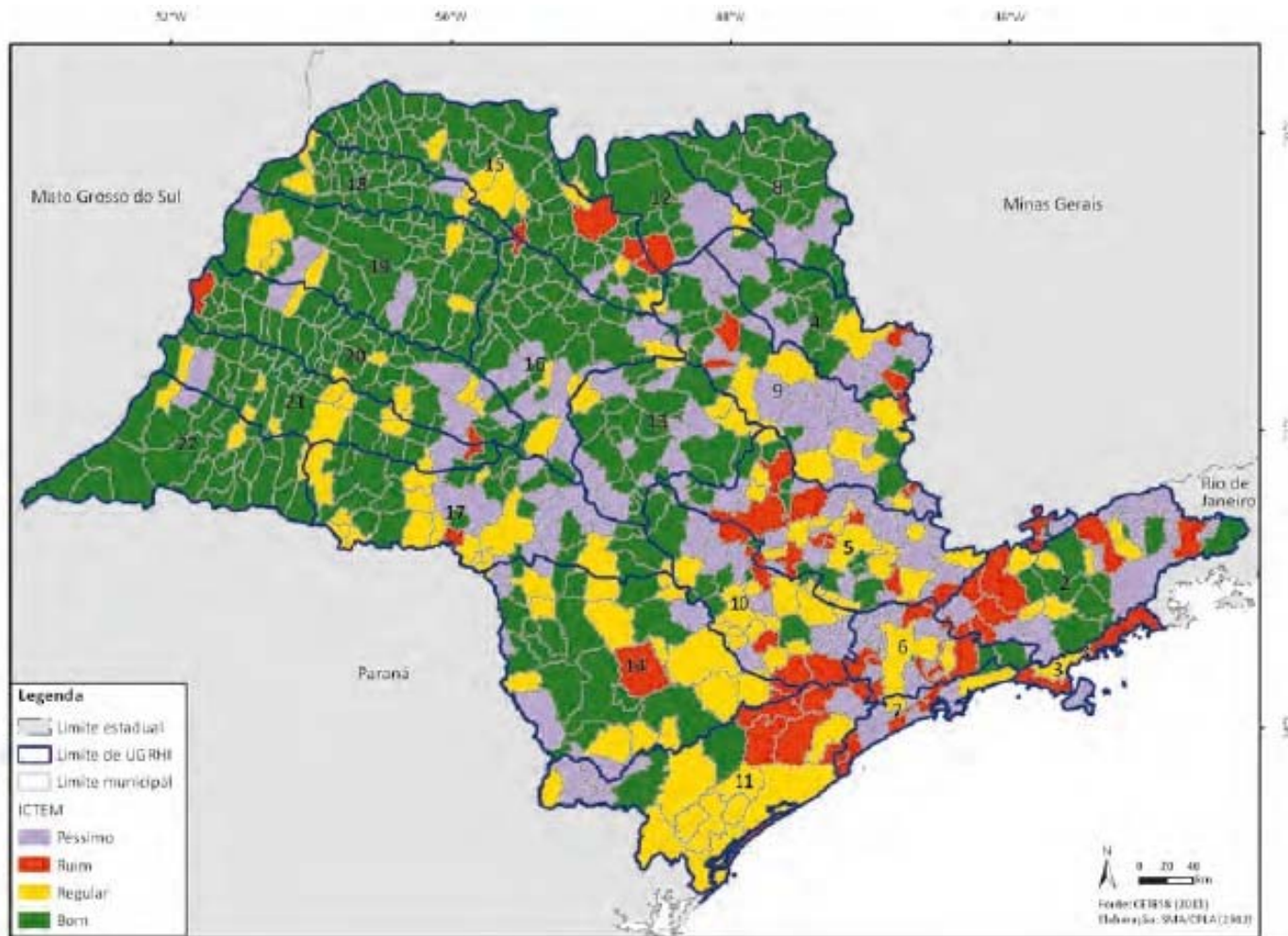
Sewage Treatment Index by Watershed



São Paulo (2012)

RESULTS AND DISCUSSION

Sewage Treatment Index by Municipality



São Paulo (2012)

ESTUARINE FISHERY PRODUCTION - 2012

Southern Sector



1. *Crassostrea* spp.
2. *Mugil* spp.
3. *Genidens barbatus*
4. *Ucides cordatus*
5. *Cynoscion* spp.
6. *Farfantepenaeus* spp.
7. *Micropogonias furnieri*

Northern Sector

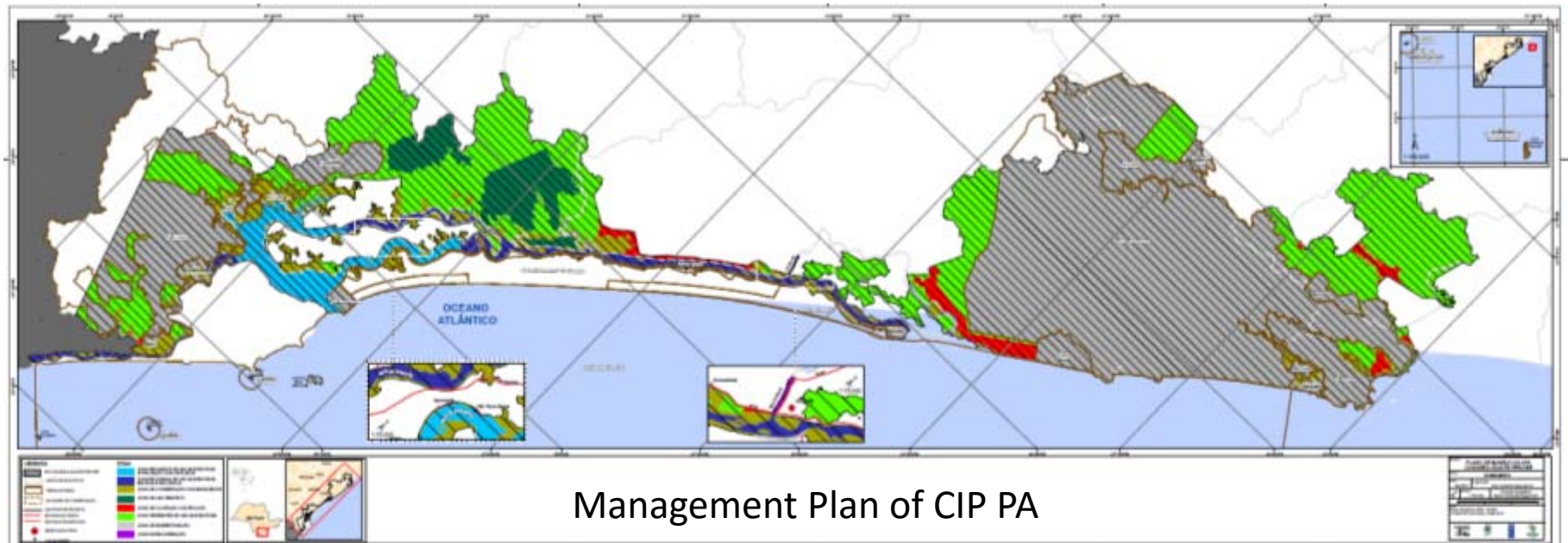


70%: *Anchoviella lepidentostole*
15%: *Genidens barbatus*

CONCLUSION

The results produced in this study were available to decision makers to use on protected area planning.

The mangrove forests monitoring, using permanent plots, is an important tool which data can be very useful to coastal management and mangrove conservation.



Financial Supports



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