

Towards Sustainable Port Development in Western Indian Ocean



Day 1: Short Overview of Situation Assessment



Content of Situation Assessment

- **Locality and overview of Ports in WIO region**
- **Port Legislation & Authorities**
- **Important Environmental Issues**
- **Habitat Assessment in selected Ports**
- **Concept of Sustainable 'Green' Ports**

Towards Sustainable Port Development
in the Western Indian Ocean

Situation Assessment



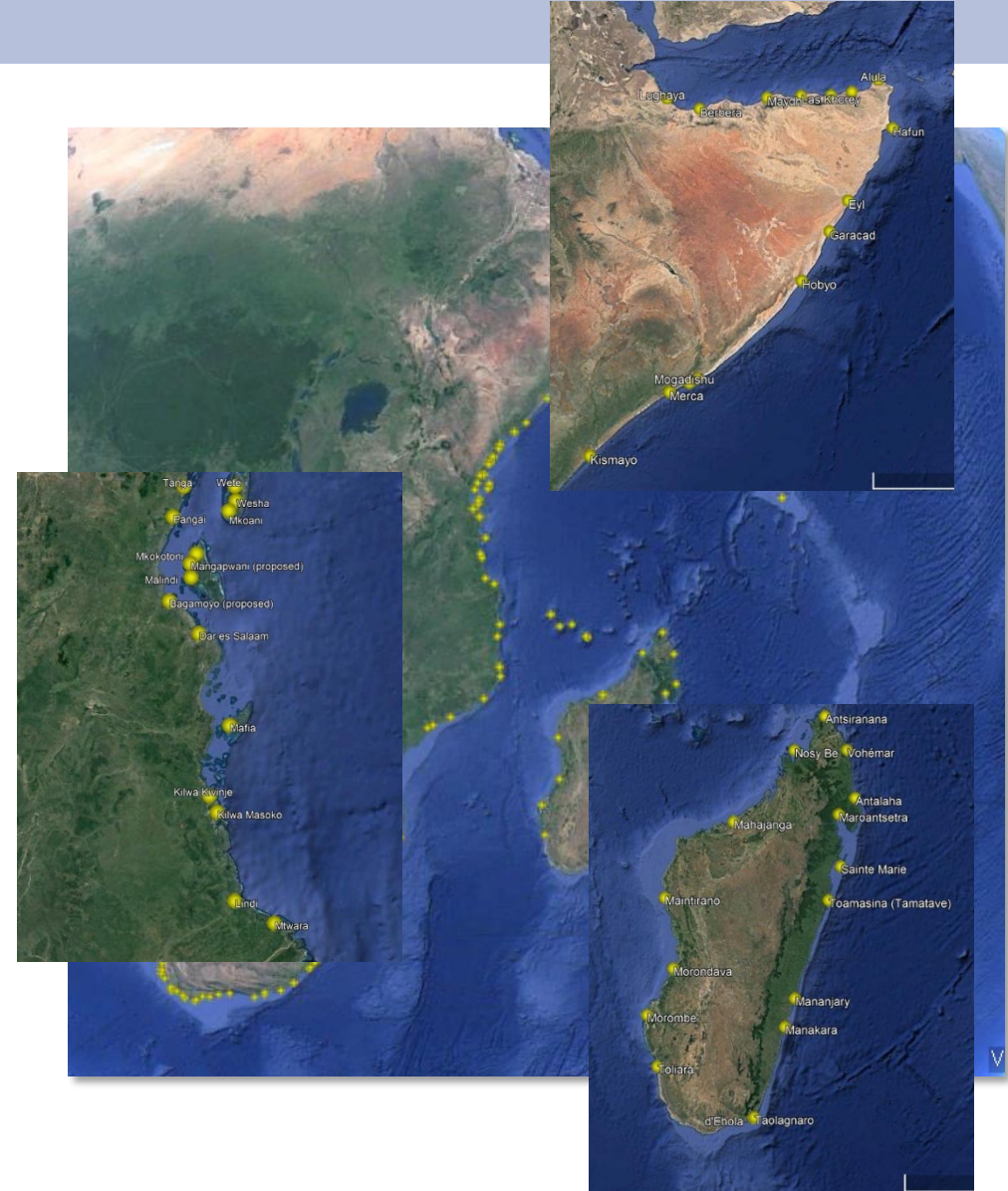
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(Draft Confidential for Review)



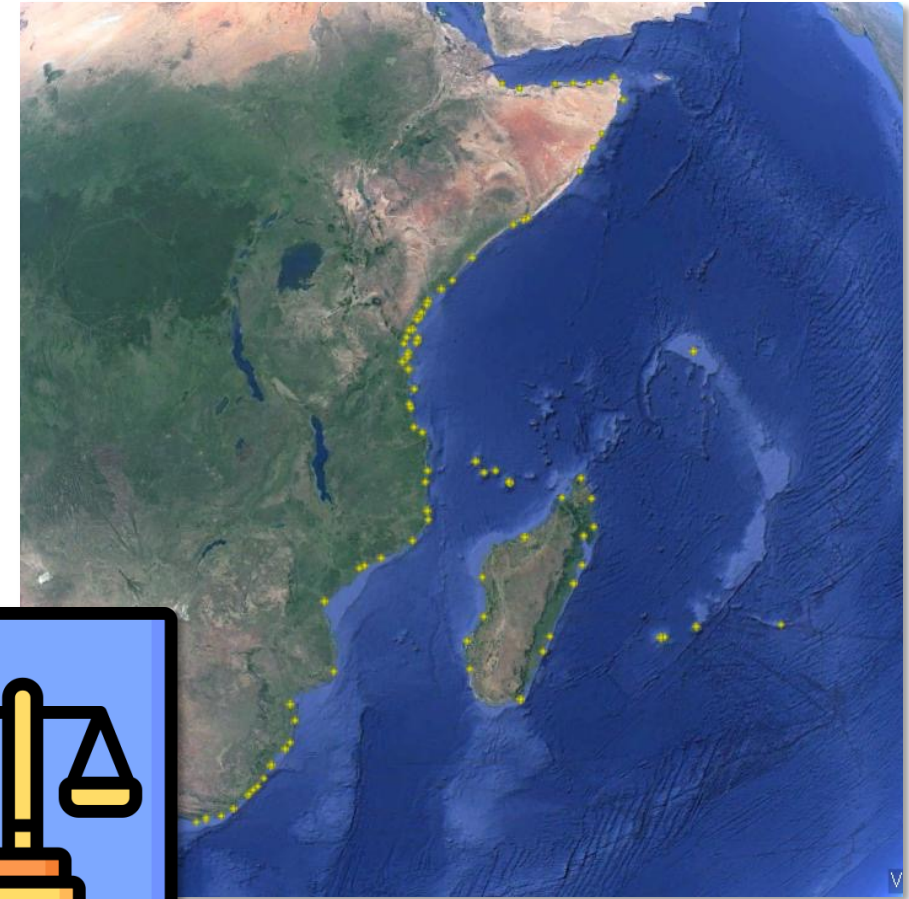
Locality and Overview of Ports

- **Google Earth (kml)** containing all documented ports in WIO region
- **Provide short descriptive overview of ports in each country** (as per information provided by stakeholders)
- **Appendix with coordinates and classification of ports** as per US National Geospatial Intelligence Agency (<https://msi.nga.mil/Publications/WPI>)



Port Legislation & Authorities

- **Summary of related international and regional agreements & conventions with signatories**
- **Overview of key national legislation and port governing authorities (as per information from stakeholders)**
- **Important to understand related national policies and responsible authorities for national implementation of Green Port Toolkit**



Key Environmental Issues associated with Ports

➤ **Safe access, ease of establishing deep entrance channel - Sandy shores**

- **Prone to sediment dynamics being disrupted and coastal erosion**
- **SLR and coastal vulnerability**

Navigable waters, dredging and dredge disposal – Coastal seas

- **Corals and seagrasses prone to sediment impacts**
- **Productive fishery habitat**

➤ **Safe anchorage - Sheltered waters**

- **Mangroves/seagrasses**
- **Productive fishery habitat**
- **Estuarine nursery area**
- **Traditionally used by coastal communities for fishing, trade and cultural activities**

Ecosystem Services

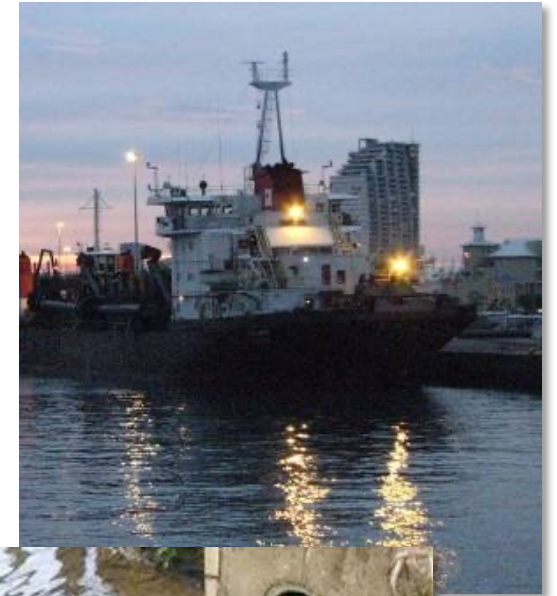
- **Regulating services (erosion buffers, carbon sinks)**
- **Provisioning services (food, building materials)**
- **Cultural services (places to gather, trade transport routes)**
- **Supporting services (nutrient assimilation, remineralization)**

CONFLICT

Dar es Salaam

Key Environmental Issues associated with Ports...

- **Port and harbour infrastructure critical to our national and regional economies and quality of life**
- **Therefore, potential environmental problems require appropriate planning and management to prevent, e.g.**
 - **Climate impacts (water wastage and green house gas emissions)**
 - **Pollution (air, water and soil)**
 - **Physical destruction of habitat and biota**
 - **Introduction of harmful and invasive organisms and pathogens**



Key Environmental Issues associated with Ports...

- Limited regional data, applied international learning to 'match' activities vs potential environmental problems (NB for management), e.g.

ACTIVITY	POTENTIAL PROBLEM									
	Climate change	Air pollution	Water, sediment & soil pollution	Physical	Other 1	Other 2	Other 3	Other 4	Other 5	Other 6
CONSTRUCTION										
Capital Dredging					•	•	•			•
Earth works			•							•
Night lights										•
Energy consumption	•	•								
Construction vehicle traffic	•	•	•	•						•
OPERATIONS										
Water consumption	•									
Energy consumption	•	•								
Maintenance dredging					•		•			•
Vehicle and railway traffic	•	•	•	•						•
Fire or explosion		•	•	•						•
Waste disposal						•		•		•
Urban stormwater runoff				•		•	•		•	•
Dry docks and ship repairs		•	•	•		•	•			•
Industries - waste/wastewater				•		•	•	•	•	•
Industries - emissions	•	•		•						
Industries - Cooling water					•					•
Industries - Desalination brine					•					•
Open stockpiles - dust		•	•							•
Vessels - emissions	•	•		•						•
Vessels - wastewater	•			•		•	•	•		•
Vessels - ballast water exchange										•

Capital dredging:
Physical habitat destruction & pollution

Inappropriate Energy consumption: Climate impacts and Air pollution

Key Environmental Issues associated with Ports...

- Range of potential environmental problems manifest in various environmental and socio-economic consequences (also NB for management), e.g.

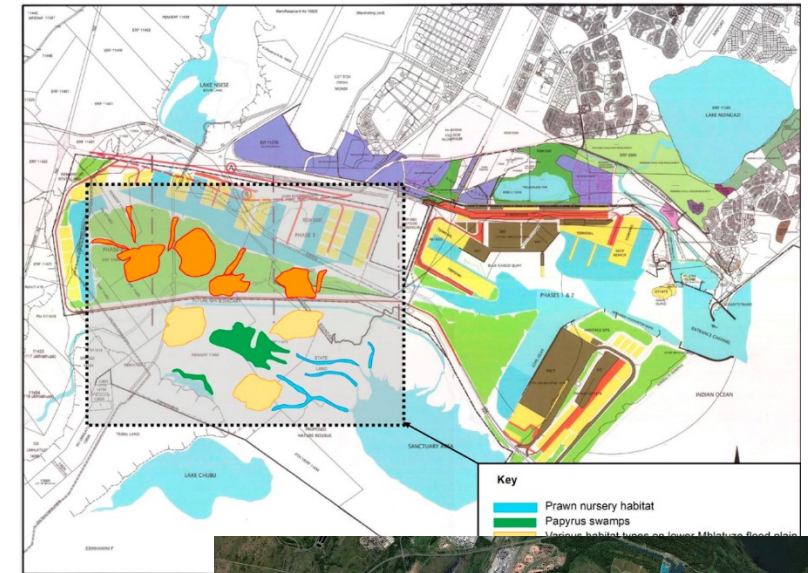
CONSEQUENCE	POTENTIAL PROBLEM			
	Climate change	Air pollution	Water, sediment & soil pollution	Physical
ENVIRONMENTAL				
Physical loss of important habitat	●	●		●
Smothering/entablement of marine life			●	●
Disorientation of marine life (birds)				● ●
Chronic/acute effects on marine life	●	●	● ● ● ●	● ● ● ●
Introduction of invasives				●
SOCIO-ECONOMIC				
Loss of aesthetic value		● ●	● ●	● ●
Human health risk (contact or seafood)		● ●	●	● ● ● ●
Human and property safety risk	●			●
Loss of livelihoods (material & food)				● ● ● ●
Commercial losses (seafood & fisheries)				● ● ● ●

Chronic/acute effects on biota:
Climate impacts, Pollution & Physical habitat destruction

Loss of livelihoods:
Pollution & Physical habitat destruction

Habitat Assessment in Selected Ports

- **Critical in port planning and operations to explicitly demarcate sensitive & critical natural habitats as geo-referenced spatial layers:**
 - **NB for environment to be considered in early stages of engineering planning and design ('becomes part of design')**
 - **Negotiate spatial 'targets' for habitat protection or off-sets (not only biodiversity, protection, but also ecosystem services)**
 - **Track change over time to monitor effectiveness of port's sustainability efforts**



Habitat Assessment in Selected Ports...

- **To demonstrate usefulness of spatial data, and to track change over time, representative ports selected as case studies:**

COUNTRY	PORT	HARBOUR TYPE
Comoros	Moroni	Open roadstead (island)
Kenya	Mombasa	Coastal natural (mainland)
Madagascar	Mahajanga	Coastal natural (island)
Mauritius	Port Louis	Coastal breakwater (island)
Mozambique	Maputo	Coastal natural (mainland)
Reunion (France)	Réunion (new port)	Coastal breakwater (island)
Seychelles	Victoria	Open Roadstead (island)
Somalia	Mogadishu	Coastal breakwater (mainland)
South Africa	Durban/	Coastal breakwater (mainland)
Tanzania	Dar es Salaam	Coastal natural (mainland)

Habitat Assessment in Selected Ports...

- **Selected habitat types...**



Mangroves



Seagrass



Coral reefs

Interrogated various regional and global spatial data bases to source data:

- 1. Adams JB. 2019. Macrophyte species and habitats in SA estuaries.**
- 2. Adams JB. 2019 SA estuarine Habitat extent and trend.**
- 3. Allen Coral Atlas. 2020.**
- 4. Bunting et al. The Global Mangrove Watch**
- 5. Giri et al. 2011. Status and distribution of mangrove forests of world**
- 6. Green & Short 2003. World atlas of seagrasses.**
- 7. Short et al. Global seagrass distribution and diversity**
- 8. Spalding et al. 1997. World mangrove atlas.**
- 9. Spalding et al. World Atlas of Mangroves**
- 10. Worthington et al. 2020. A global biophysical typology of mangroves**

Habitat Assessment in Selected Ports...

COUNTRY	PORT	CORAL REEFS	MANGROVE							SEAGRASS		
		3	1	2	4	5	8	9	10	3	6	7
Comoros	Port of Moroni	Y				Y	Y	Y		Y		
Kenya	Port of Mombasa	Y			Y	Y	Y	Y	Y	Y	Y	Y
Madagascar	Port of Mahajanga				Y	Y	Y	Y	Y		Y	Y
Mauritius	Port of Port Louis				Y	Y	Y	Y	Y		Y	Y
Mozambique	Port of Beira				Y	Y	Y	Y	Y			
Reunion (France)	Port Réunion										Y	Y
Seychelles	Port Victoria				Y		Y	Y	Y		Y	Y
Somalia	Port of Berbera				Y	Y	Y	Y	Y		Y	Y
South Africa	Port of Durban		Y	Y	Y		Y	Y	Y			
Tanzania	Port of Bagamoyo	Y			Y	Y	Y	Y	Y	Y	Y	Y
	Port of Dar es Salaam	Y			Y	Y	Y	Y	Y	Y		

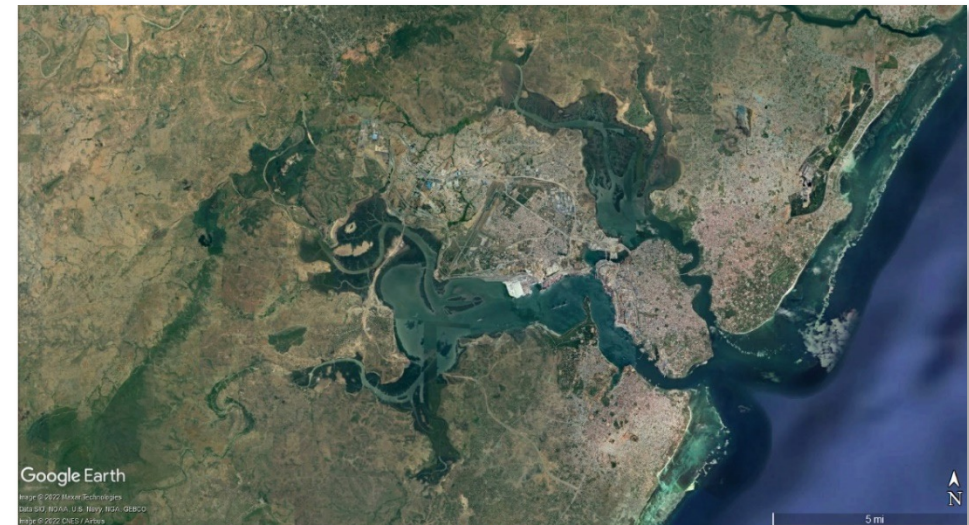
Suitable

Partly suitable, with some spatial refinement

Not suitable, must be re-generated at port scales

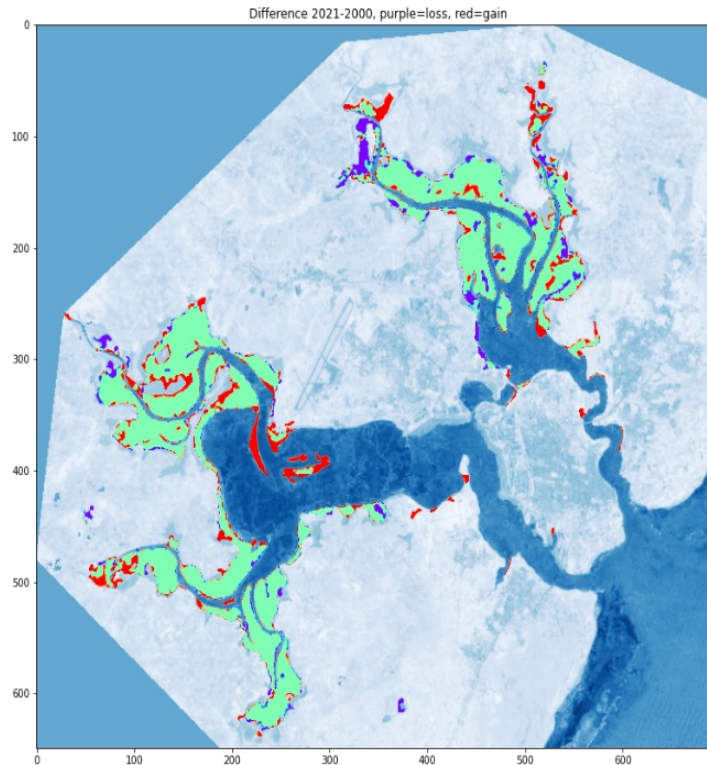
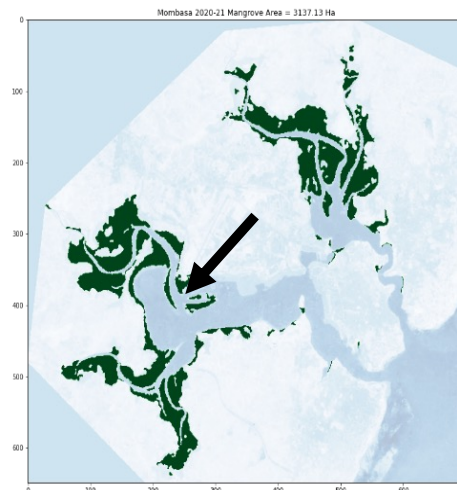
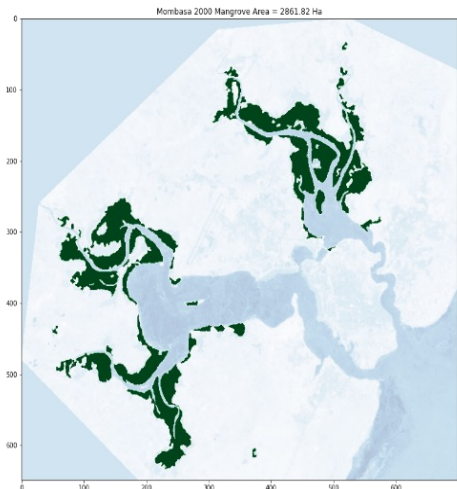
Habitat Assessment in Selected Ports...

- Existing regional and global spatial data bases not at sufficient resolution to be useful at port planning and management levels
- Explore Google Earth Engine method to gain improved resolution using mangroves and two case study ports - Mombasa and Durban (where team had knowledge)



Habitat Assessment in Selected Ports...

- **Mombasa: Assessed mangrove cover using Landsat and SRTM datasets for 2000 & 2021**

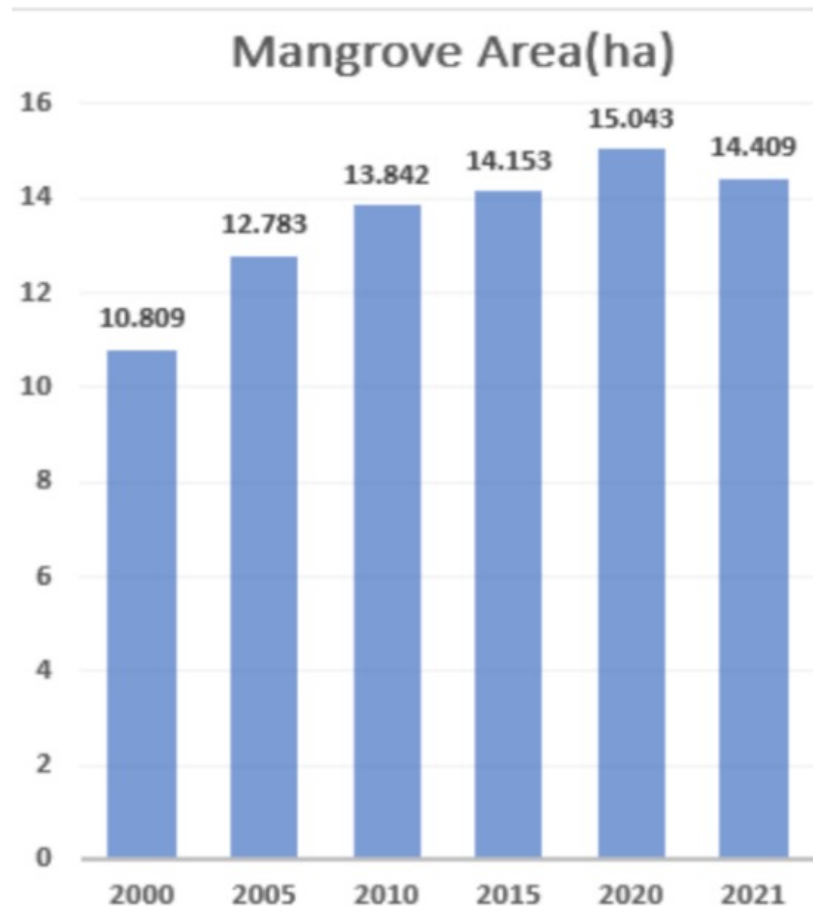


Purple = Loss; Red = Gain

- **Overall gain of 69.84 ha of mangroves for 2000 to 2021**
- **Dredging for port expansion around 2011 possibly contributed to mangrove proliferation**
- **Mangroves not reduced, but port development contributed to deterioration of other habitat types (e.g., UNEP et al. 2021)**

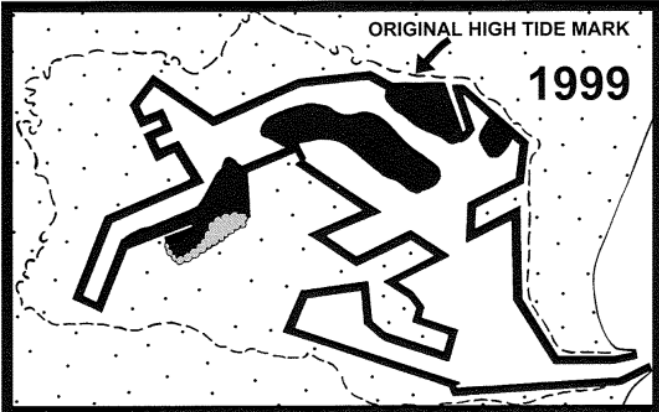
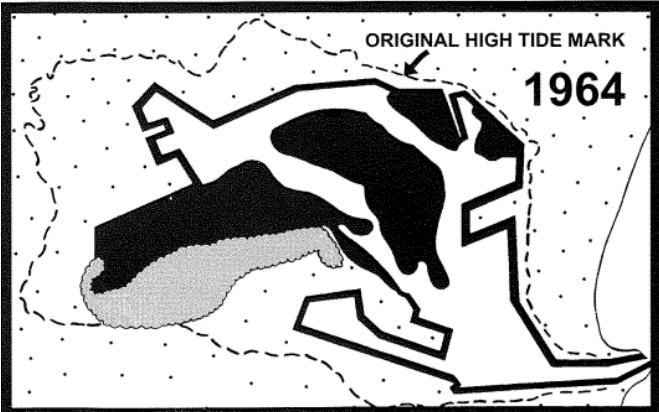
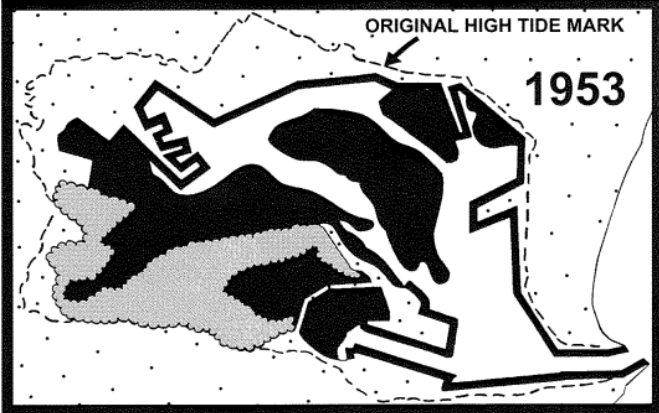
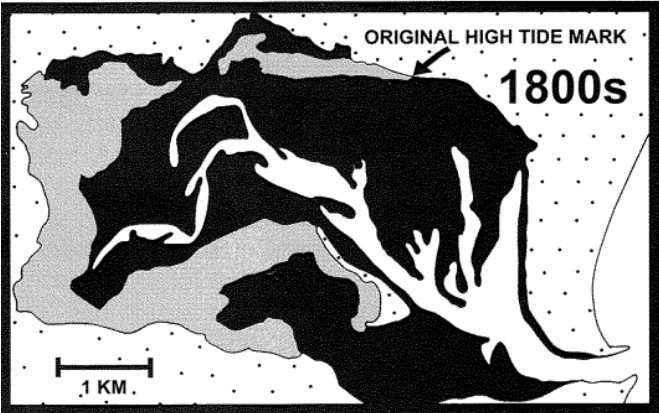
Habitat Assessment in Selected Ports...

- **Durban: Compared timeseries of mangrove cover using Landsat and SRTM incrementally from 2000 & 2021**



- **Mangroves steadily increased in area within the wider port**
- **Cover data do not necessarily indicate mangrove health (areas of mangrove die-off in Durban observed, e.g., oil spills)**
- **Also does not reflect loss of other habitat types, e.g., sandbank habitat as a result of proposed ongoing port development and need to deepen and widen shipping canals and basins.**

Habitat Assessment in Selected Ports...



Habitat Assessment in Selected Ports...

- **Key findings of this demonstration study:**
 - **Spatial assessment at port scale requires finer resolution than that typically applied in regional or global data bases**
 - **For strategic port planning resolution of 5 x 5 m can probably suffice**
 - **Detailed port planning and design, ideally requires sub-meter resolution**
 - **Investment in appropriate geo-referenced data acquisition techniques, but also alternative methods where remote sensing may be less suitable, e.g., deeper coral reefs and seagrass beds**

To explore ways forward on habitat mapping approaches with stakeholders in next session

Concept of Sustainable (Green) Ports

- **Originally ports developed for safe and cost-effective trade with little competition (1st generation ports)**
- **Growing global trade, rapid coastal urbanization, and depletion of natural resources - increased societal and regulatory pressures**
- **Concept of 'Green Ports' and 'Sustainable Ports' emerged - for ports to remain economically viable, but addressing environmental and social responsibilities (5th generation ports)**
- **Increasingly, ports authorities worldwide compelled to pursue greater sustainability to safeguard their 'license to operate' (competitiveness)**



Concept of Sustainable Green Ports...

- WIO region experiencing unprecedented development growth, including ports – we have opportunity ‘to do it right’
- Failing to do so potentially significant impacts on critical coastal habitats and dependent livelihoods
- Ports need to safeguard ‘license to operate’ to grow competitiveness
- Sustainable development key aspiration of *Agenda 2063: The Africa We Want*



This project aims to assist regional ports in addressing challenges drawing on best (and appropriate) international practice



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