ECOLOGY AND BALLAST WATER MANAGEMENT IN CENTRAL AFRICAN PORT AREAS

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The Gulf of Guinee face a major trait in the management of their coastal environment (zone) due to divers pollution that can originate from natural and/or anthropogenic activities (land, petroleum platform and ballast waste).

- Great port activity in the Gulf of Guinea.
- Need to preserve marine and coastal biodiversity.
• “Ballast Water” means water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship.

• “Ballast Water Management” means mechanical, physical, chemical, and biological processes, either singularly or in combination, to remove, render harmless, or avoid the uptake or discharge of Harmful Aquatic Organisms and Pathogens within Ballast Water and Sediments.
Ballasting Process
Seaport Ecology

Pollution

Ballast water

Biodiversity
Elements Transported in Ballast Waters
- Animals and plants organisms (phytoplankton, zooplankton, ichthyofauna)
- Organic matter with sediments

Colonization of infrastructure by fast-growing organisms here introduced mussels.
International Conventions


Objective: regulate ballast water discharges and reduce the risk of introduction of invasive species from ship ballast water

- 57 signatory countries
- 07 out of 38 coastal Africans countries
- Absence of Cameroon (but a member state of IMO)
- Congo in Central Africa
Ballast Water Treatment Process

Physical solid-liquid separation
- Treatment:
  - Hydrocyclone
  - Surface filtration
- Chemical enhancement:
  - Coagulation/Flocculation

Disinfection
- Chemical treatment:
  - Chlorination
  - Electrochlorination or electrolysis
  - Ozonation
  - Peracetic acid
  - SeaKleen
  - Chlorine dioxide
- Physical:
  - UV irradiation
  - UV + TiO₂
  - Deoxygenation
  - Gas injection
  - Ultrasonic treatment
  - Cavitation
- Residual control:
  - Chemical reduction (sulphite/bisulphite)
- Physical enhancement:
  - Ultrasonic treatment
  - Cavitation

MONITORING AND TREATMENT

Interest
Sample → (pre-processing) → Dosage

Excel → Modelling → MatLab
MEASURING TOOLS

NISKIN bottle

Multiparameter

Microbiological analysis

Remote Sensing
METHODOLOGY

Define the area of study → Acquire Satellite Imagery

Processing

European Space Agency (ESA) Sentinel data and tools such as SNAP, Vtweb (interacting and can be visualized in KML file through Google map)
Analysis Tools

Ecological modelling with ECOPATH

Statistical analysis: R, XLSTAT, SPSS
Tendance de la Chlorophylle de Surface sur les périodes 1998-2007 (SeaWiFS) et 1998-2012 (SeaWiFS+MODIS)

- SeaDAS from NOAA (https://oceancolor.gsfc.nasa.gov)
- Synphony Model, University of Toulouse France
Starfish predation maintains a diverse community
(a) starfish
   carnivorous gastropods
   mussels
   barnacles (2 spp)
   anemones & tunicates
   chitons (2 spp)
   benthic algae (4 spp)
   sponge
   nudibranch

(b) Removal of Starfish allows mussels to dominate, and reduces species diversity
   starfish removed
   mussels (very abundant)
   small limpets only
   carnivorous gastropods
   only 1 epiphyte sp abundant
   algae
   fewer barnacles (mainly goose)

In Cury et al. 2003 (from Paino 1966)
INTERESTS

• To evaluate the trophic state of the port environment.
• Monitor pollution in the area.
• This will be done in collaboration with Douala and Kribi Seaport Cameroon.
Conclusion

• Establish a research centre (JEAI-RELIFORM) that will handle the ballast water analysis to determine if the treatment performed by the ship is effective.

• Monitor the environment and compare the samples with those of the different vessels.

• Evolve to research institute oriented in the treatment and monitoring of ballast water and forge technical partnerships for capacity building.
MERCI DE VOTRE AIMABLE ATTENTION

Earth Observation Portal: https://directory.eoportal.org/
European Space Agency: http://www.esa.int/ESA
Envisat: https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/envisat
AVHRR: http://edc2.usgs.gov/1KM/avhrr_sensor.php
IRS: https://directory.eoportal.org/web/eoportal/satellite-missions/i/irs
GeoEye: https://www.orbitalatk.com/space-systems/commercial-satellites/imaging-satellites/docs/FS017_10_OA_3695%20GeoEye-1.pdf
MODIS: http://modis.gsfc.nasa.gov/