



# MASTER REGIONAL EN GESTION INTEGREE DES ENVIRONNEMENTS LITTORAUX ET MARINS

Université de Douala – Université Omar Bongo – Université de Yaoundé 1 – Université des Sciences et Techniques de Masuku

## ECOLOGY AND BALLAST WATER MANAGEMENT IN CENTRAL AFRICAN PORT AREAS

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Marine Environment**



# CONTEXTE



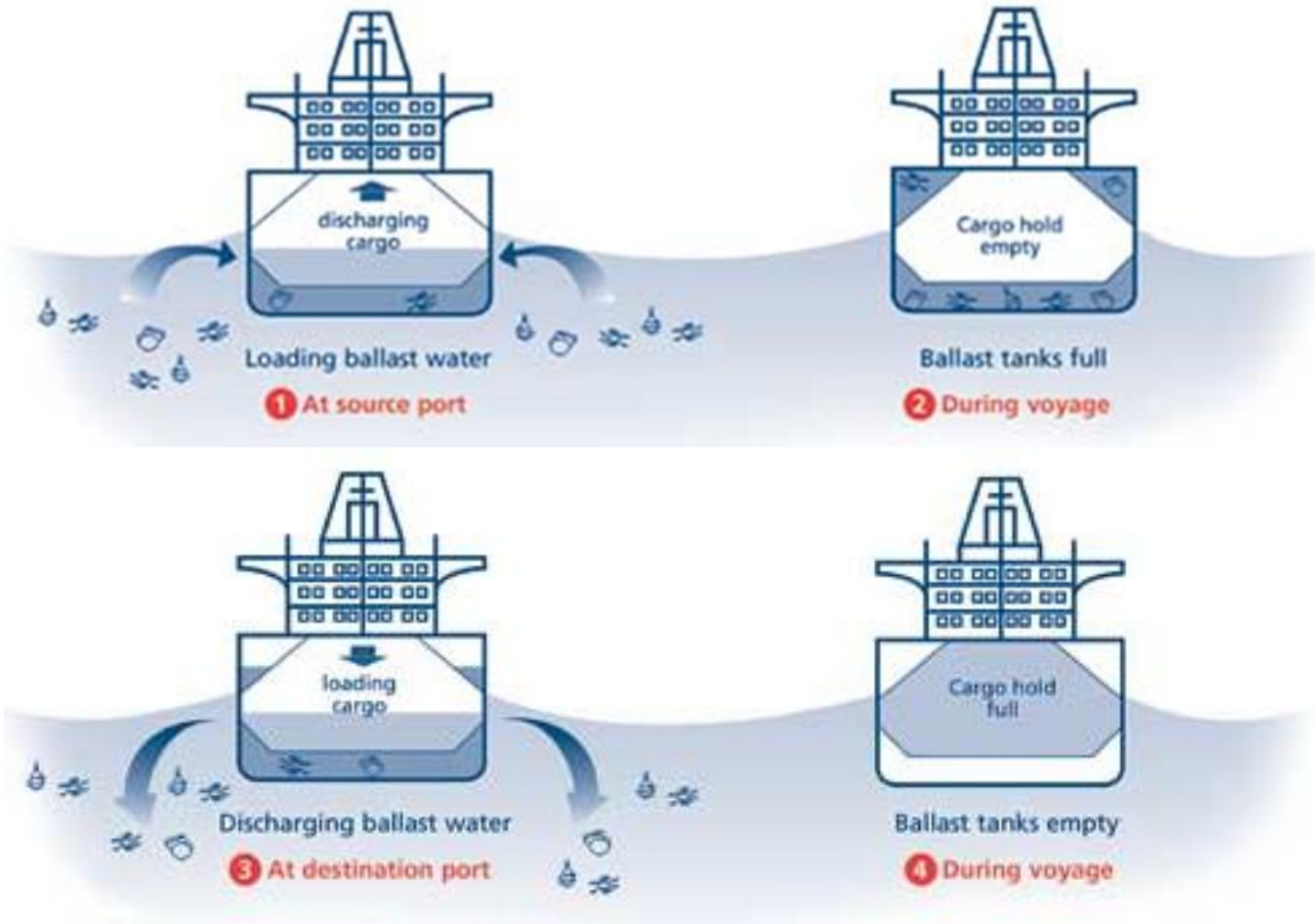
- The Gulf of Guinea face a major threat in the management of their coastal environment (zone) due to diverse pollution that can originate from natural and/or anthropogenic activities (land, petroleum platform and ballast waste).
- Great port activity in the Gulf of Guinea.
- Need to preserve marine 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



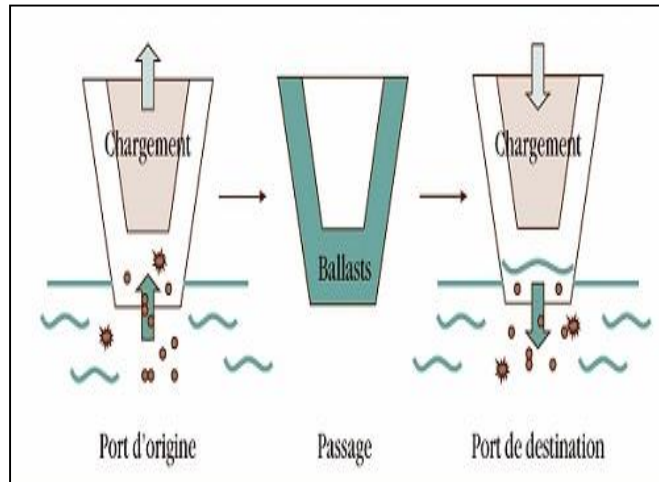
# CONTEXT



Pollution



Pollution



Ballast water



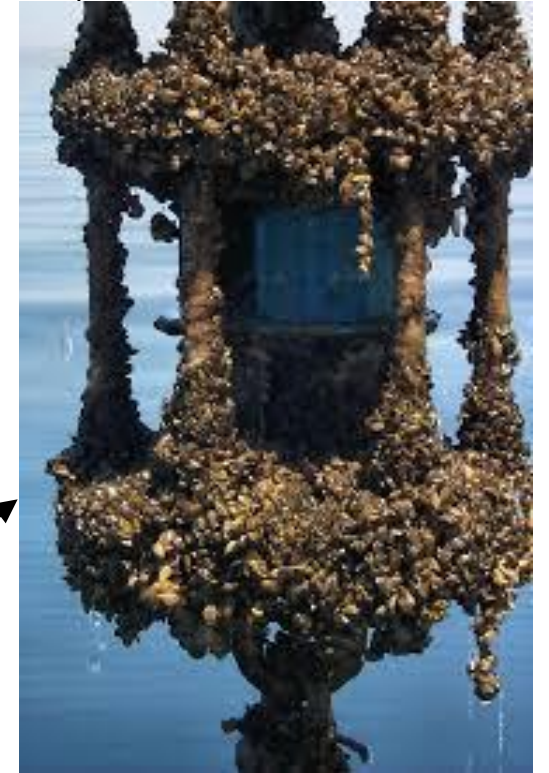
Biodiversity

## Elements Transported in Ballast Waters

- Animals and plants organisms (phytoplankton, zooplankton, ichthyofauna)
- Organic matter with sediments



Algae Bloom



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

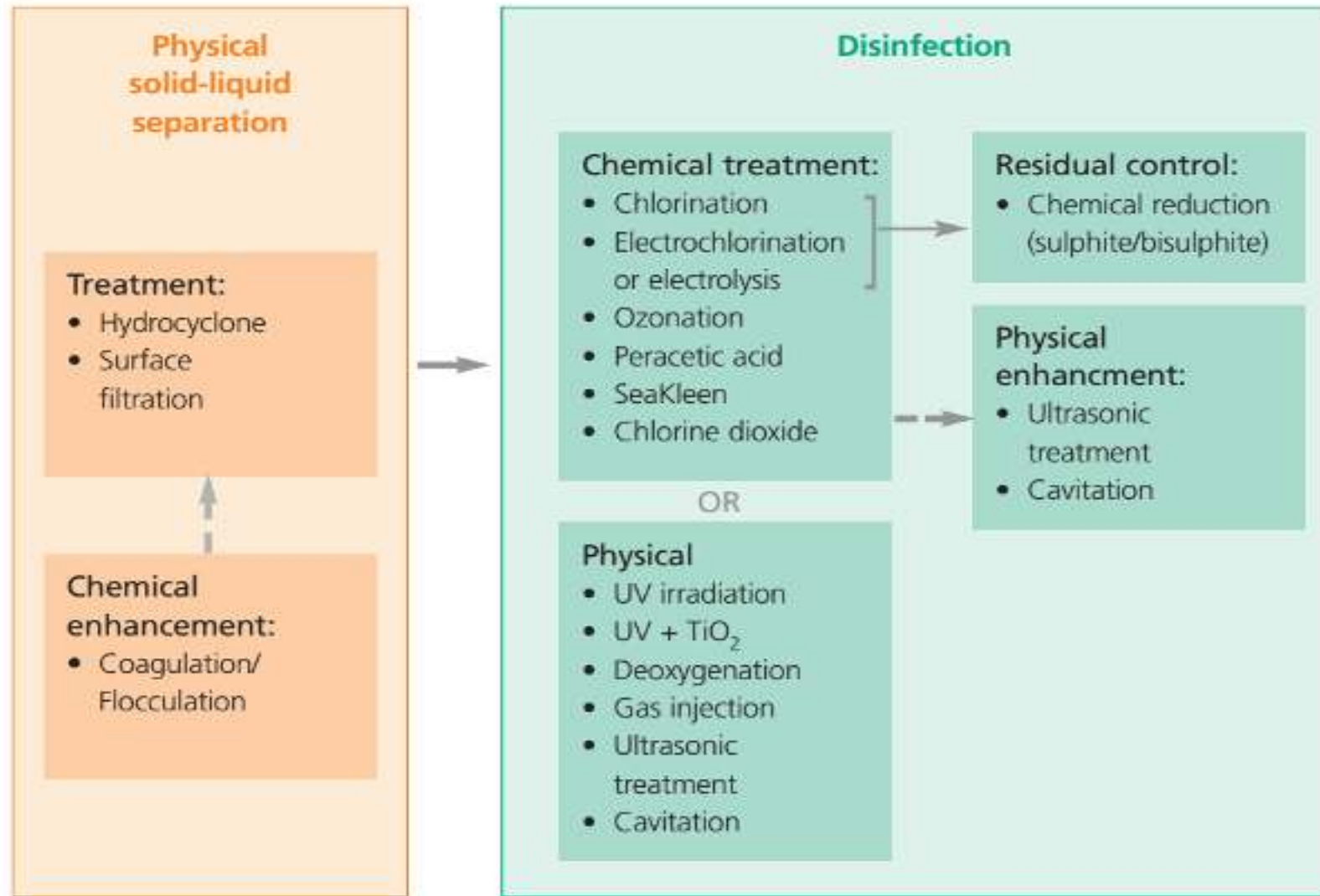
## International Conventions

- International Convention for the Control and Management of Ships' Ballast Water and Sediments (adopted 13 February 2004) now known as BWM Convention (entry in to force:8 September 2017).

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



**MONITORING AND TREATMENT**



Interest



# METHODOLOGY

Sample



(pre-processing)



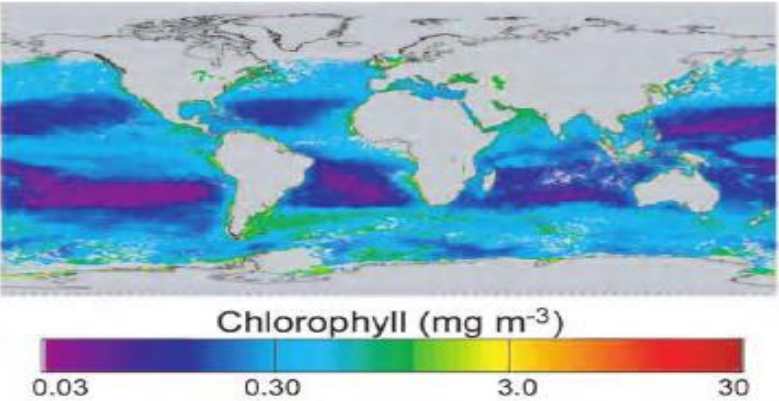
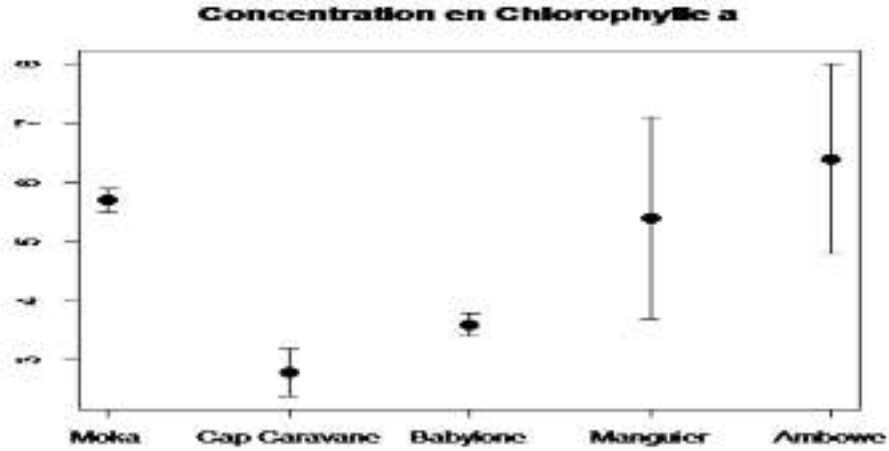
Dosage



Excel

MatLab

Modelling



# MEASURING TOOLS



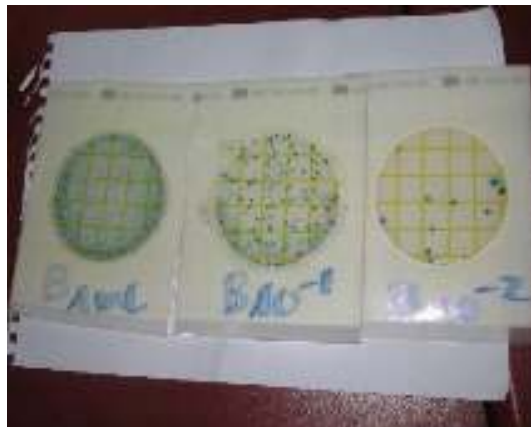
NISKIN bottle



Multiparameter



Microbiological analysis



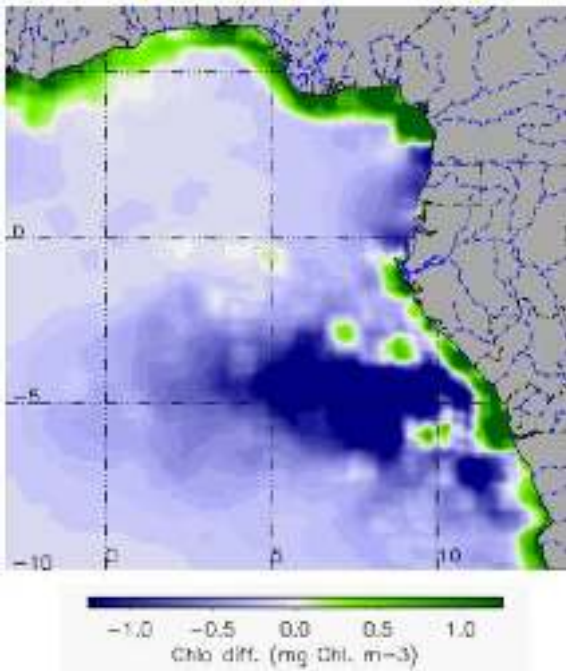
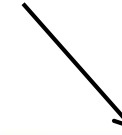
Remote Sensing

# METHODOLOGY

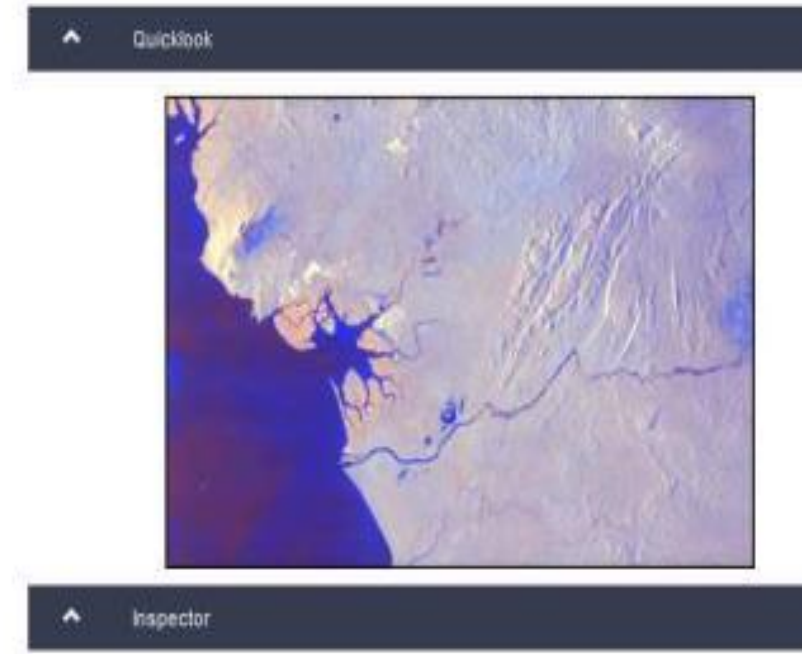
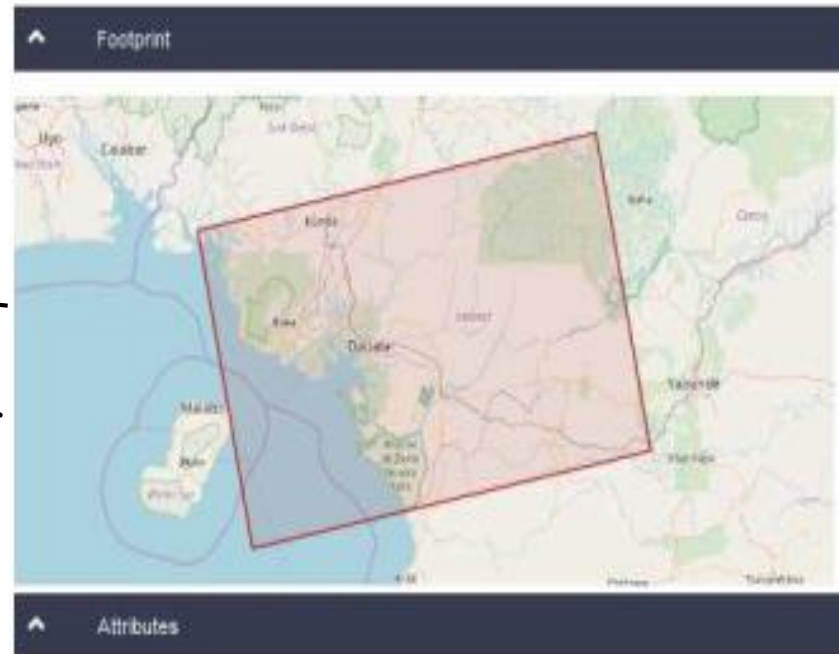
Define the area of study



Acquire Satellite Imagery

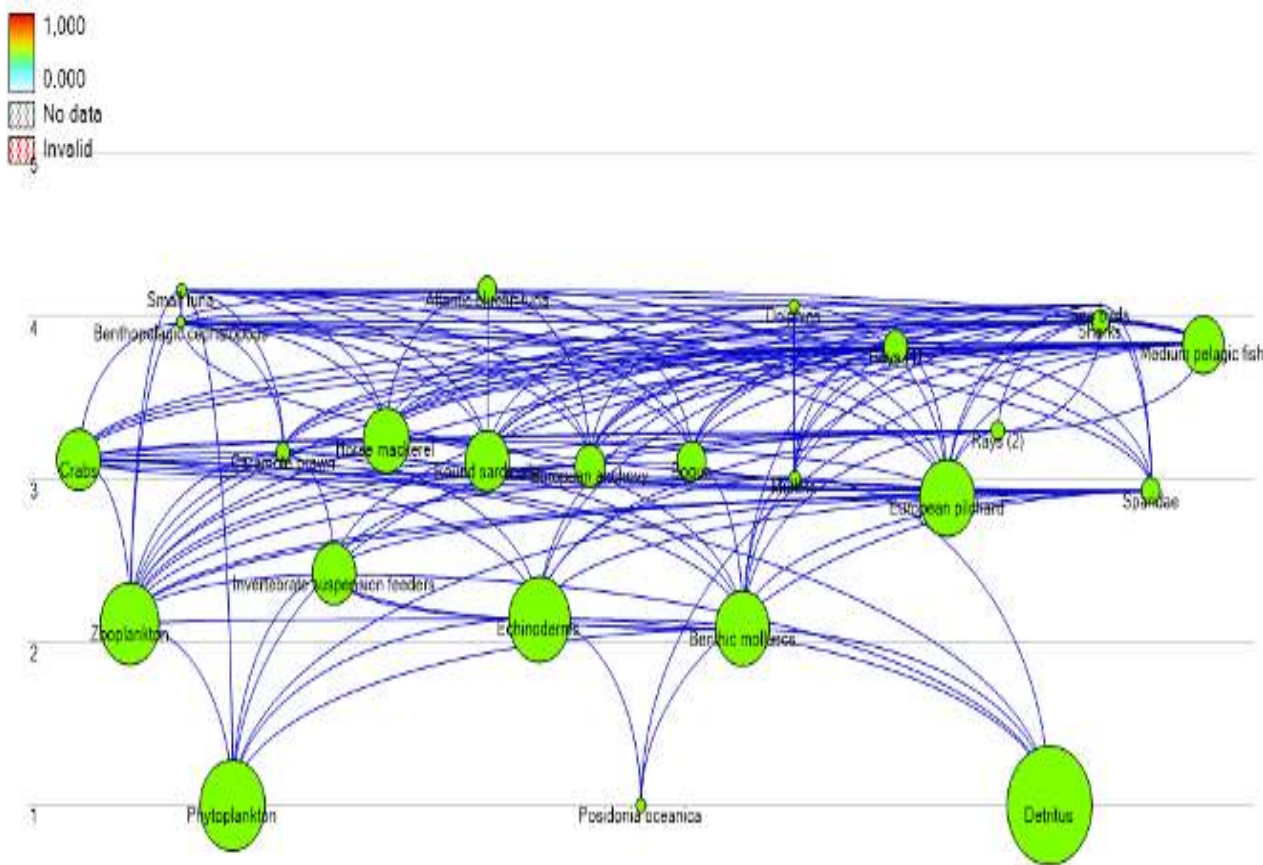


Processing

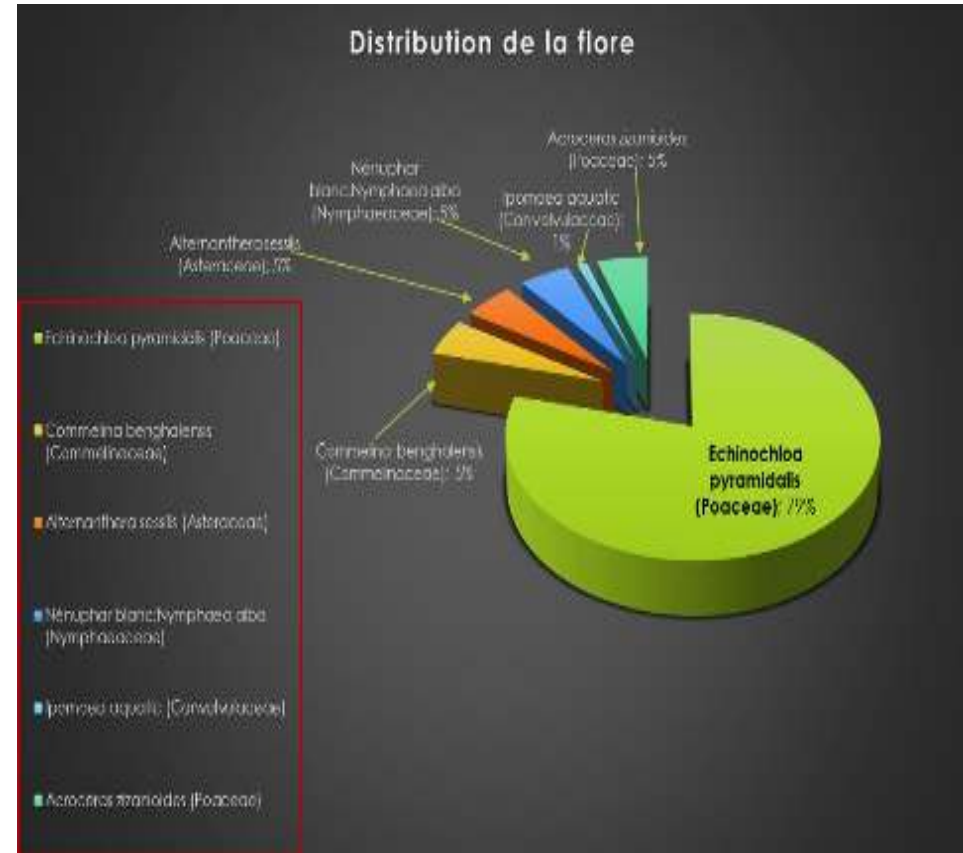


European Space Agency (ESA) Sentinel data and tools such as SNAP, Vtweb (interacting and can be visualized in KML file through Google map)

# Analysis Tools

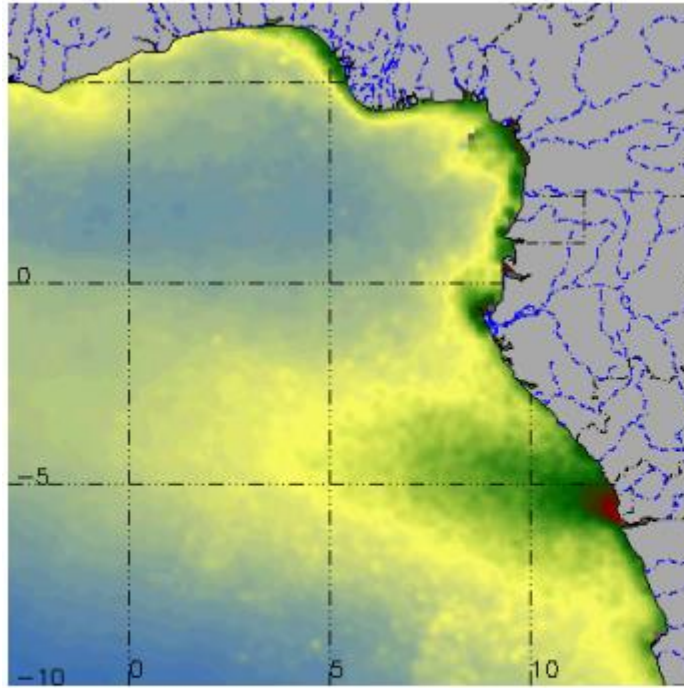


Ecological modelling with ECOPATH

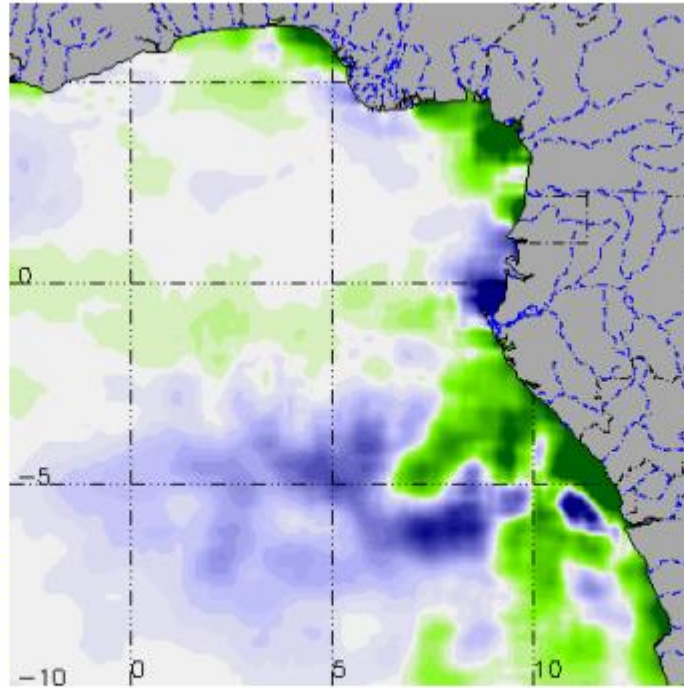


Statistical analysis: R, XLSTAT, SPSS

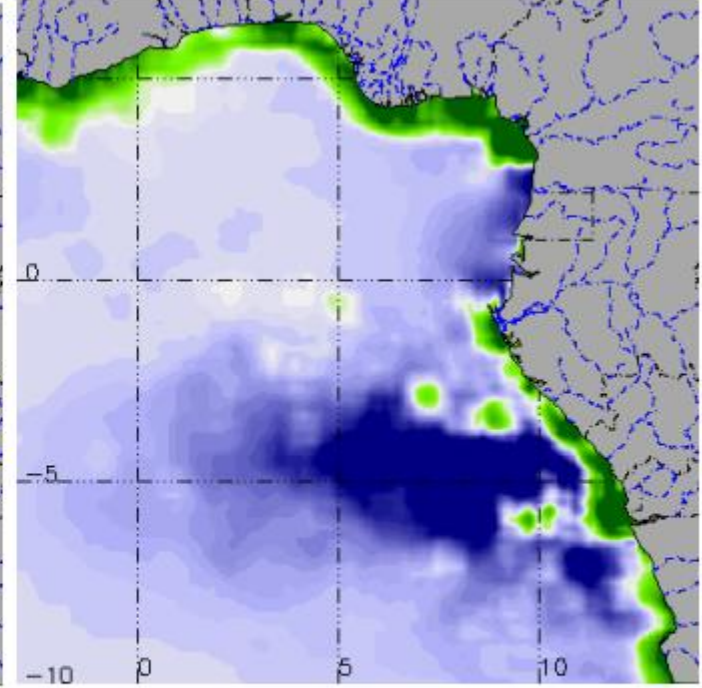
# Tendance de la Chlorophylle de Surface sur les périodes 1998-2007 (SeaWiFS) et 1998-2012 (SeaWiFS+MODIS)



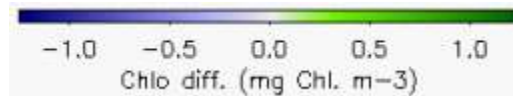
**Moyenne  
(1998-2007)**



**Tendance  
1998-2007**

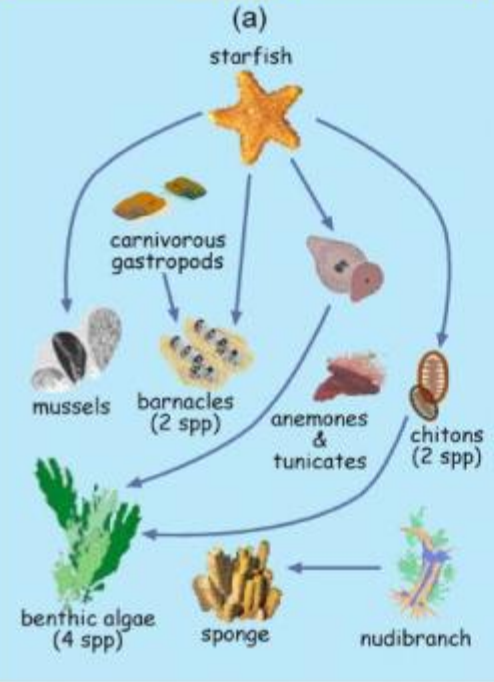


**Tendance  
1998-2012**

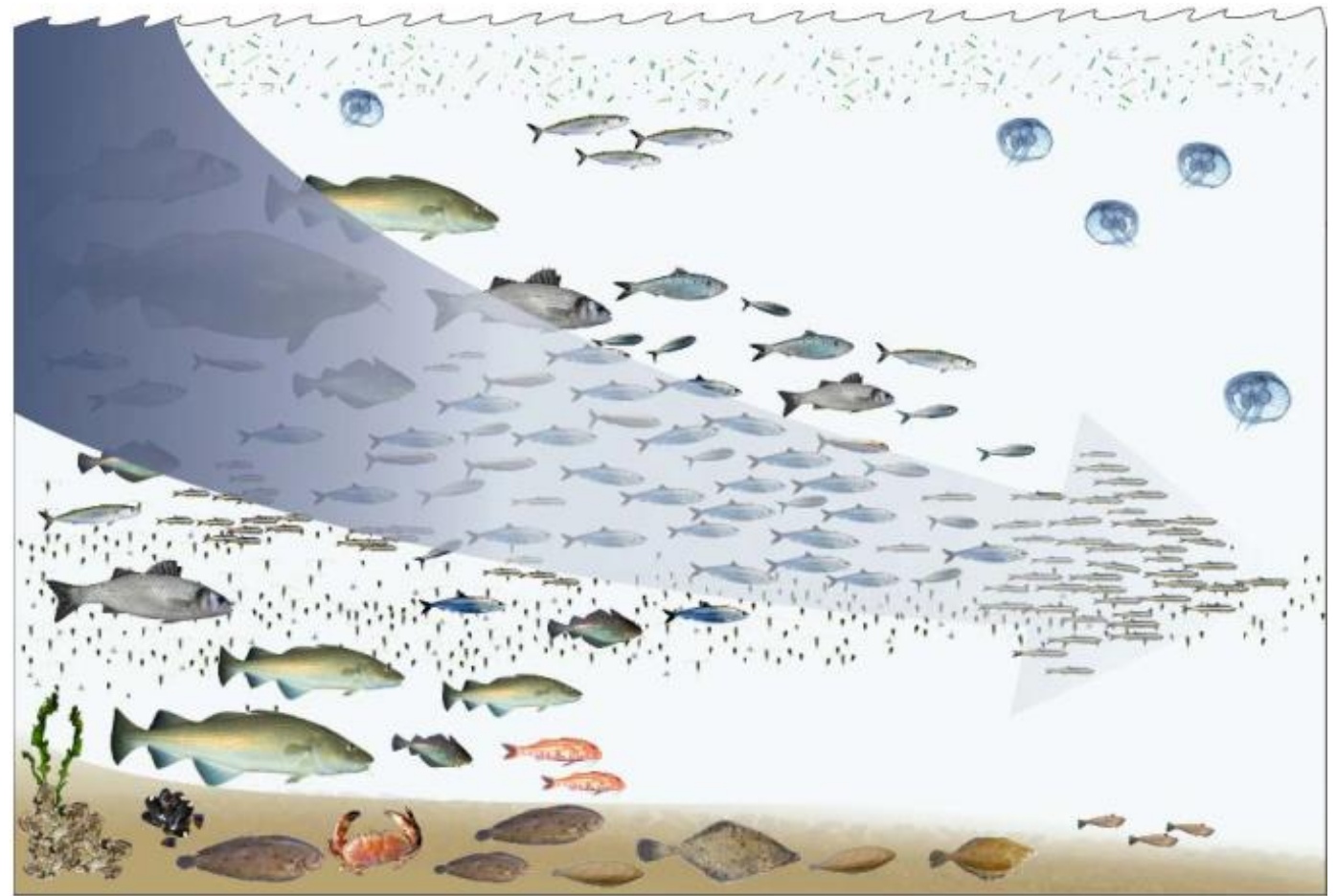
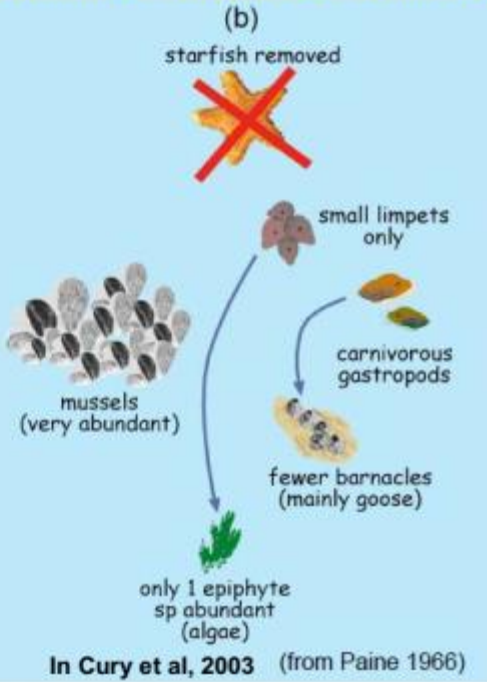


- SeaDAS from NOAA (<https://oceancolor.gsfc.nasa.gov>)
- Symphony Model, University of Toulouse France

Starfish predation maintains a diverse community



Removal of Starfish allows mussels to dominate, and reduces species diversity



# 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>.

**Landsat:**<http://pubs.usgs.gov/fs/2015/3081/fs20153081.pdf>.

**Envisat:**<https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/envisat>.

**AVHRR:**[http://edc2.usgs.gov/1KM/avhrr\\_sensor.php](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](https://www.orbitalatk.com/space-systems/commercial-satellites/imaging-satellites/docs/FS017_10_OA_3695%20GeoEye-1.pdf).

**MODIS:**<http://modis.gsfc.nasa.gov/>.