

Support fisheries management in West Africa using Earth Observation

Monitoring for Environment and Security in Africa (MESA) Programme

Kwame Adu Agyekum

ECOWAS Coastal & Marine Resources Management Centre
University of Ghana

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African Union Commission



European Union



ACP Secretariat



5 African Regional Economic Communities

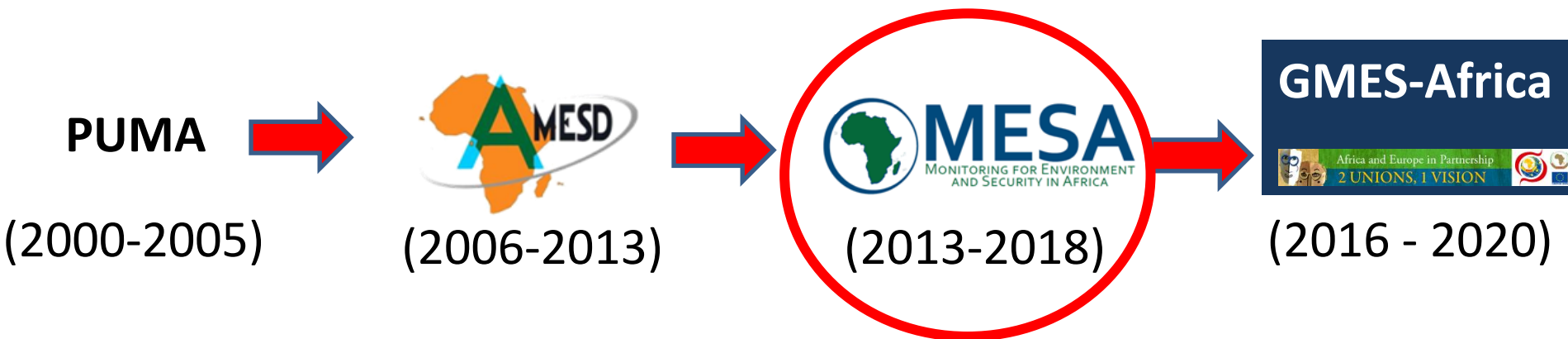


Purpose

To support African **decision-makers** and **planners in designing and implementing** national, regional and continental policies and **development plans towards sustainable development** with the view to **advance the socio-economic progress** and well-being of populations **towards achievement of the MDGs**



Essence : Increase **information** capacity management of Regional and National institutions



MESA Regional Thematic Actions

THEME : «Crop and rangeland management»

RIC : Cilss, Agrhymet Niamey

THEME Marine & Coastal management

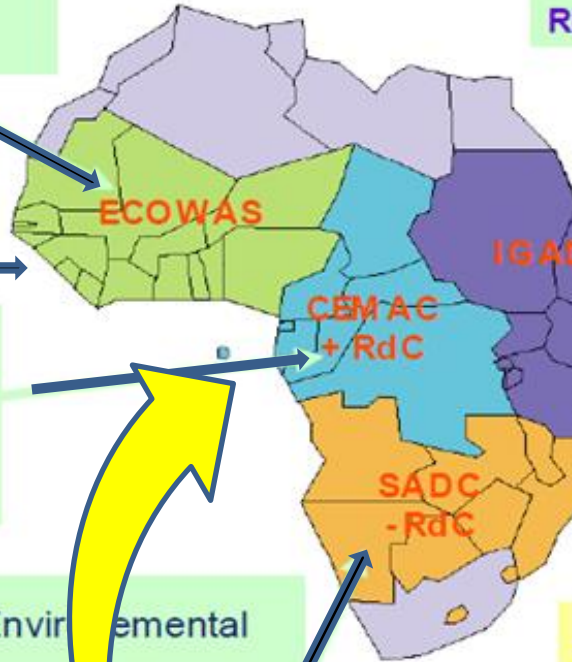
RIC: University of Ghana

THEME : « Integrated Water Resource Management »

RIC : Cicos, Kinshasa, RDC

THEME : «Agricultural & Environmental resource management»

RIC : NMS Gaborone, Botswana



ECOWAS

1. Benin
2. Cape Verde
3. Cote d'ivoire
4. Gambia
5. Ghana
6. Guinea
7. Guinea Bissau
8. Liberia
9. Nigeria
10. Senegal
11. Sierra Leone
12. Togo
13. Mauritania
14. Sao Tome & Principe

CEMAC

1. Cameroon
2. Equatorial Guinea
3. Gabon
4. R. Congo
5. DR Congo

MESA (Marine) in West Africa

- **Focus**

- Earth observation services for coastal and marine resources management in ECOWAS

- **Objective**

- To increase the information management, decision-making and planning capacity of ECOWAS institutions mandated for coastal and marine management, by enhancing access to and exploitation of relevant Earth Observation (EO) data.

Context: Fisheries Challenges in Gulf of Guinea

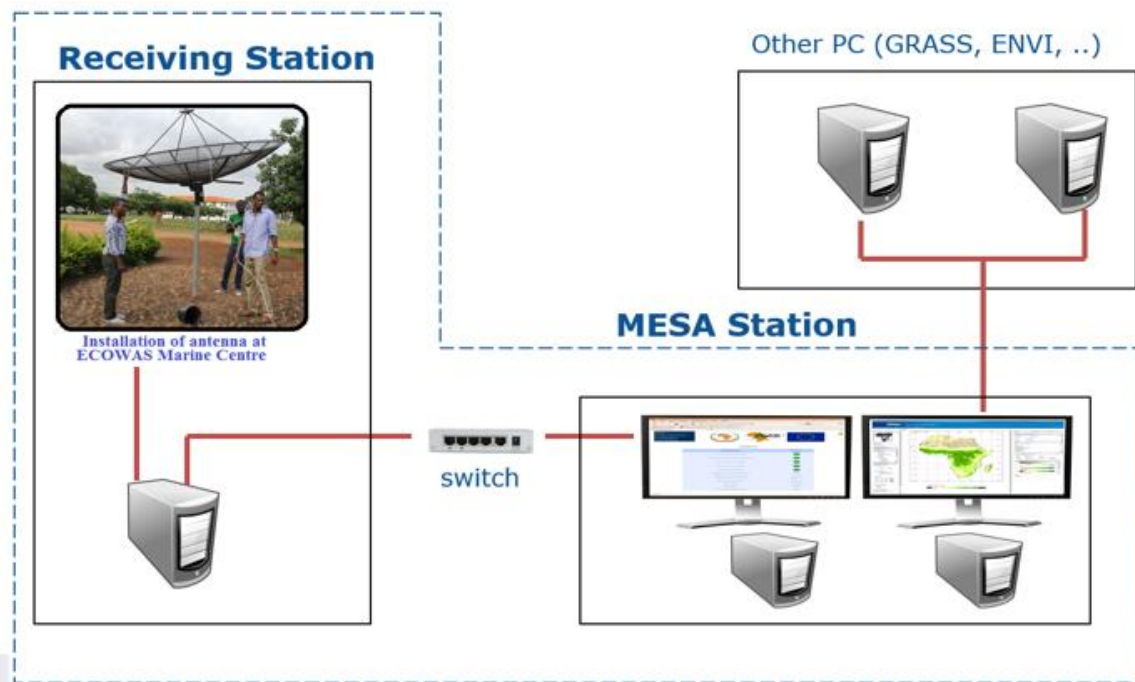
- 3 million: People directly or indirectly employed in fishing industry
- 20 kg: Avg. annual per capita consumption of fish protein for the region (World: 18 kg: Avg)
- 1.6 Million tons of catch per year (about \$3 billion)
- \$1.5 Billion: Value of lost fishing revenue due to IUU
- 10% of GDP in Guinea-Bissau and Sierra Leone from fishing industry
- >30% of export revenues in fish (Mauritania & Senegal)
- Source: *Illegal Fishing Plunders and Strains West Africa* (<http://www.reuters.com/article/2012/03/15/us-westafrica-fishing-idUSBRE82E0HD20120315>); *Governance in West African Fisheries. Experiences from the West African Regional Fisheries Program* (http://www.lib.noaa.gov/about/news/Virdin_07112012.pdf)

Data source & Processing

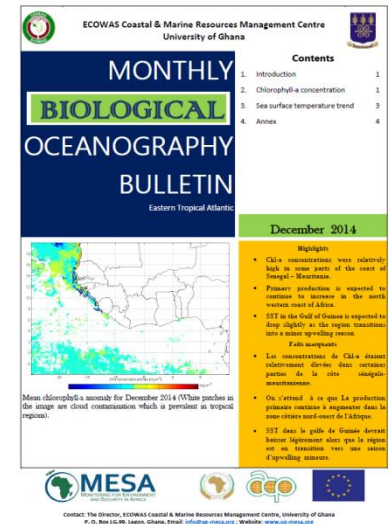
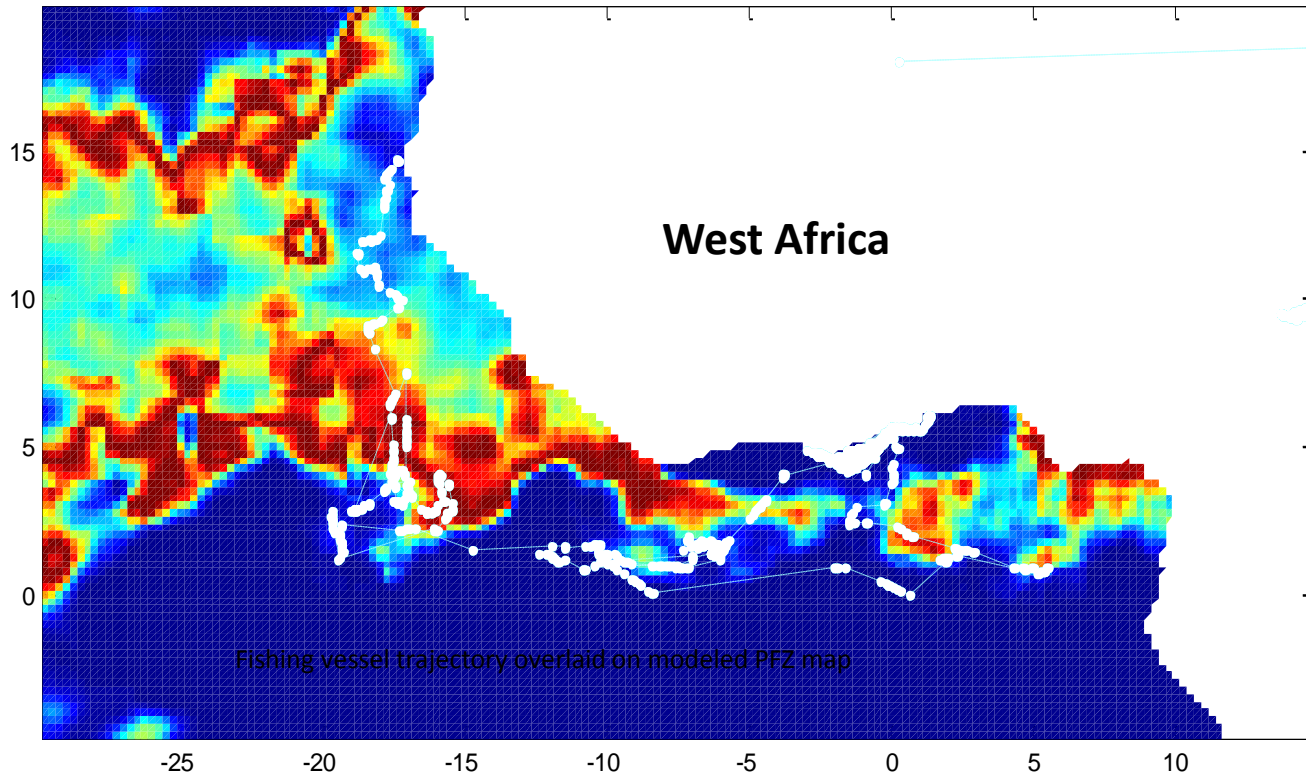
- Sources of Earth Observation (EO) data:
 - EUMETSat via MESA Stations
 - Oceanographic buoys & drifters
 - Satellite Automatic Identification System (Sat-AIS)
- Processing satellite and in situ data
 - ocean colour and SST fronts using Cayula and Cornillon Single Image
 - Edge Detection (SIED) technique
 - Mecartor forecast products; analyses of wave and current data
- Generation and dissemination of products to 19 countries
 - Potential fishing zone (PFZ) maps overlaid with fishing vessel traffic
 - Monitoring and forecast of ocean conditions (waves, currents, altimetry, etc)

Continuous data access

- EUMETSat provides data stream via MESA-station
- In-situ data via directional wave buoy



Service 1: Potential Fishing Zone maps overlaid with fishing vessel traffic

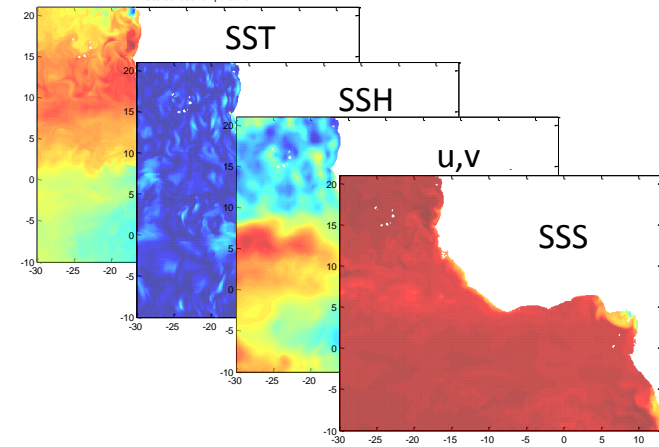


Environmental Bulletin

Methodology

Data

- Tuna catch data from logbooks obtained Fisheries Enforcement Unit – Ministry of Fisheries & Aquaculture Development, Ghana
- Environmental / Oceanographic parameters covering
 - Sea surface temperature (SST)
 - Sea surface height (SSH)
 - Geostrophic current (u,v)
 - Sea surface salinity (SSS)[covering latitude 10°S - 30°N; longitude 35°W - 10°E, 2014 - 2015]
- Fishing vessel trajectories from satellite Automatic Identification Systems (Sat- AIS)

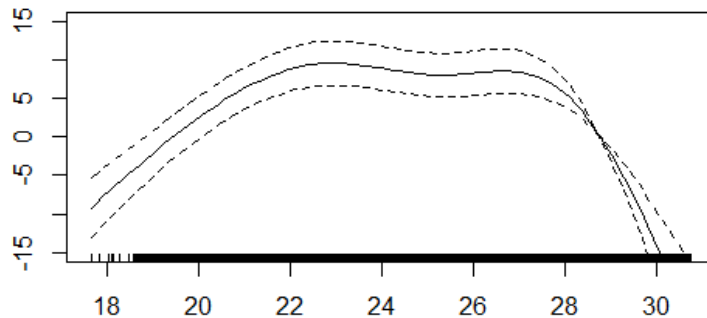


Analyses

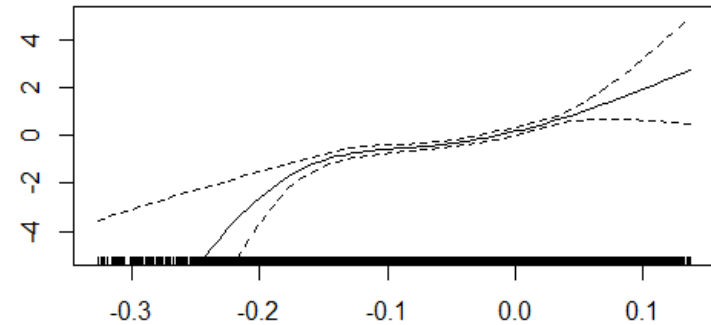
- Presence/absence data [0 or 1 / Yes or No] extracted from geolocated tuna catch data along with ocean datasets (SST, SSH, uv, SSS) in a 0.01°x0.01° grid.
- Generalized Additive Model $y = \alpha + f(\text{SST}, \text{SSH}, \text{uv}, \text{SSS}) + \epsilon$
- Trajectory of fishing vessel extracted and overlaid on PFZ maps and fishing speed analysis to identify fishing speed

Generalized Additive Model

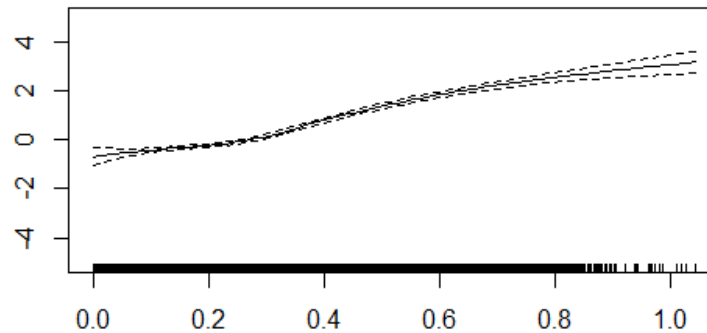
Optimal range of environmental parameters tuna catch



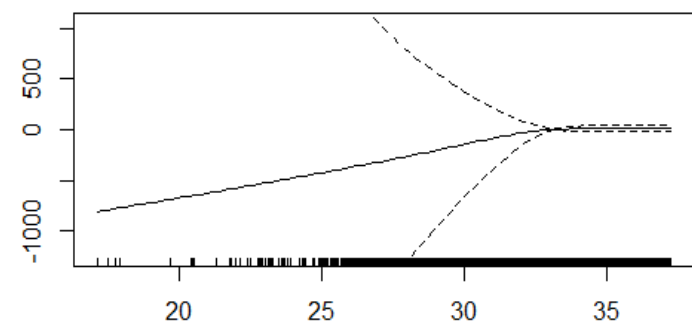
SST
22 – 28.5°C



SSH
> -0.05m



UV
> 0.3m/s

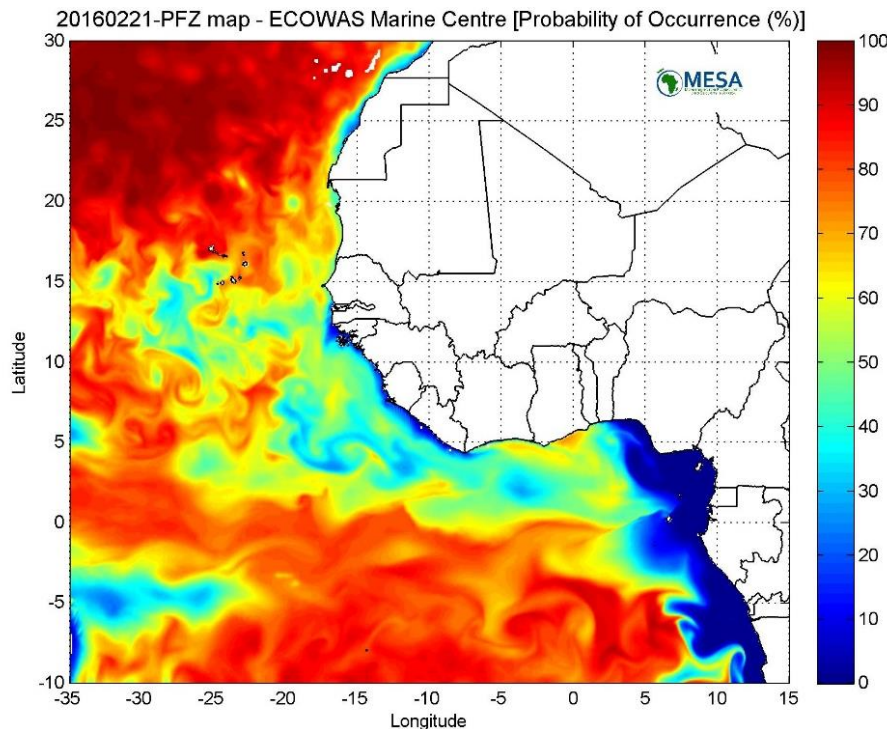


Sal
>34

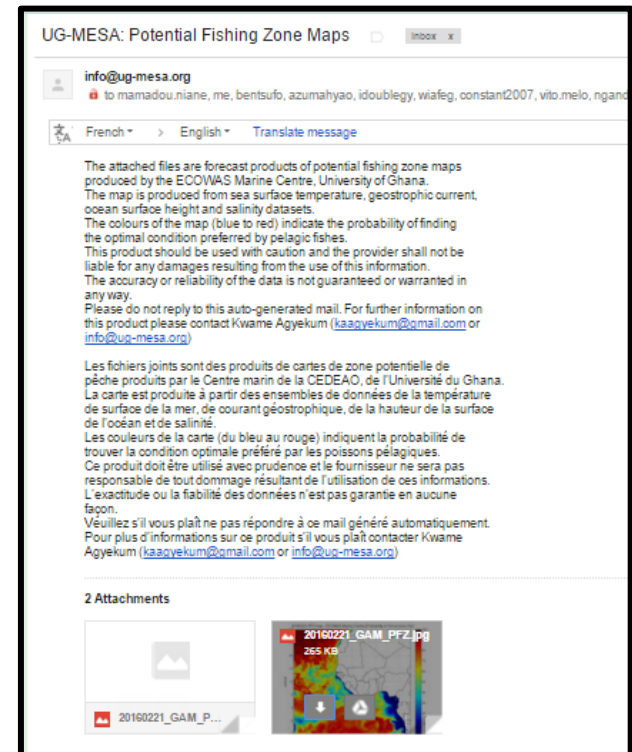
PFZ Mapping Service

Potential fishing zone (PFZ) charts

The service is operational, 6-day forecast are disseminated automatically to fisheries managers via email/ftp



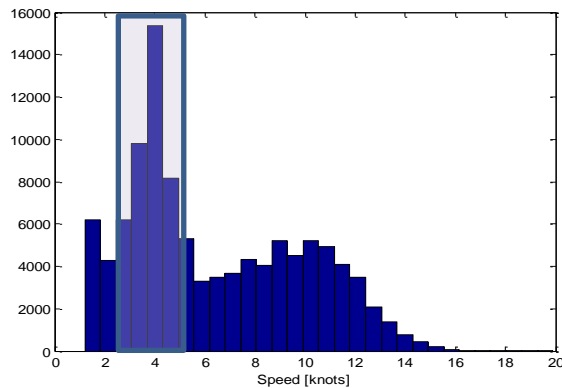
Probability of finding tuna (blue – low, red - high)



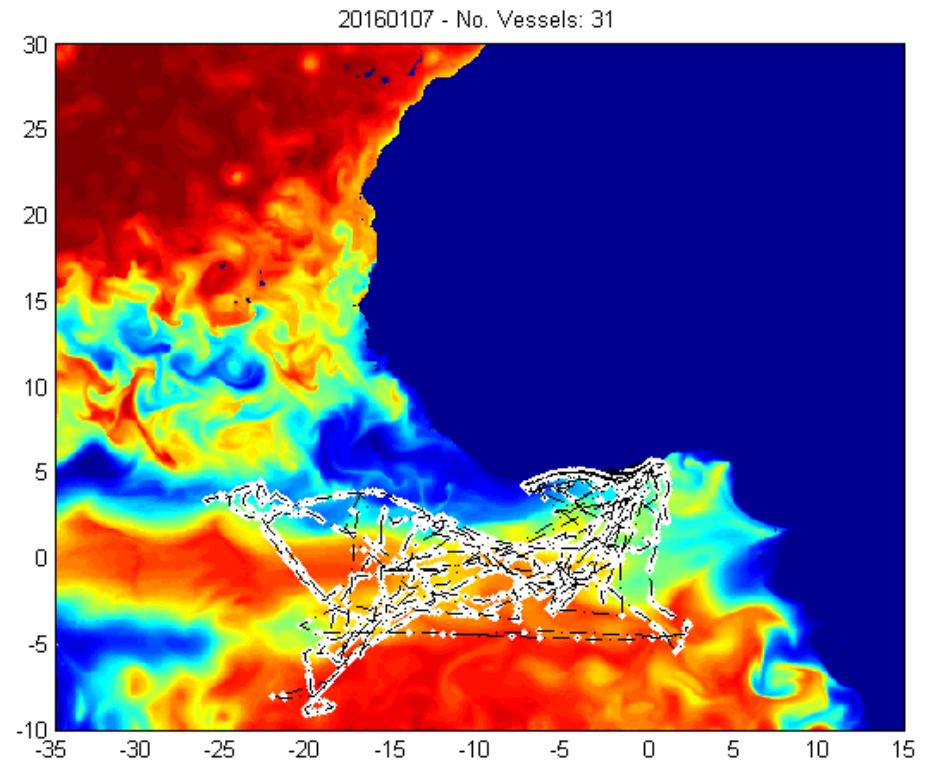
PFZ Mapping Service

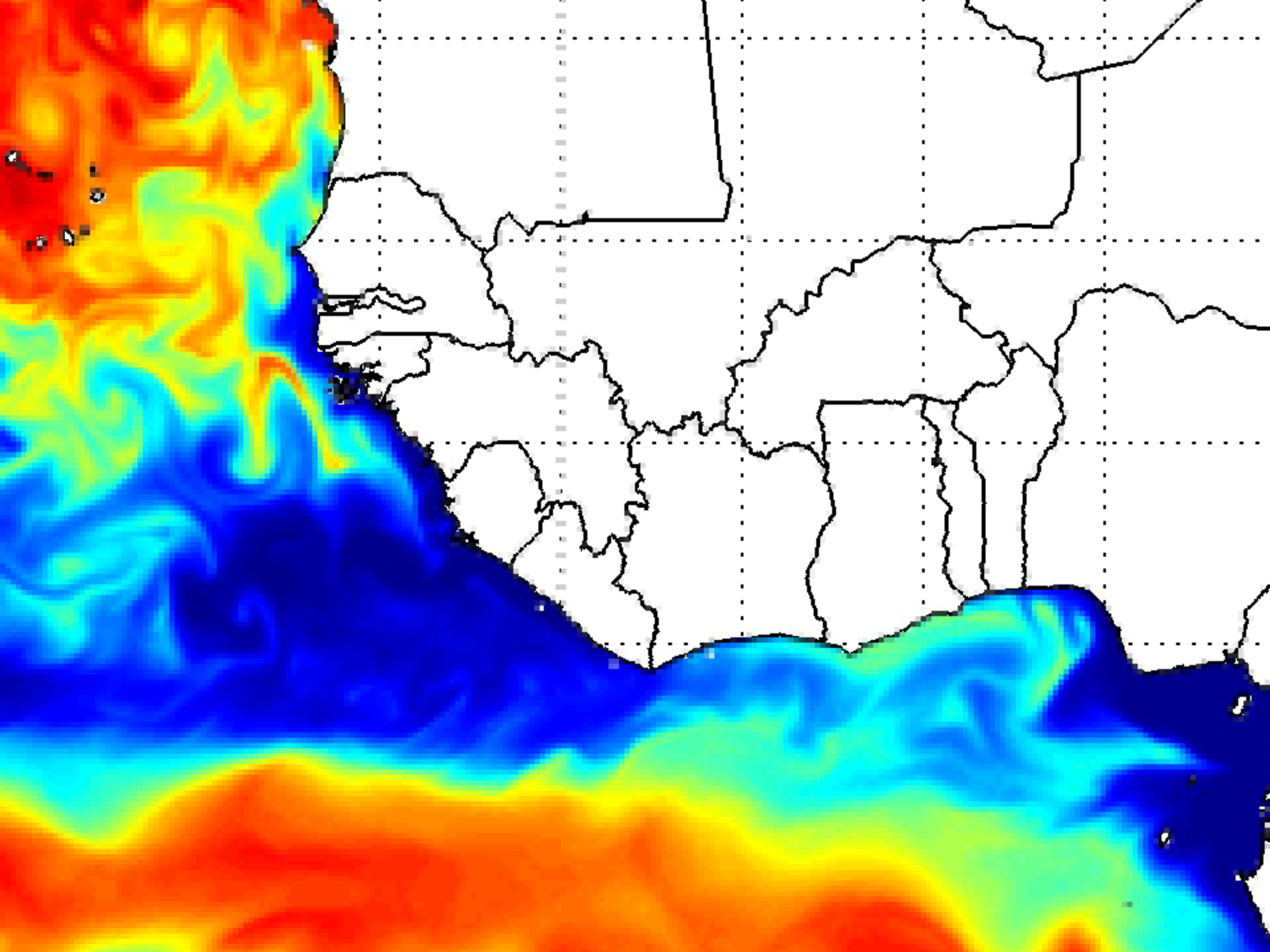
Potential fishing zone (PFZ) charts + Fishing Vessel

This service when operational will provide fisheries managers information on fishing activities flagged to their country or in their territorial waters



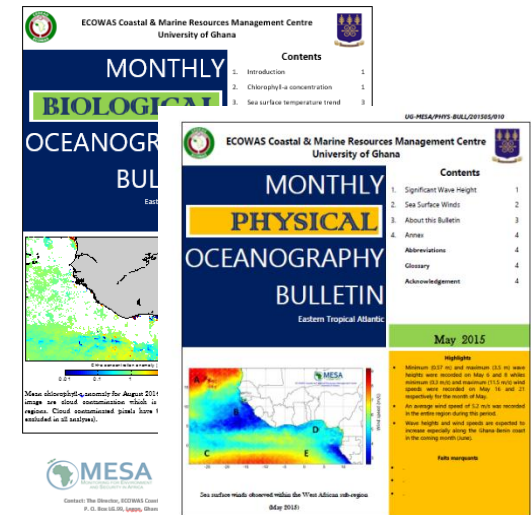
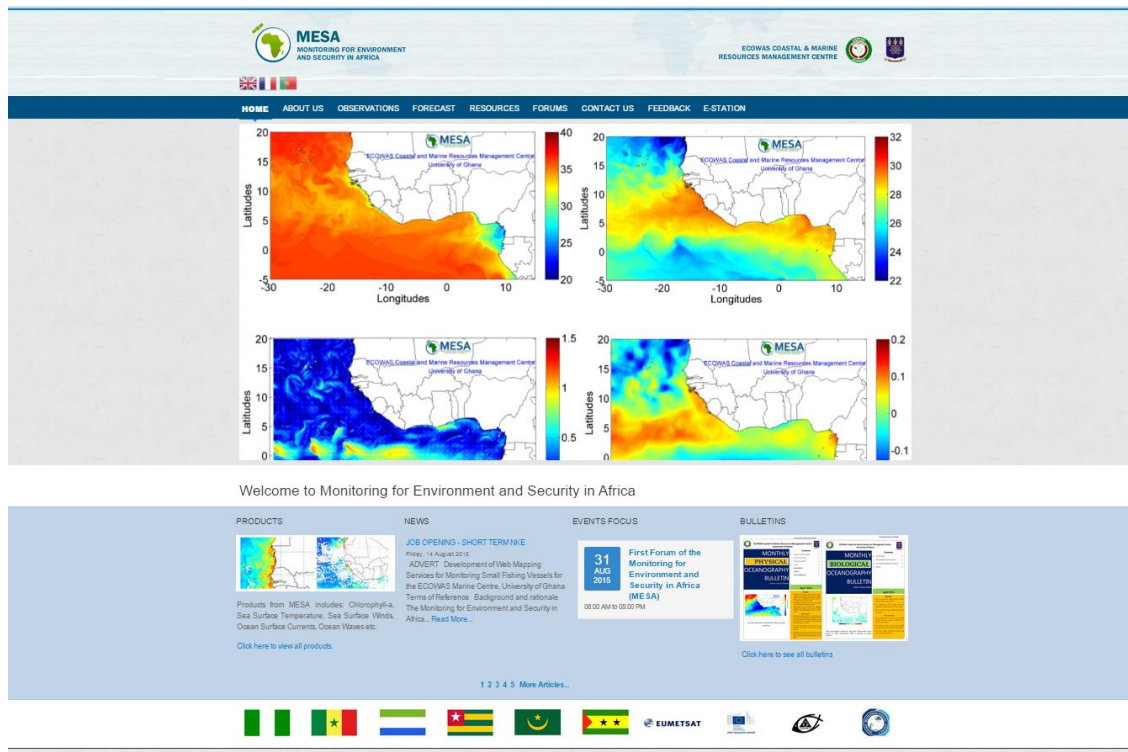
Histogram plot of fishing vessel speed from the AIS data indicates industrial fleets trawl or pay out their fishing nets between 2.5 and 4.5 knots



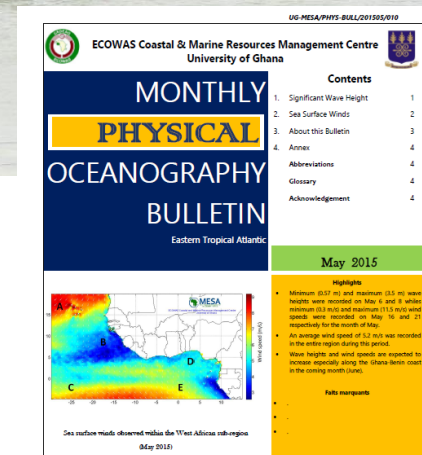
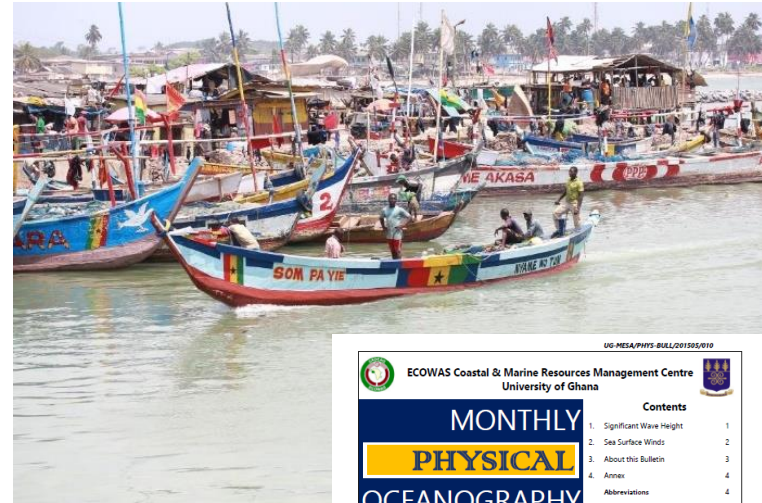


Online portal & bulletins

Online portal and dissemination of daily/weekly products and monthly bulletins

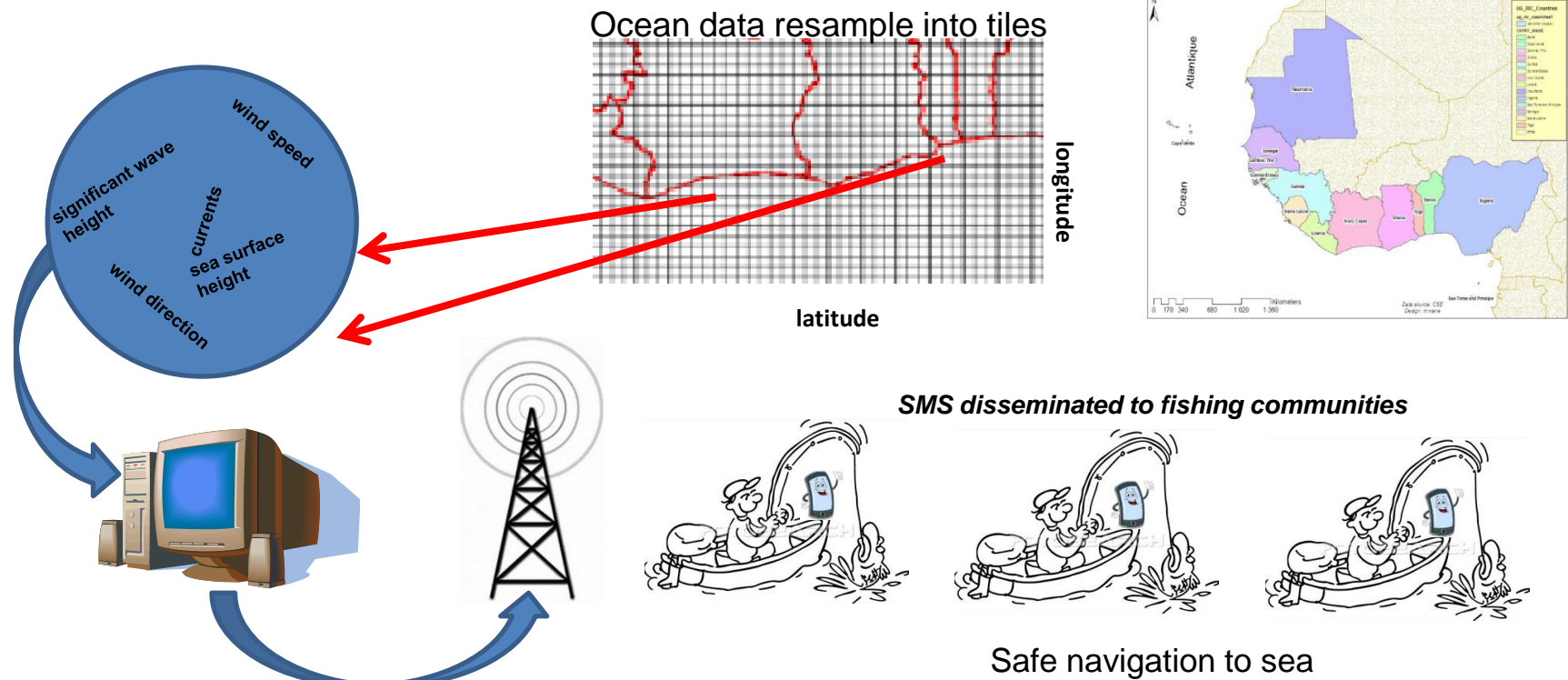


Service 2: Monitoring and forecast of ocean conditions



Contact: The Director, ECOWAS Coastal & Marine Resources Management Centre, University of Ghana
P. O. Box LG 99, Legon, Ghana. Email: info@ug-mesa.org | Website: www.ug-mesa.org

Definition and development of ECOWAS Marine SMS Services



Artisanal vessels

- Open Access; Registered; Not licensed; 9,000 canoes exclusively permitted to the Inshore Economic Zone (30m depth); operate from 308 landing sites



Semi-industrial vessels

They are licensed; 400 operational: exclusively permitted to fish in the Inshore Economic Zone (30m depth); operate from 6 landing sites



Installation of ABSEA Transponders - Sekondi



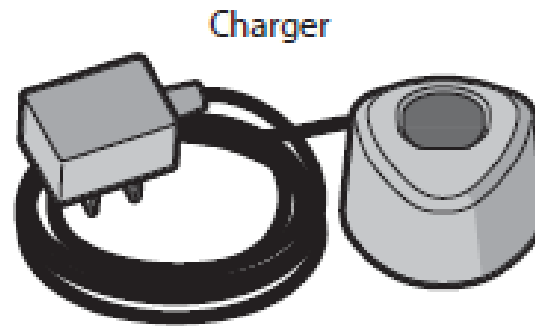
- 20 inshore fishing vessels were installed with transponders



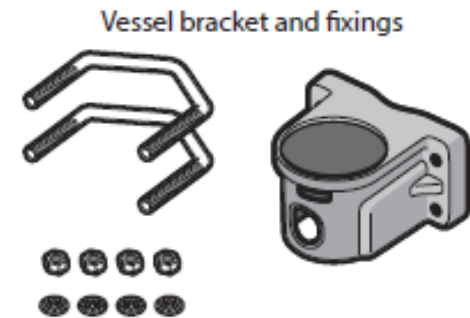
ABSEA transponder



Identifier



Charger



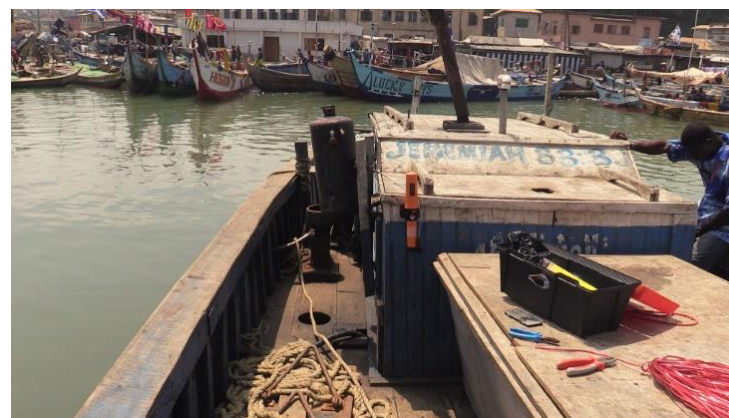
Vessel bracket and fixings

Installation of ABSEA Transponders - Sekondi

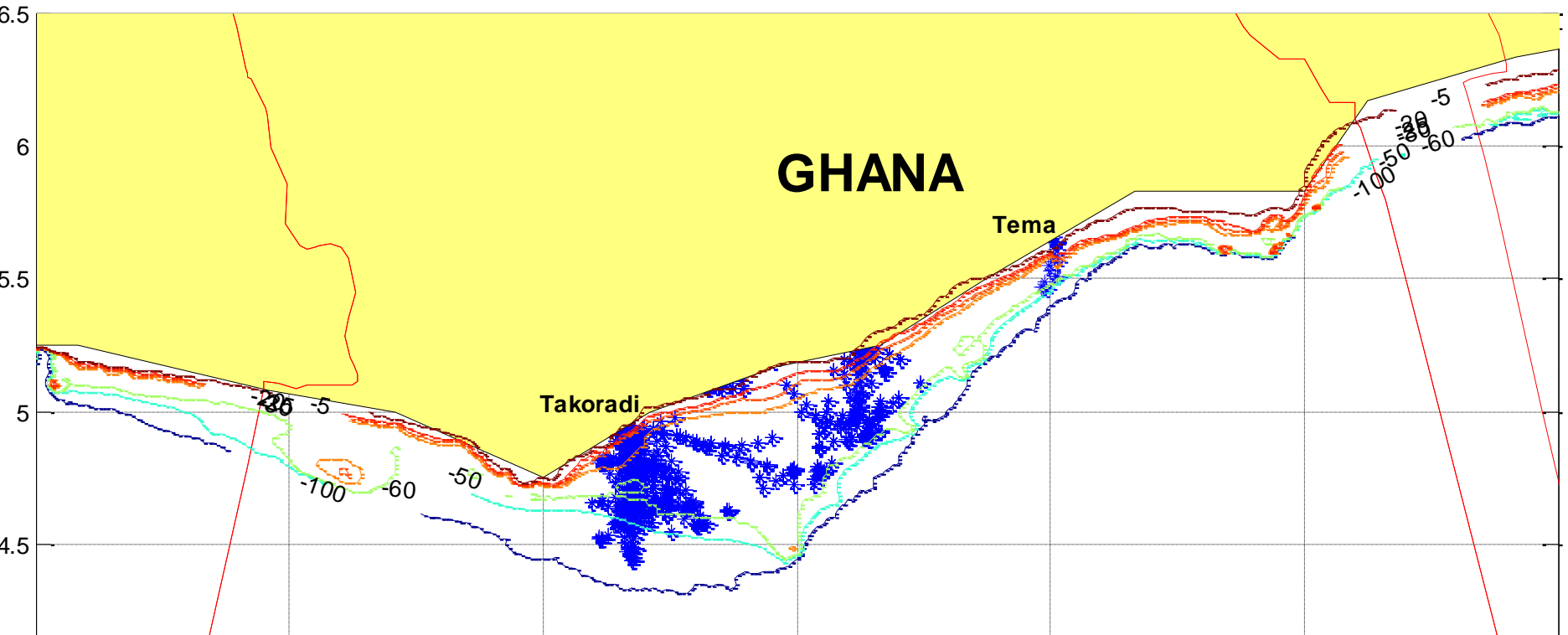
- 2 canoes installed with ABSEA transponders.
- Transponders are powered by a 5W solar panel.



Installation of ABSEA Transponders - **Elmina**

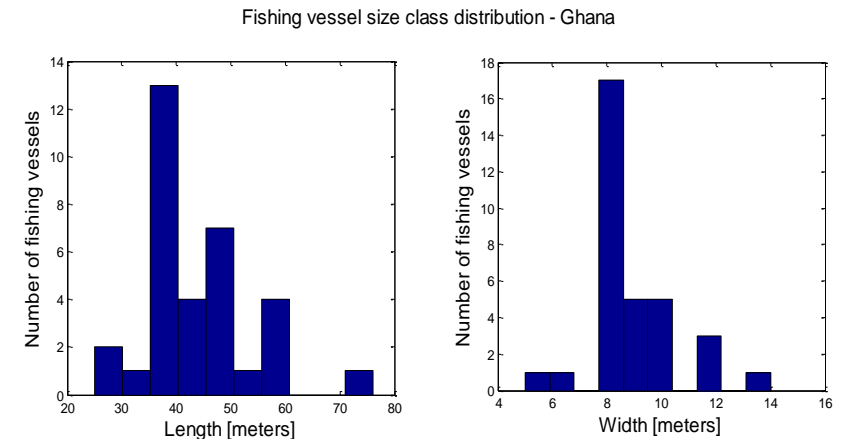
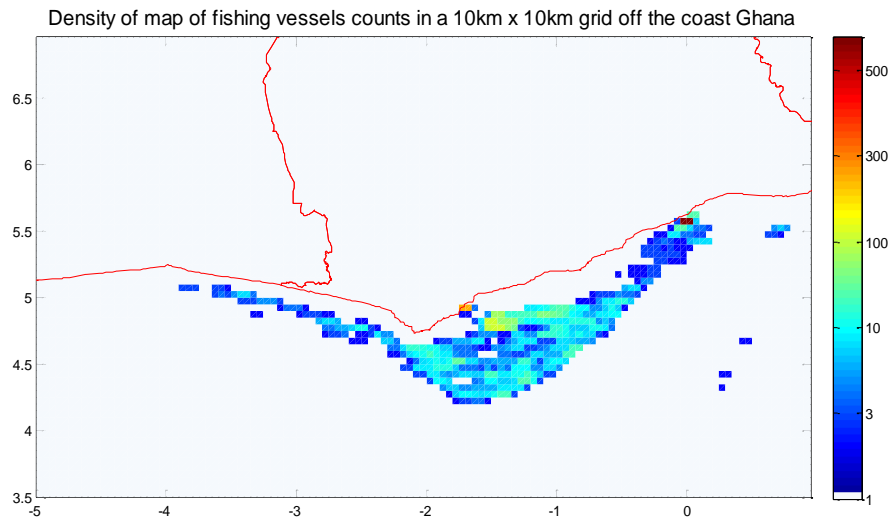
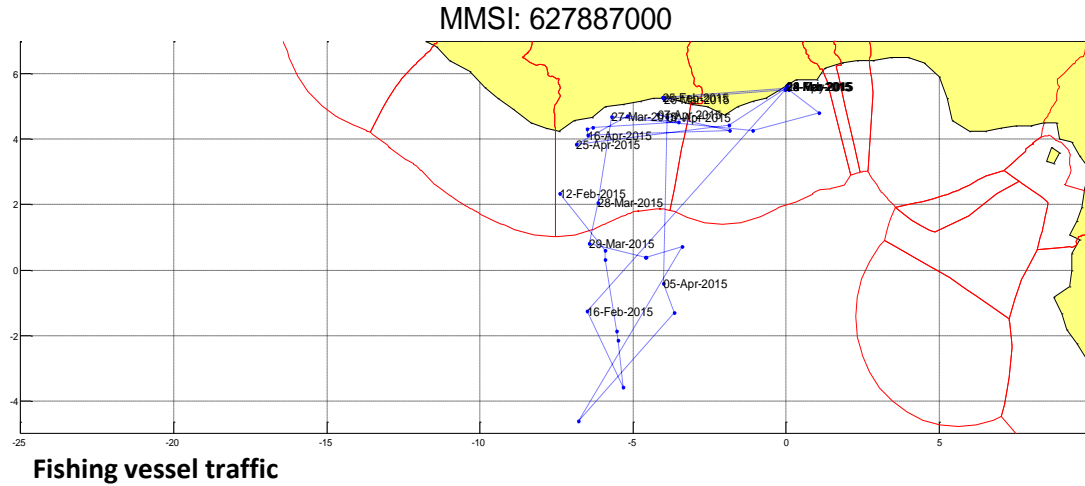


Monitoring of fishing vessels



Tracks of fishing vessels monitored with ABSEA transponders from June to November, 2015

Periodic dissemination of fishing vessel traffic report



Future Perspectives

- Analyses of vessel behaviour from archived data
- Automatic detection of category of vessels and activity
- Online portal for Fisheries managers to access IUU fishing scenarios
- Potential visits of blacklisted IUU vessels in West Africa
- Roll-out of small fishing vessel monitoring in West Africa

Conclusion

- ✓ Growing interest in EO applications to support fisheries management
- ✓ Harmonization of legal framework for monitoring small fishing vessels in West Africa



Fishermen and MESA marine experts after installation of ABSEA transponders



Ghana Navy officers aboard a Defender Class patrol boat



Regional Fisheries Directors' Forum (RDFD) of ECOWAS Marine Thema

Thank you

