BLUE PLANET

Session 4: Earth Observations for Detection and Monitoring of Vessel Activities to Reduce Illegal, Unreported and Unregulated Fishing

11 December - 2020

Protecting fishery resources using a suite of spaceborne sensors

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Outline

- *Ocean surface measurements from satellite and models to identify fishing grounds*
- *AIS data for detecting fishing infractions and gathering information on fishing operations*
- *Fusing AIS and Optical/SAR detection to identify potential IUU fishing vessel*

Threats to fishing

Overfishing, Pollution, Climate Change

Credit: Brittanica

… affecting the opportunities the marine environment provides, and there is the need to adopt fast, cost-effective means of tackling these challenges

Credit: XL Catlin Seaview Survey

…its not just about conservation!!!

Coastal states especially those in West Africa are not only confronted with reduced fish sizes and catch .

Recent report from the Multinational Maritime Coordinating Centre indicates **growing attacks by Pirates on fishing vessels**.

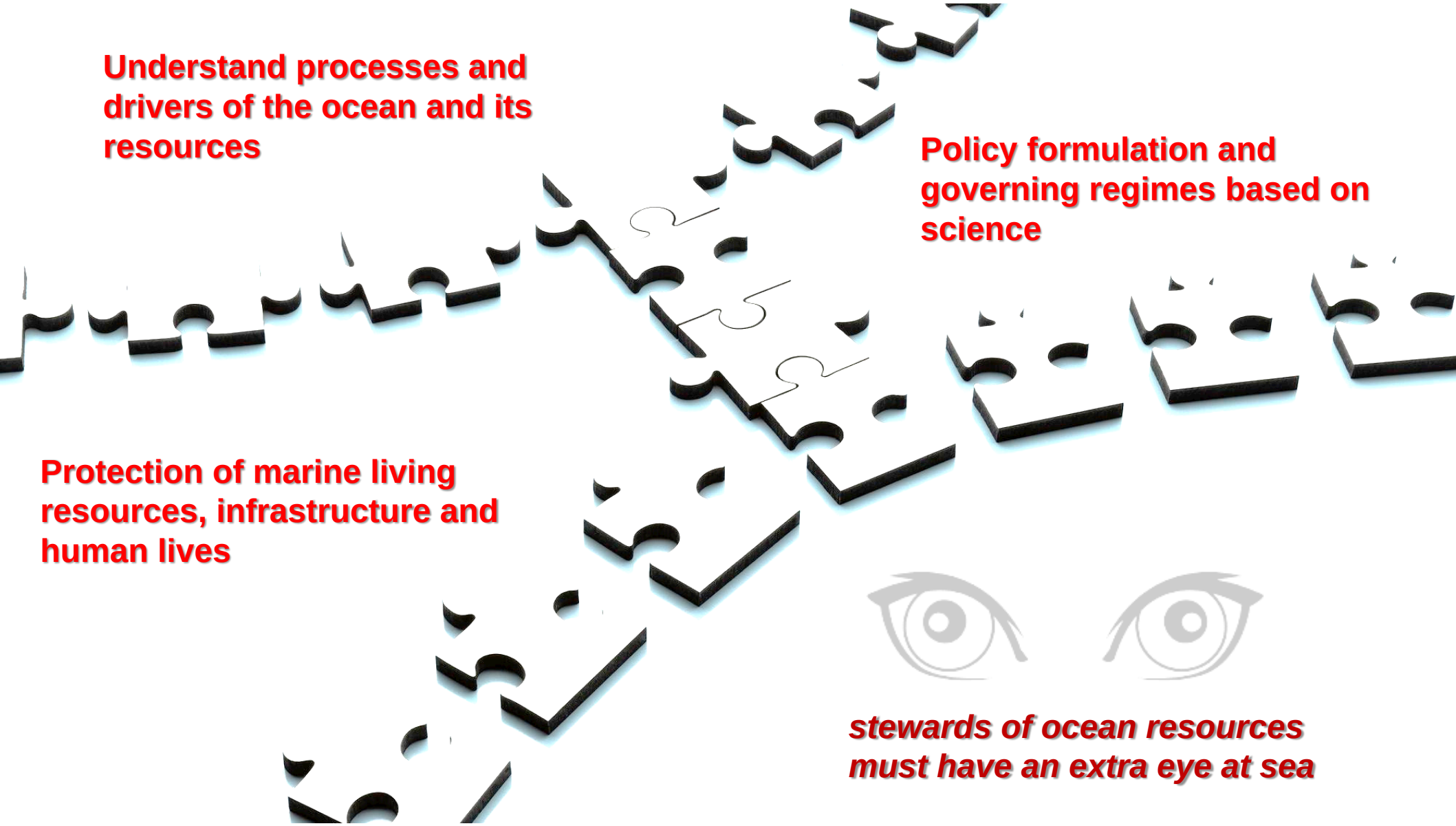
Credit: VOA News

Maritime operations and fishing has cultural connection with the indigenes and an important **source protein** and **revenue**

Safeguard resources and lives

Understand processes and drivers of the ocean and its resources

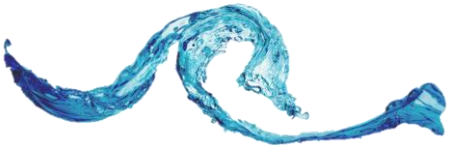
Policy formulation and governing regimes based on science



Protection of marine living resources, infrastructure and human lives

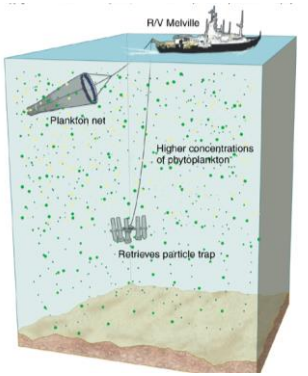
stewards of ocean resources must have an extra eye at sea

Eyes At Sea: safeguard resources and lives



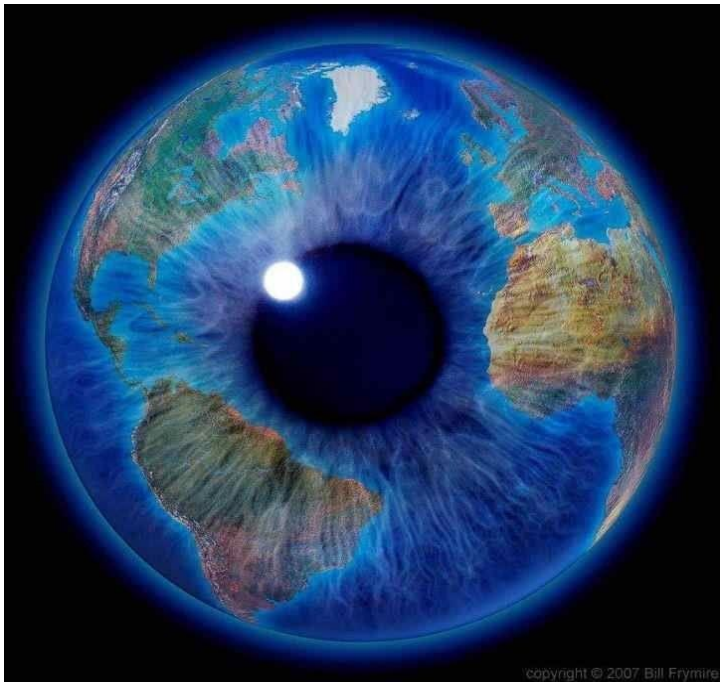
Where are the currents moving heats, nutrients, larvae

Know what the fisherman does at sea

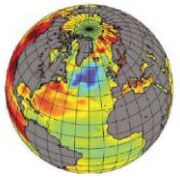


Understand biological, physical and chemical interactions

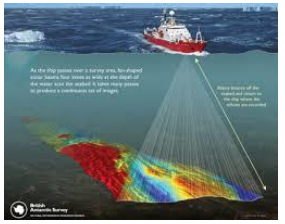
Where are the ships, who owns it, what is it carrying, where is it going?



Credit: Pinterest



How warm is the ocean, where are the fishes



Where are all the important assets

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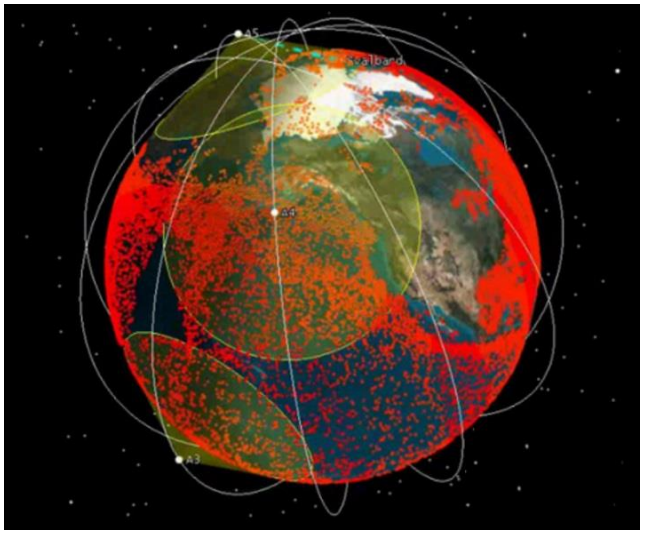
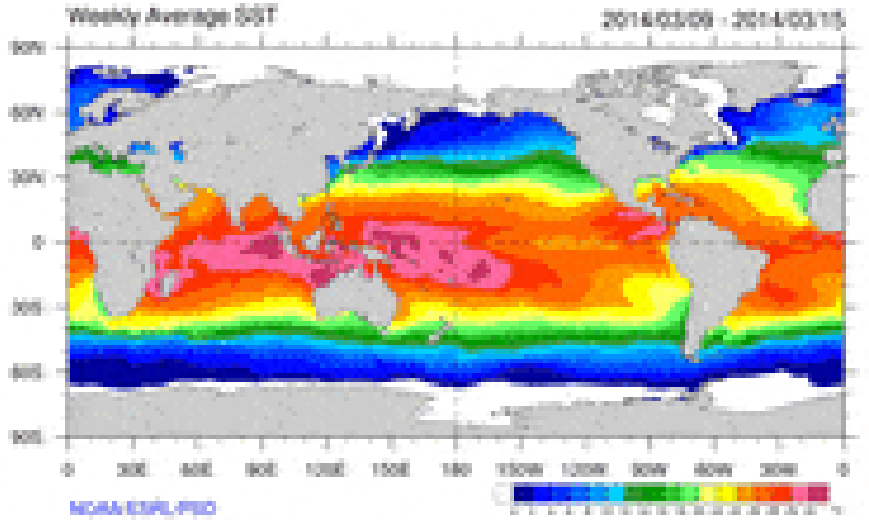
Satellites for Earth Observation

Need to know where fishes and fishermen are for effective monitoring



Fishing vessel trajectory from AIS

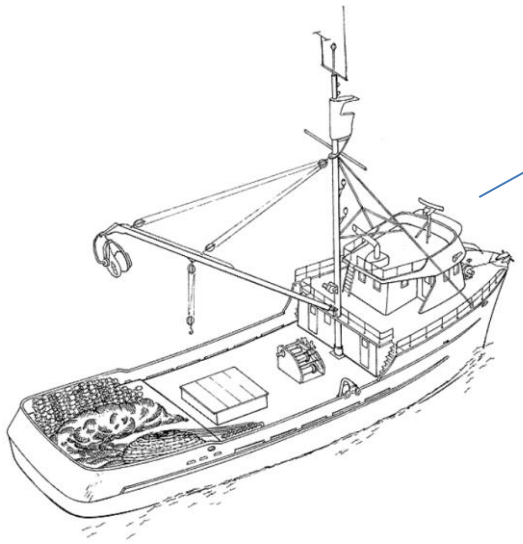


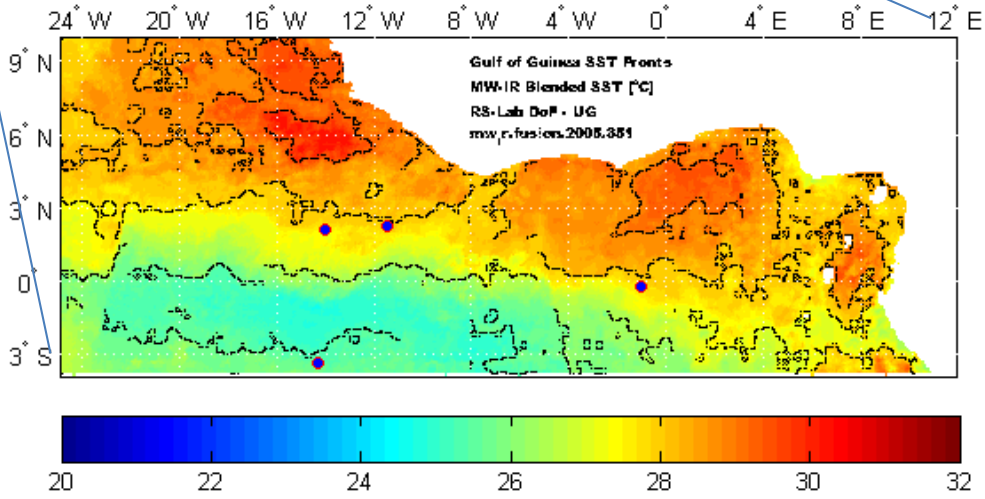
Mapping fishing grounds

Develop a habitat suitability model from environmental data

Map of 1 environmental descriptor
(static or temporal)

1 survey data (position, date)
1 associated value for this descriptor



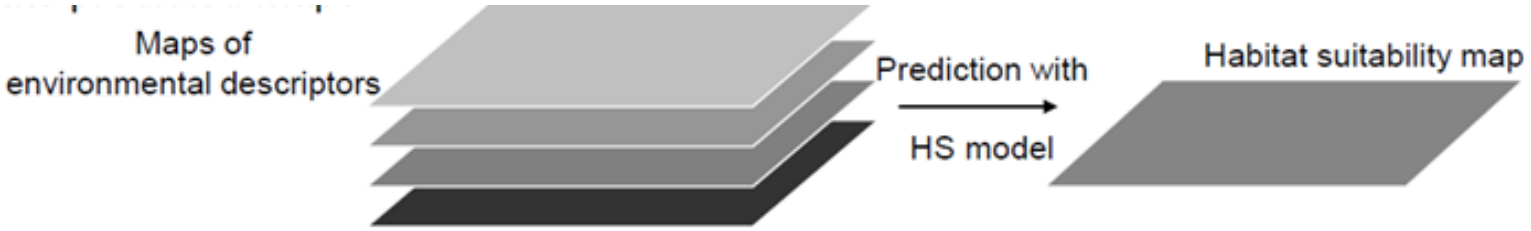


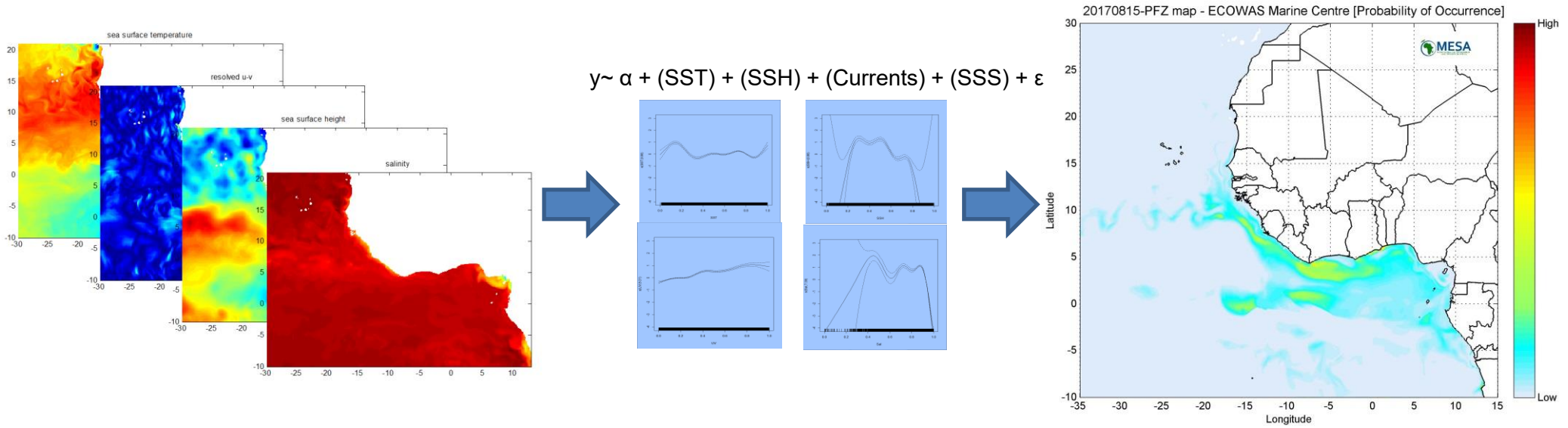
Challenge – fish survey data

- **Limited access** to fish catch data
- **Errors** in catch data from log books
- Need for **more data to setup & update** better models

Mapping fishing grounds

Create forecast maps of potential fishing zones





Disseminate to fisheries managers, combine PFZ maps in a GIS management process

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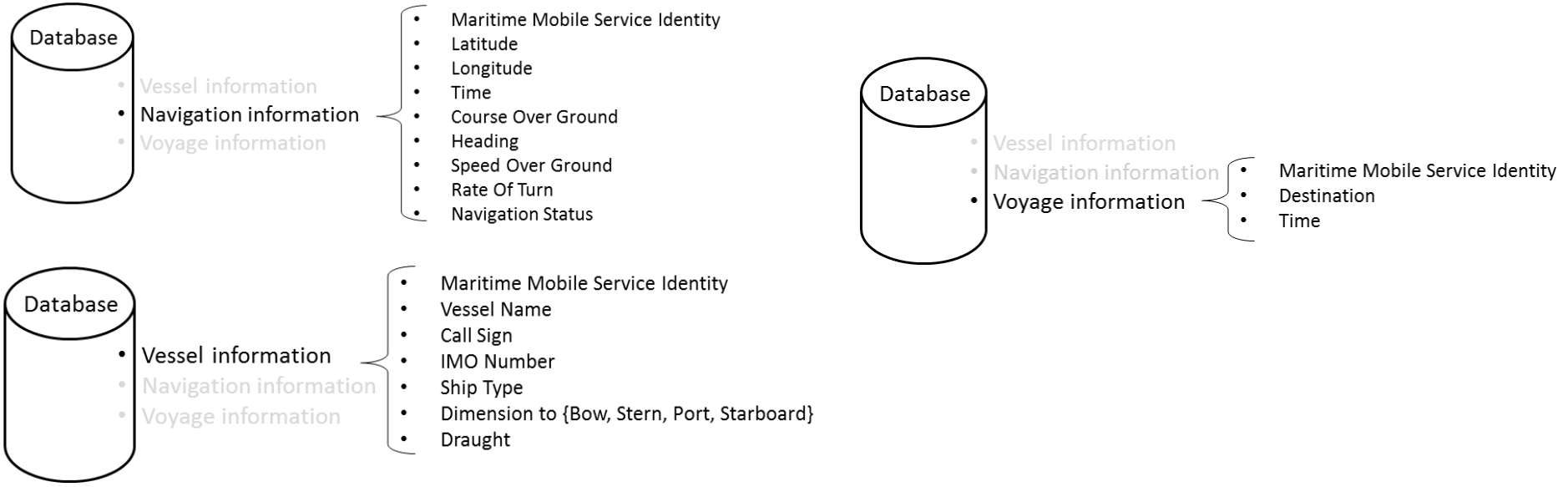
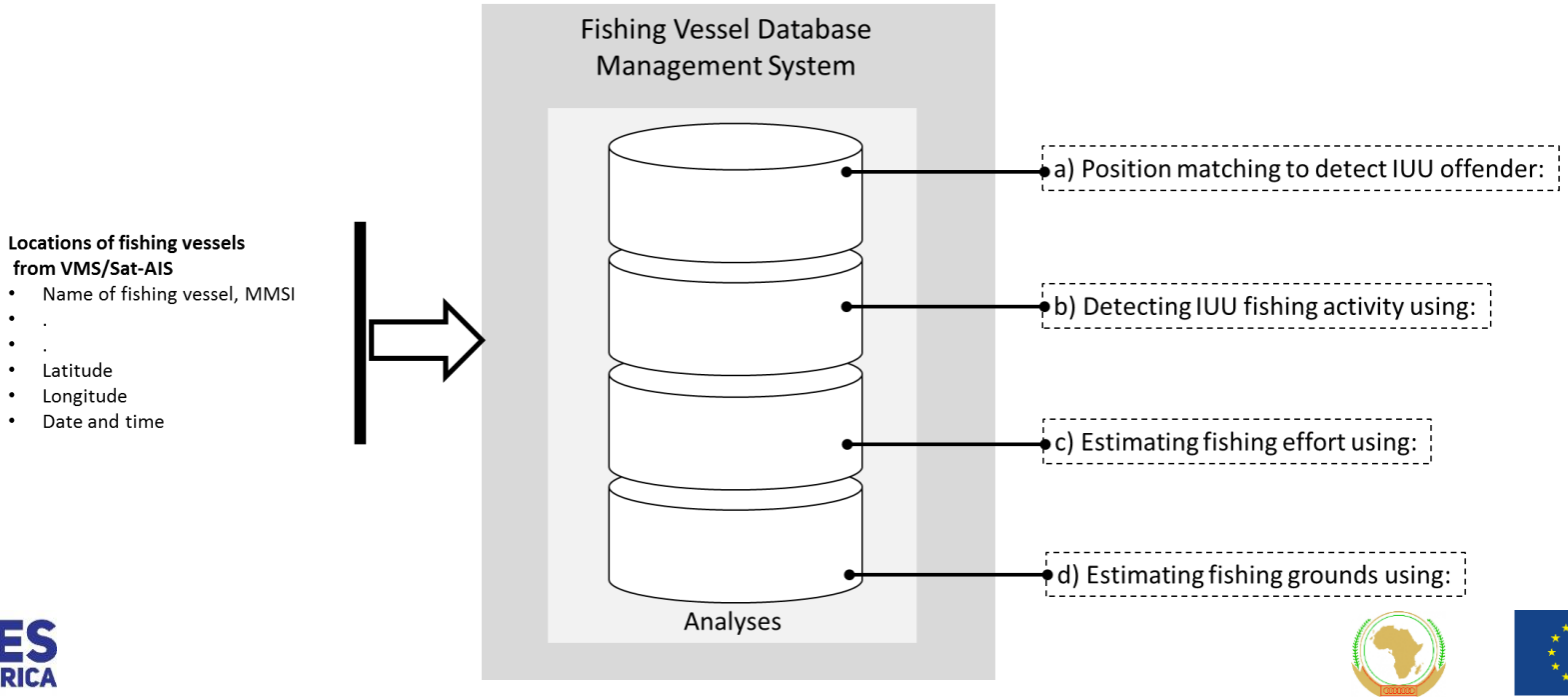
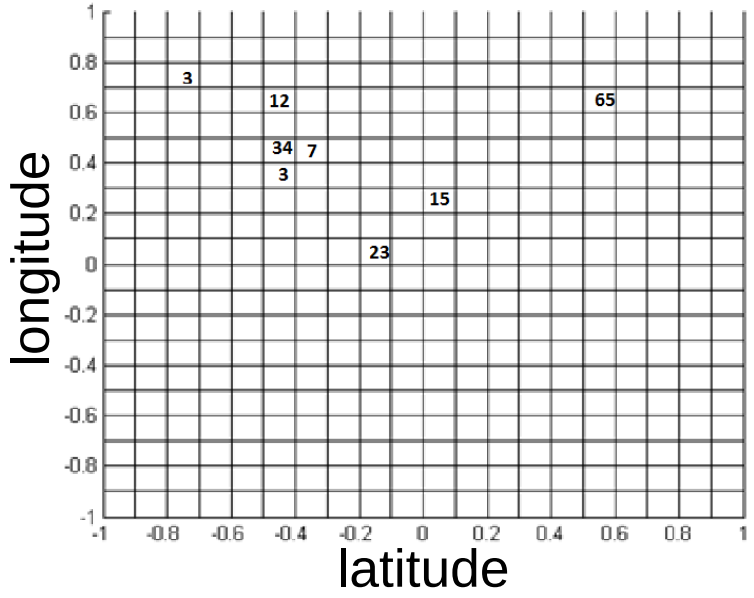
Monitoring fishing vessels with AIS

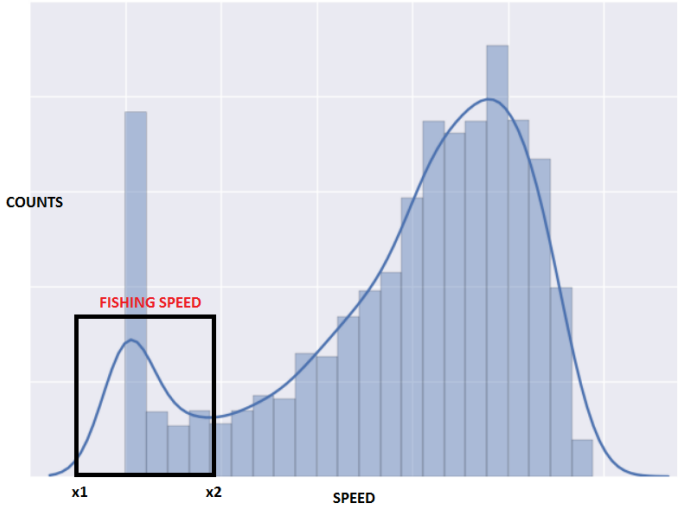


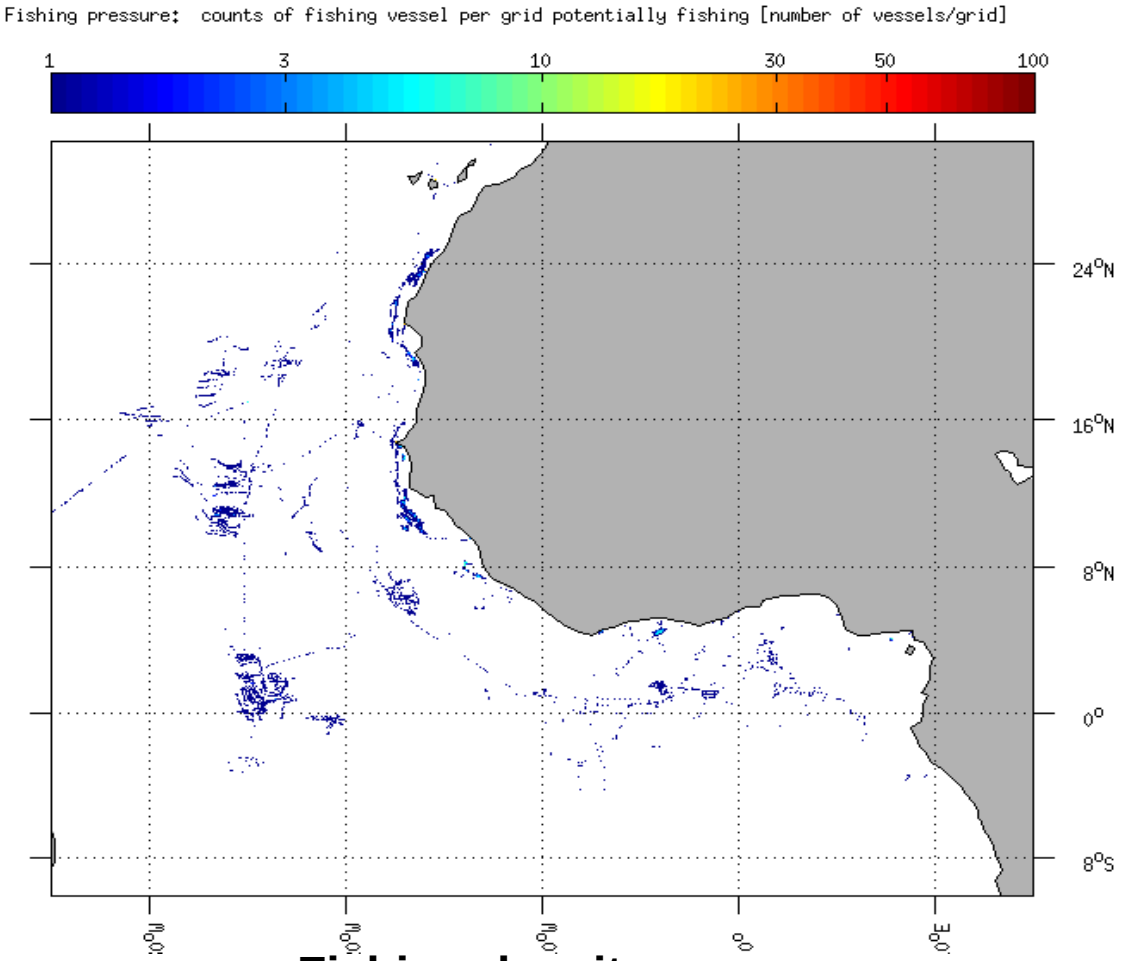


Generating fishing density map from AIS

- Build a grid (latitudes & longitudes)
- Step through each grid and count distinct fishing vessels using e.g. speed to map possible fishing areas







Fishing density maps

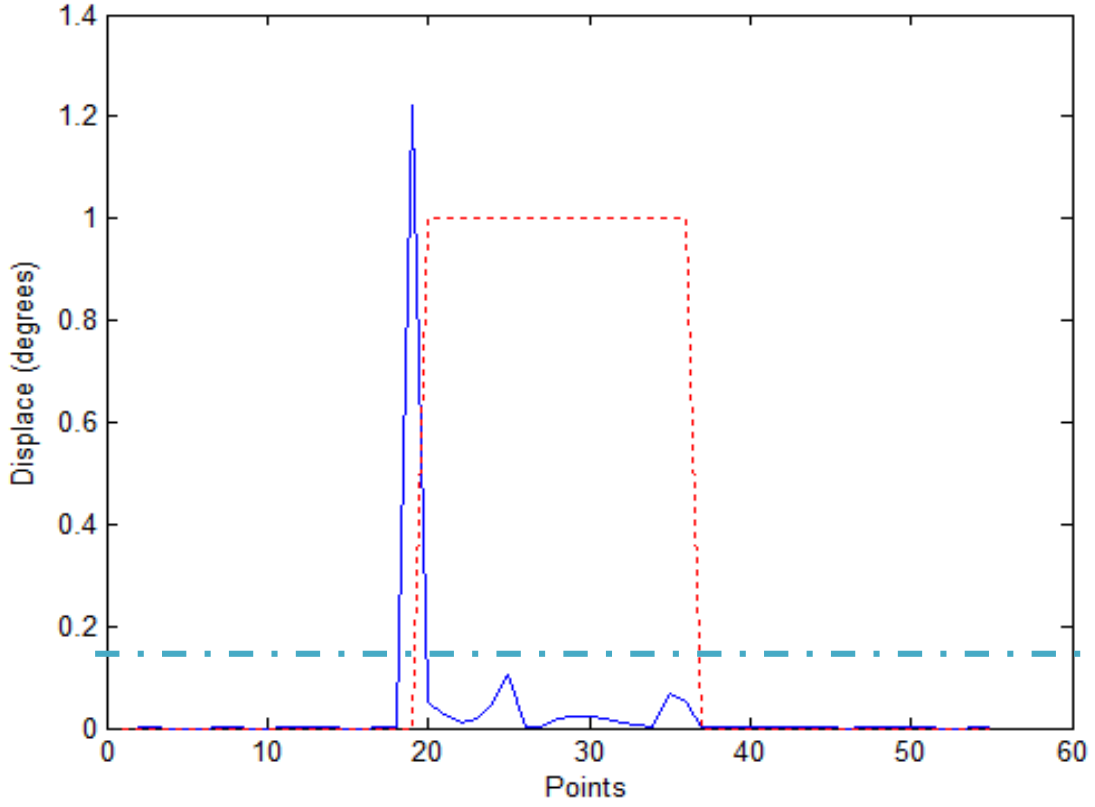
Estimating fishing trip

Displacement analysis is based on the premise that fishing vessels will travel a significant distance from a landing site to a fishing ground.

- Find large changes in between position: **sqrt([diff(lat_)'].^2 + [diff(lon_)'].^2)**

…from the changes in positions **start and end times, duration and number of fishing trips** can be derived.

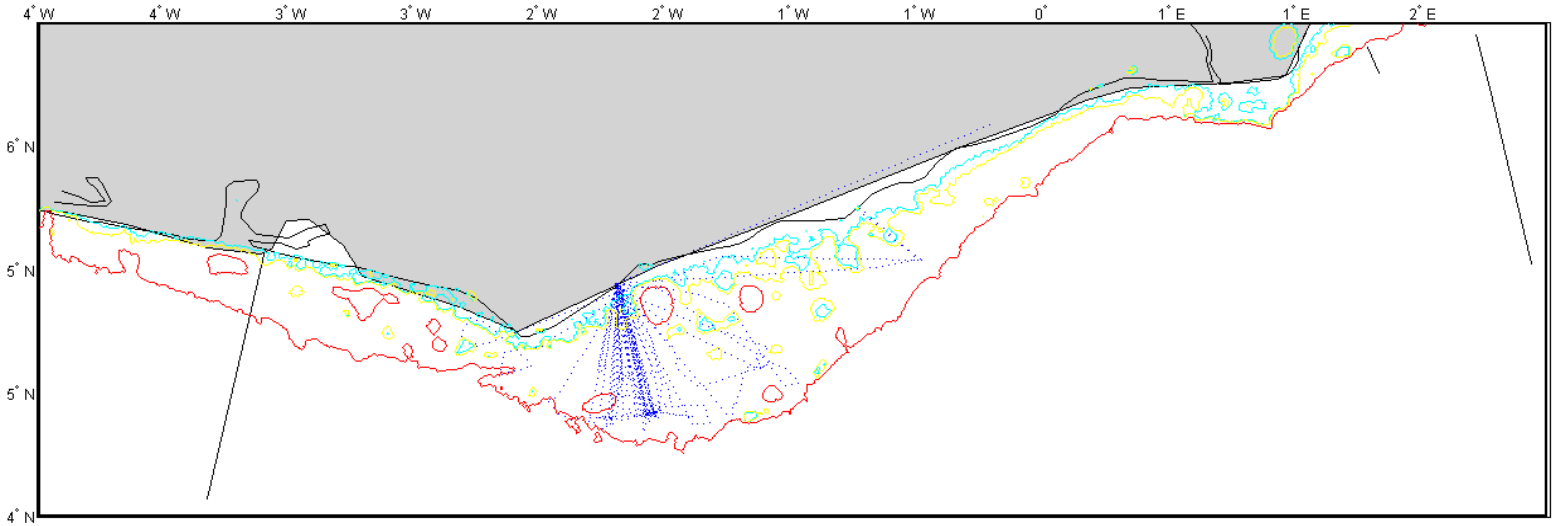
- **sqrt([diff(lat_)'].^2 + [diff(lon_)'].^2)**



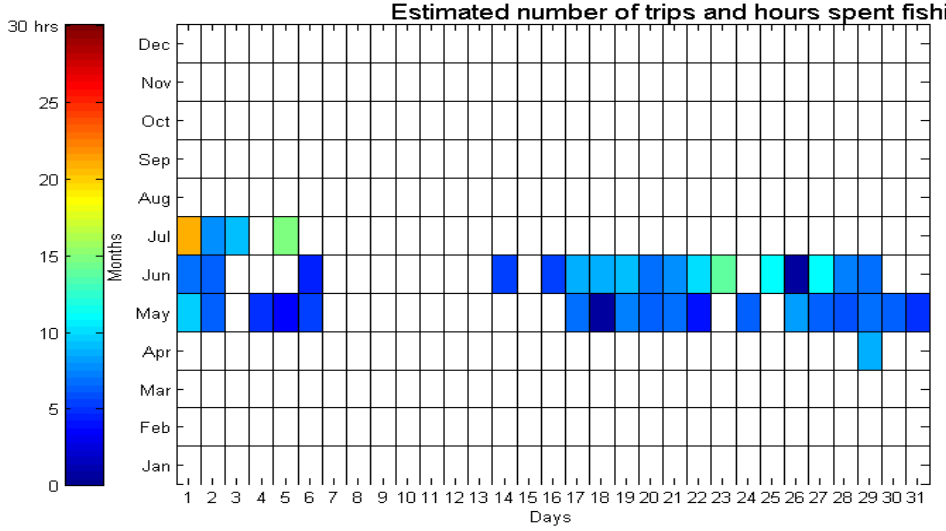
Threshold = 0.15

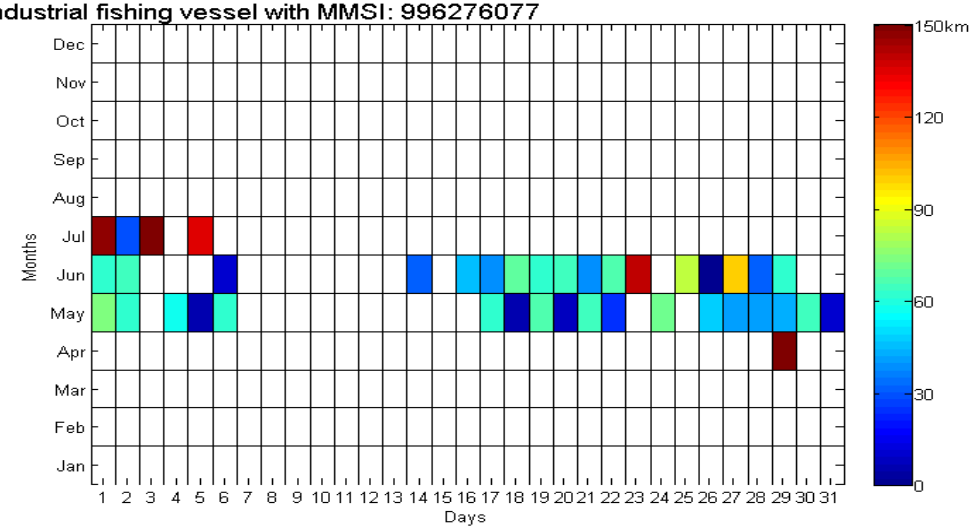
Estimating fishing trip

Trajectory of semi-industrial fishing vessel with MMSI: 996276077



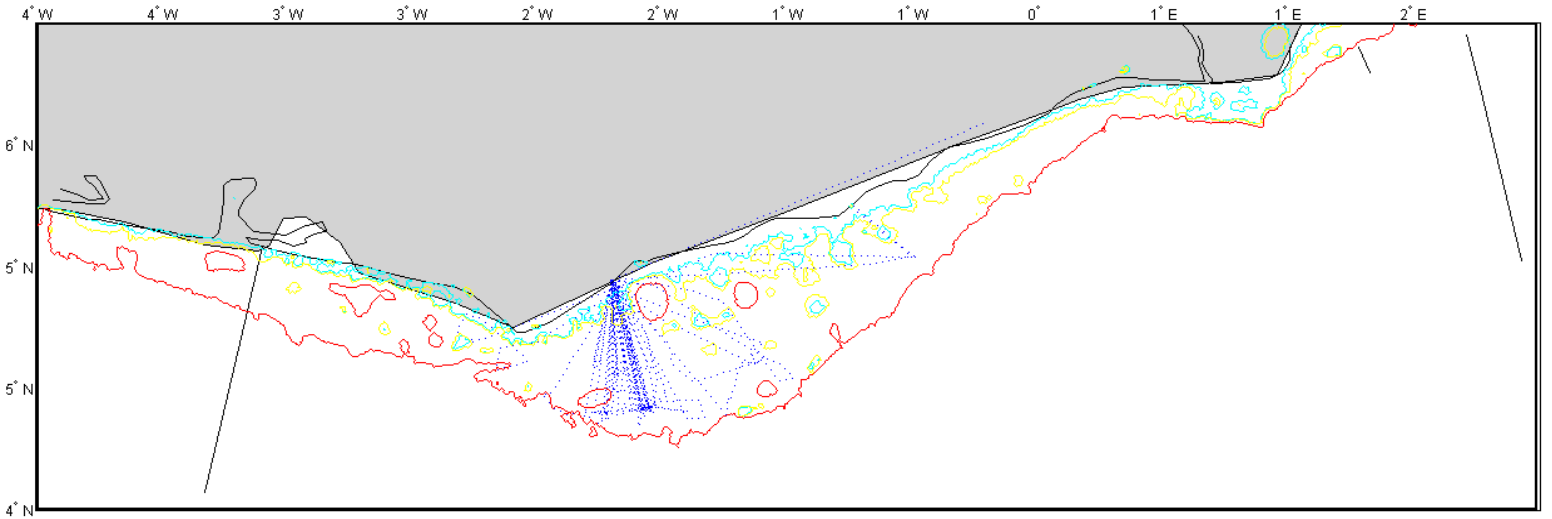
Estimated number of trips and hours spent fishing for semi-industrial fishing vessel with MMSI: 996276077



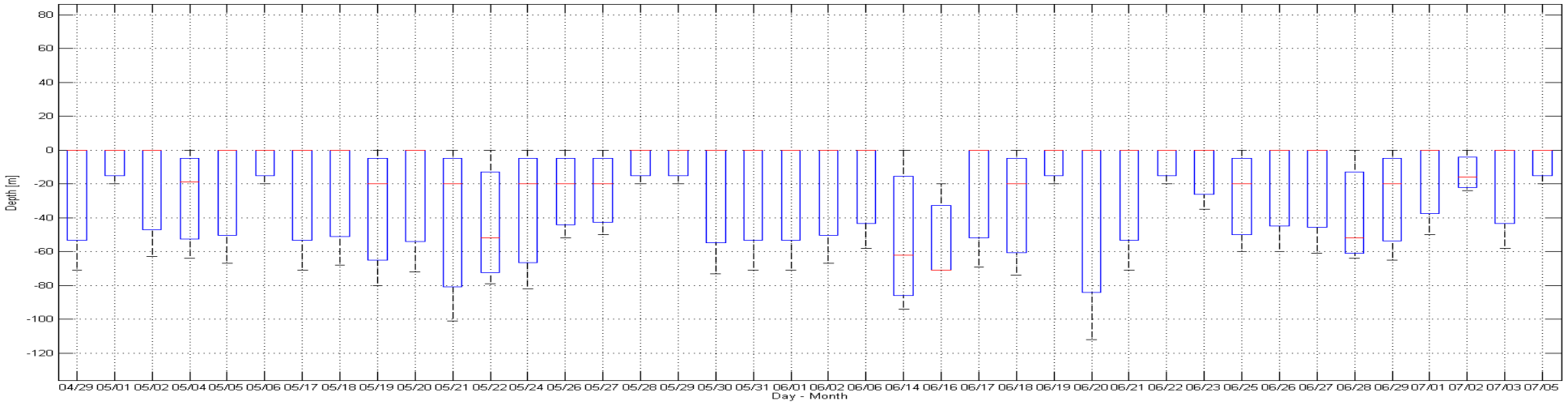


Trips for single fishing vessel

Trajectory of semi-industrial fishing vessel with MMSI: 996276077



Estimated depth of areas fished by semi-industrial fishing vessel with MMSI: 996276077



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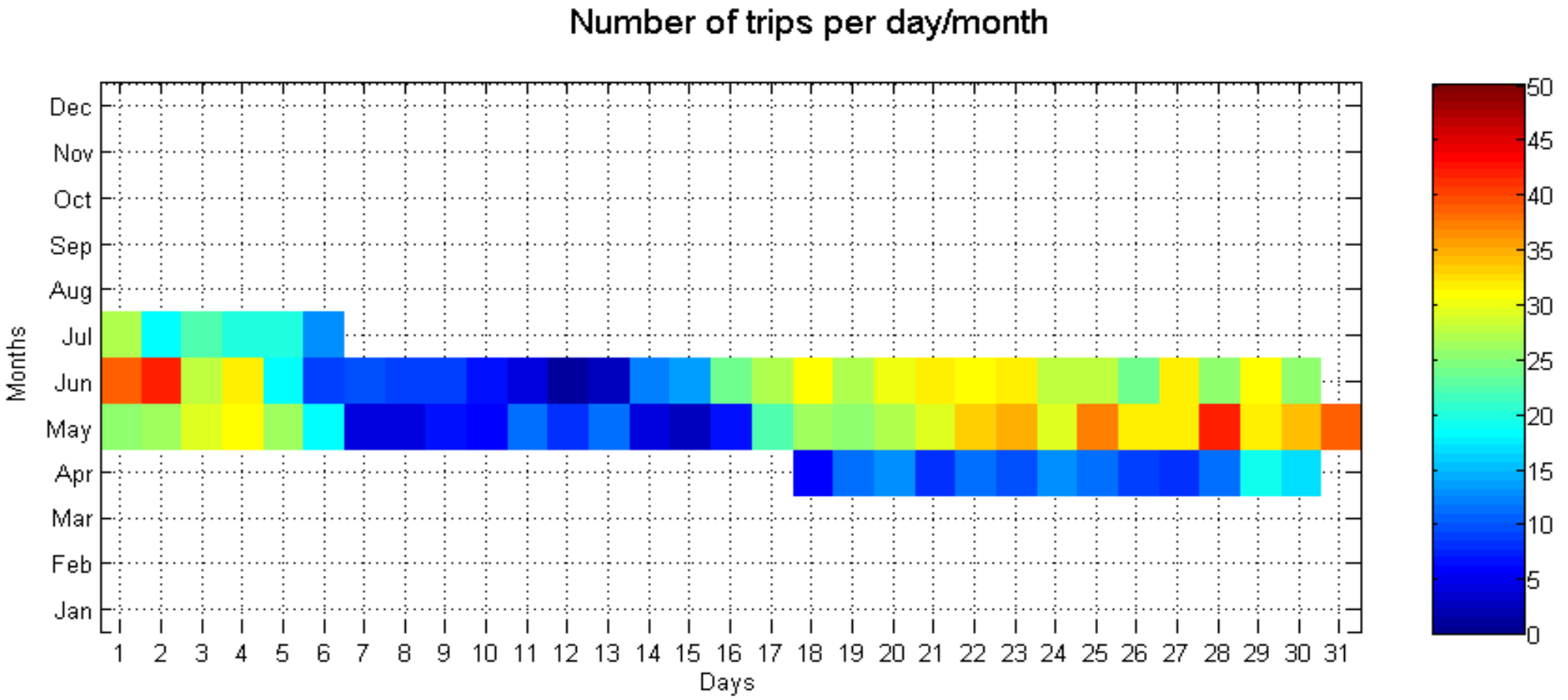
Fishing trip for all vessels



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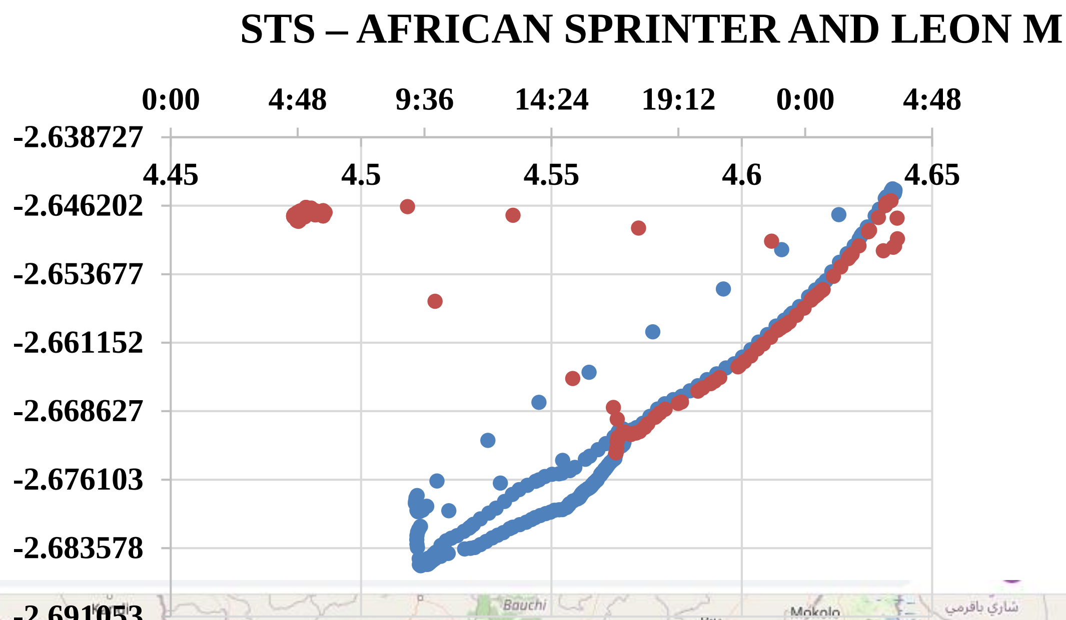
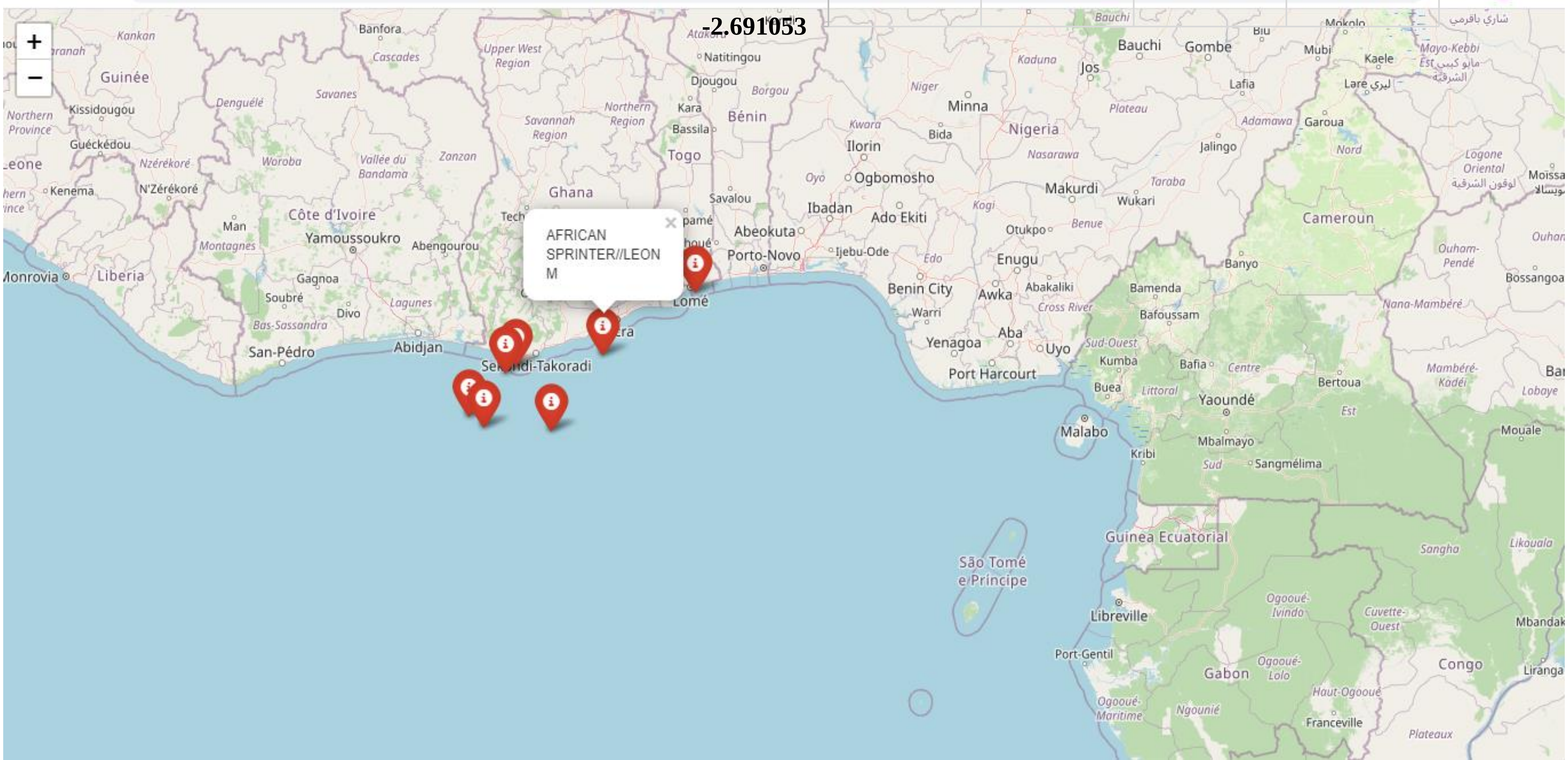
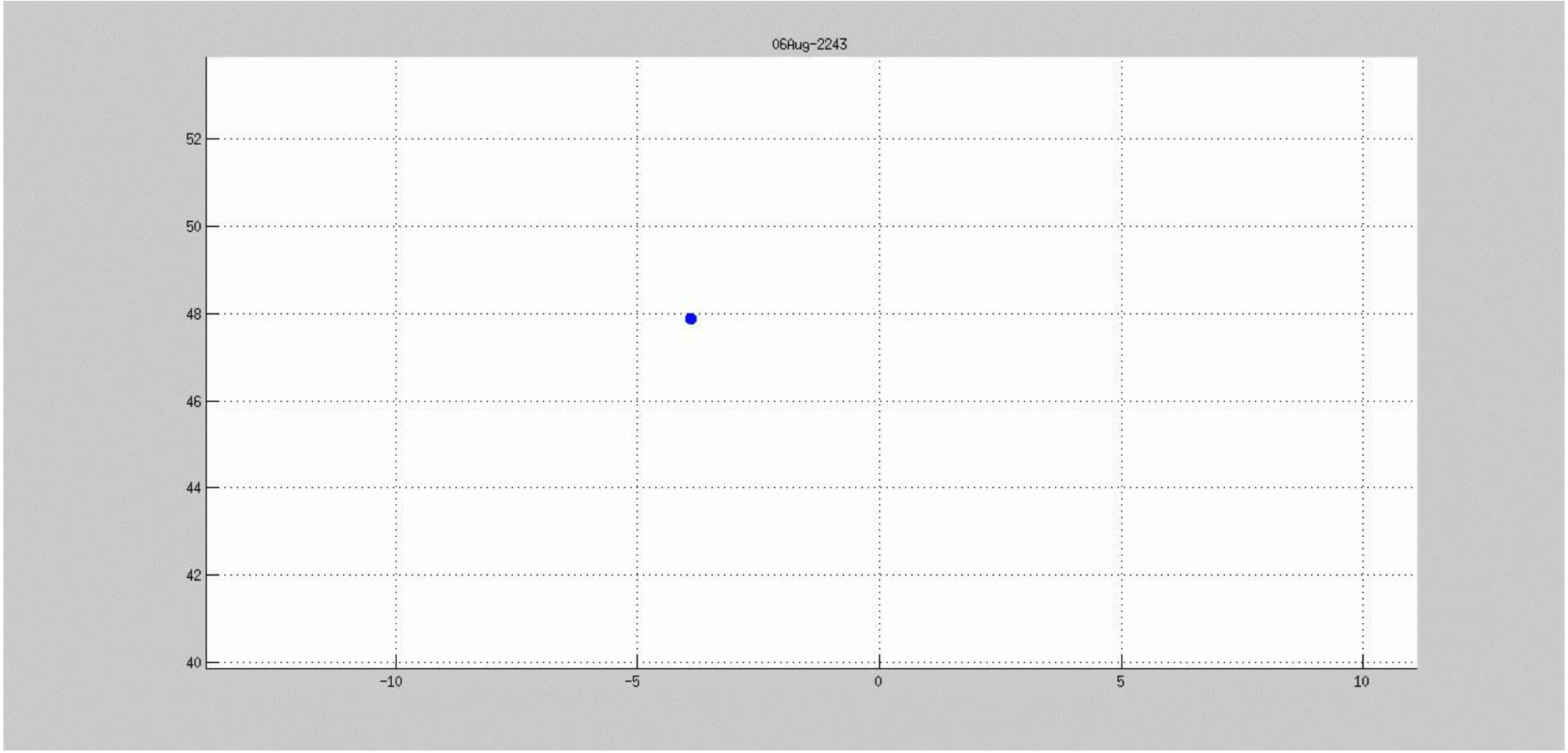
Detecting transhipment



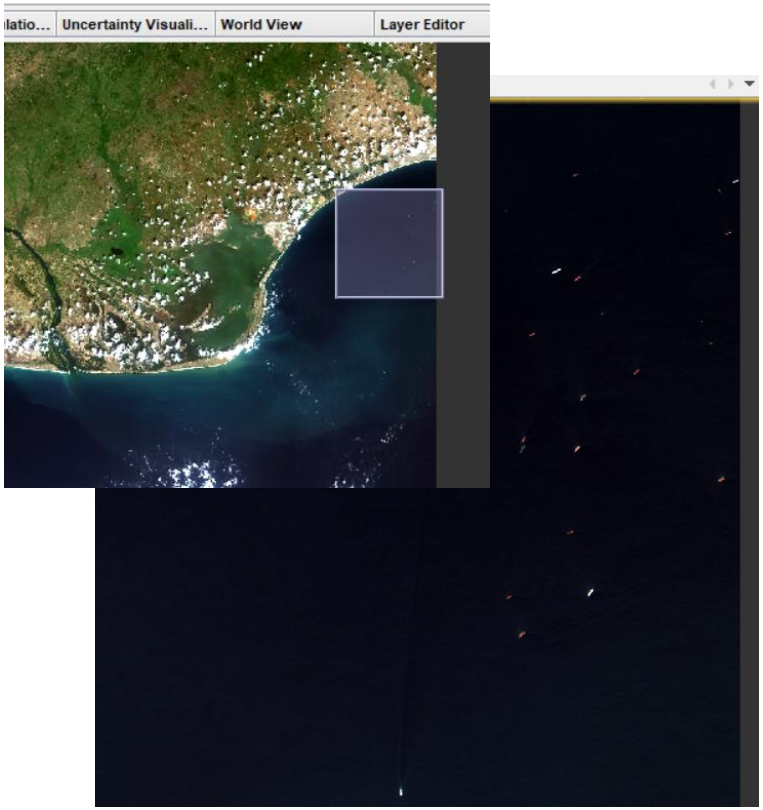


…example of using AIS data to support surveillance of fishing grounds

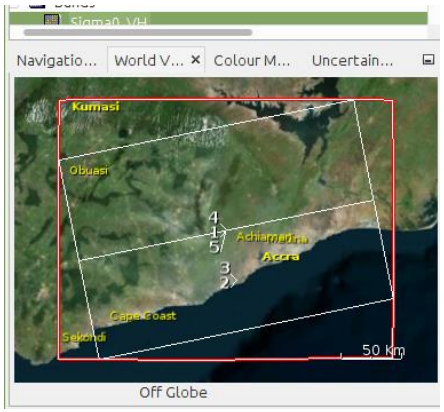


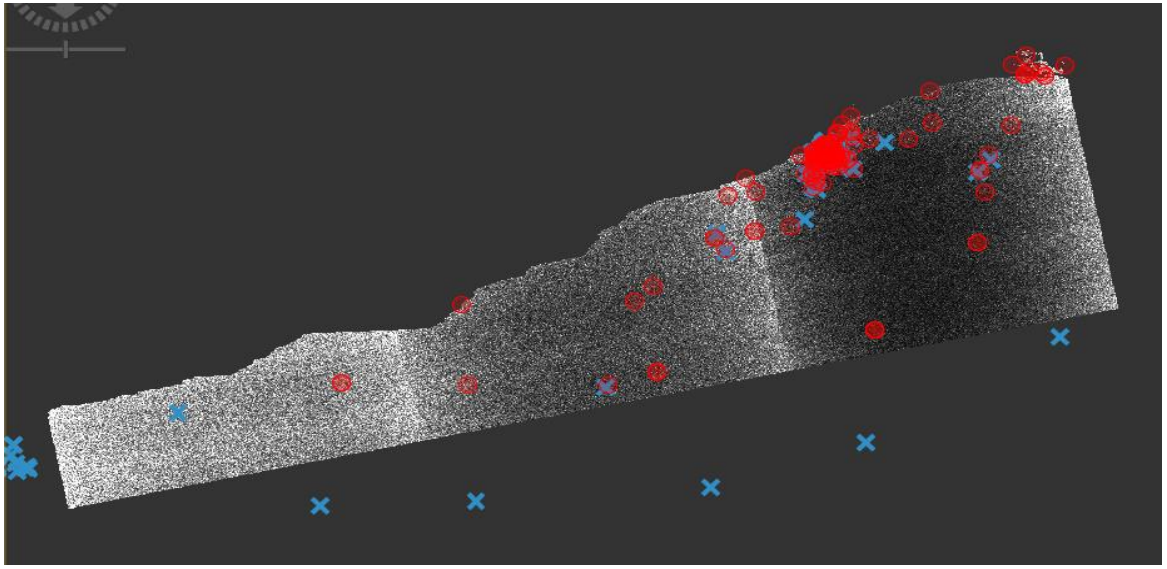
Earth Observation to curb illegal fishing

- *AIS/VMS data + ship detection from optical and SAR imageries (Sentinel 1 & 2)*



Detected ships from
Sentinel-2 imagery off the coast of Ghana





Detected ships (red circles) with AIS (blue cross)
from Sentinel-1 imagery off the coast of Ghana

Many thanks

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