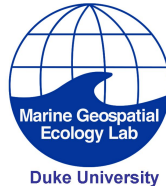


# Preparatory Data Discovery and Analysis to Support Enhanced Management and Governance of the Sargasso Sea & Costa Rica Thermal Dome

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Marine Geospatial Ecology Lab  
Duke University  
Durham, NC USA



# MGEL Project Partners



**Global Fishing Watch**

**Paul Woods** - Founder and Chief Innovation Officer

**Matt Gummery** - Product Manager

Washington DC USA & London UK





## Global Fishing Watch

We are an **International NGO**

using **Big Data, Machine Learning and Remote Sensing**

sharing **free and open** data and tools

to create **greater transparency**, support **novel research**

increasing **sustainable use** of our ocean

and reducing **Illegal, Unregulated and Unreported (IUU)** fishing

hours of fishing per km<sup>2</sup>

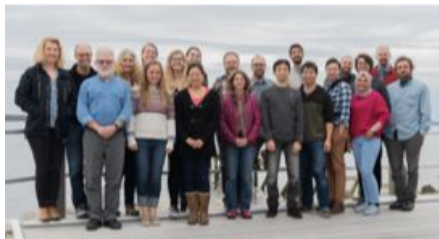
0.1

1.0

10.0

# Marine Geospatial Ecology Lab

Working at the intersection of marine science, technology, management, and governance



<https://mgel.env.duke.edu/>

Our focus is on **data analysis**, and **modeling** - linking biological, satellite, and ocean observing data to develop innovative analysis and visualization tools to **inform management and ocean governance**.



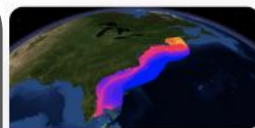
## Flagship Tools & Datasets



### MiCO

MiCO is developing a system that aggregates and generates actionable knowledge to support worldwide conservation efforts for numerous migratory species and the oceans on which they depend.

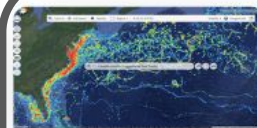
[Read more...](#)



### Marine Geospatial Ecology Tools

MGET is a free, open-source geoprocessing toolbox that can help you solve a wide variety of marine research, conservation, & spatial planning problems.

[Read more...](#)



### OBIS-SEAMAP

The world data center for marine mammal, seabird, sea turtle, shark & ray distributions.

[Read more...](#)



### Model Repository

Characterizing and mapping marine life in the Northeast region to support the Northeast Ocean Plan. Creating "base layer" distribution products for cetacean, avian, and fish species.

[Read more...](#)

## What is MiCO's progress to date?

1,157 references about migratory connectivity data on  
 110 species have been reviewed  
 101,131 locations from 415 animals have been analyzed  
 27 nodes and 17 corridors for 8 species have been produced

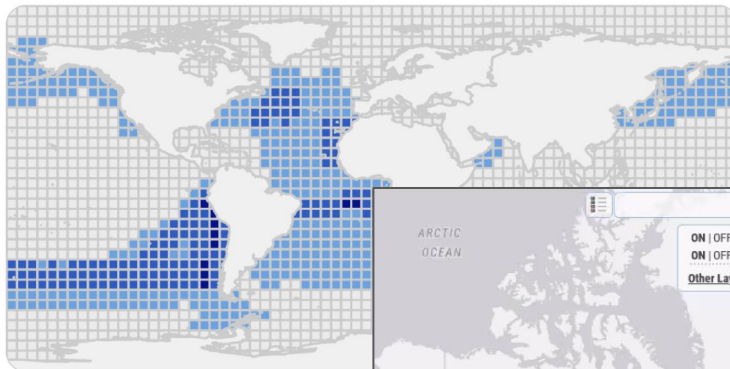
### Nodes Corridors

Humpback Whale	<i>Megaptera novaeangliae</i>	2	1
Ancient Murrelet	<i>Synthliboramphus antiquus</i>	4	4
Chatham Albatross	<i>Thalassarche eremita</i>	4	0
Chatham Petrel	<i>Pterodroma axillaris</i>	3	2

See "Which migratory species do you want to explore?" below for more details

63 datasets from 37 individuals/groups have contributed to derive the MiCO products

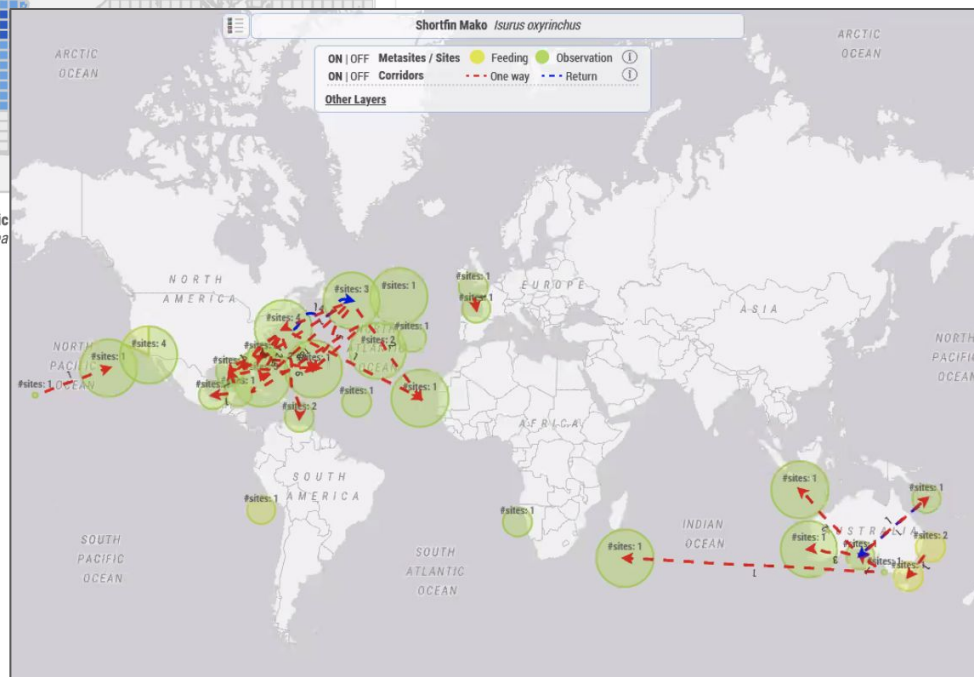
See "Who has contributed?" below for more details



Atlantic-centric  
Concentration of species whose area

MiCO describes broad scale **connectivity of ocean species and ecosystems**

We feel that this work will directly inform both projects



# Introduction

The Sargasso Sea & Costa Rica Thermal Dome are two examples of ***dynamic oceanographic ecosystems*** in ABNJ. These features and their uses must be **defined** and **characterized** to be dynamically managed into the future.

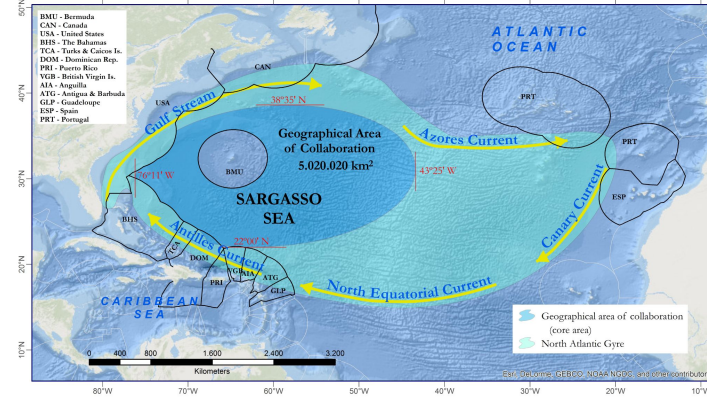
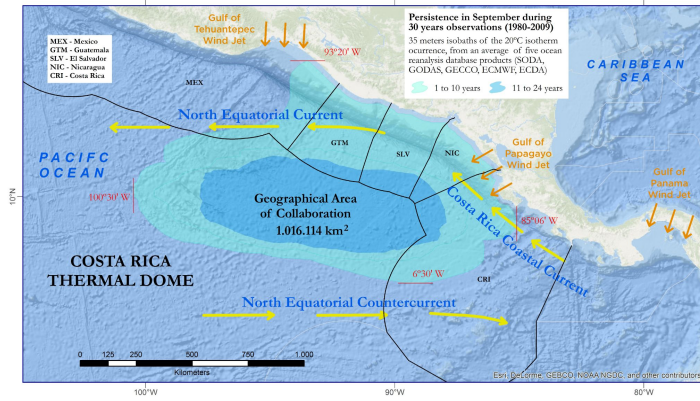


Figure 1 : Geographical location and delimitation of the [Thermal Dome](#) (A) and the [Sargasso Sea](#) (B). Black lines: Delimitation of EEZ; yellow arrows: direction of currents; orange arrows: direction of winds. (Credit: Marine Geospatial Ecology Lab, Duke University, and MarViva).

# Introduction

The Marine Geospatial Ecology Lab (MGEL) has worked closely with both the Sargasso Sea and Costa Rica Thermal Dome regions for a number of years. MGEL helped facilitate the **CBD EBSA** workshops that describe both sites as ecologically significant areas

Our familiarity with the ocean ecosystems and regional partners will aid in our ***characterization*** and ***synthesis*** of data for these regions.

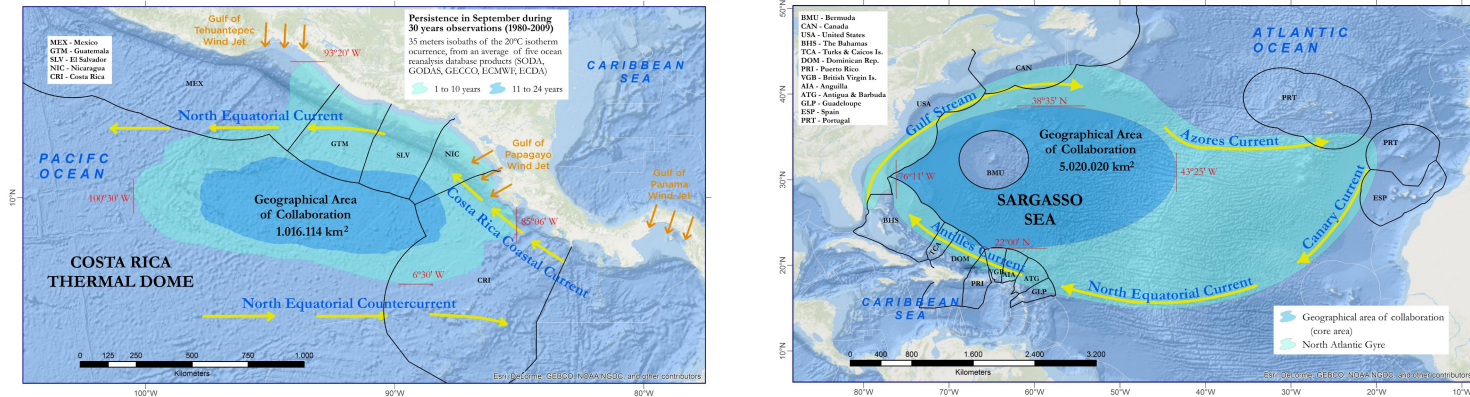


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# Tasks

There are three tasks in the proposed work supporting a future **Ecosystem Diagnostic Analysis (EDA)** for the Sargasso Sea & Costa Rica Thermal Dome:

1. **Describe** the dynamic feature and their spatio-temporal variability
2. Review the **data and information needs** for the EDA
3. Analyze and **synthesize** existing research and information

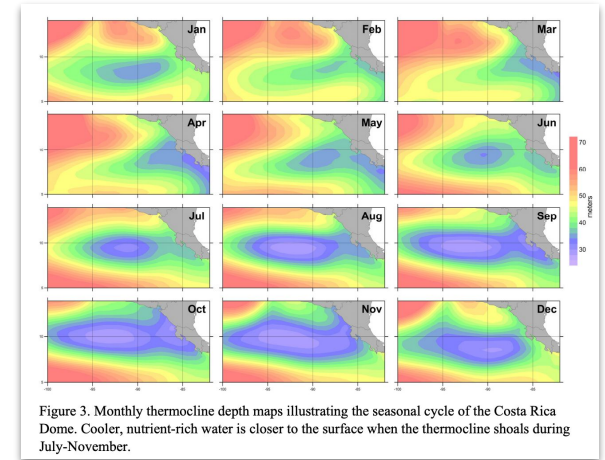


Figure 3 from Fiedler et al. (2017)



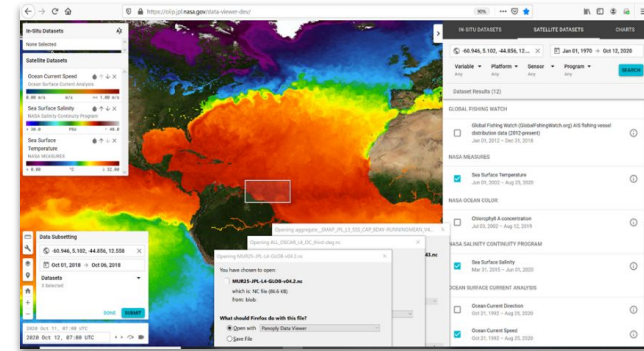
# Tasks

## 1. Describe these dynamic features and their spatio-temporal variability

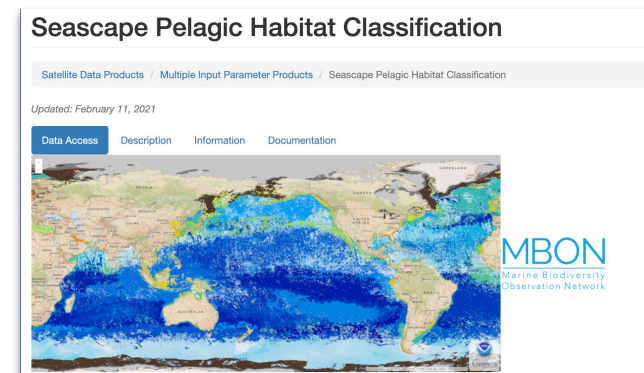
The project will begin with a review of the existing information on these ***oceanographic features*** and their ***dynamic nature*** in time and space. A range of ***new satellite monitoring and data derivations*** are now available to refine the current understanding of the feature. These could include:

- Dynamic pelagic seascape analyses (Kavanaugh et al. 2016)
- Improved floating algae remote sensing (Hu et al. 2015)
- Ecological Marine Units (Sayre et al. 2017a, 2017b)

Deliverables include a ***description of the feature*** through these data and an assessment of the ***spatial variability*** at a time step discussed with the project leads.



NASA COVERAGE Portal



NOAA CoastWatch Portal

# Tasks

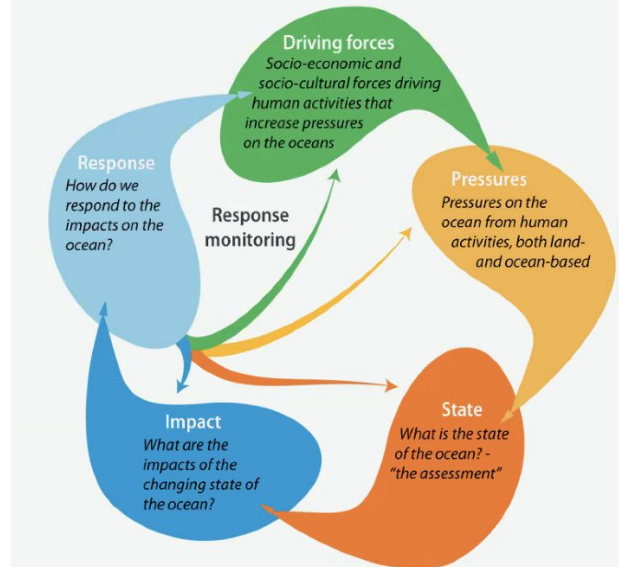
## 2. Review the data and information needs for the Ecosystem Diagnostic Analysis (EDA)

A series of **stakeholder consultations** will then take place to better quantify the data and **information needs** for the subsequent EDA. Stakeholders will include the developers of the EDA analysis under the GEF proposal and consultants addressing the socio-economic analyses. The **Driver-Pressure-State-Impact-Response (DPSIR)** framework will serve as the lens to focus these discussions toward a list of required datasets.

Deliverables will include a list of **environmental and human uses datasets** that address the current ecosystem state and human pressures

### The levels of DPSIR framework

- Driving forces - Pressures - State (of the oceans) - Impacts - Responses



# Tasks

## 3. Analyze and synthesize existing research and information

Once the feature and its spatial-temporal fluidity are described (Task 1) and a list of data needs for ecosystem state and pressure assessment are listed (Task 2), a next step is to ***gather, analyze, and synthesize these datasets***.

Syntheses and new index development will allow other FFEM stakeholders (managers, trainers, policy experts) to quickly assess possible management and governance improvements in the subsequent years of the project.

Development of any ***new indices*** and ***syntheses*** will be guided by project leads and EDA stakeholders. The datasets contributing to the ***feature characterization*** will also be used in the development of any synthetic products for the region.

Deliverables will include a **data and technical report**, **workshop presentations** and a **peer-reviewed publication**.



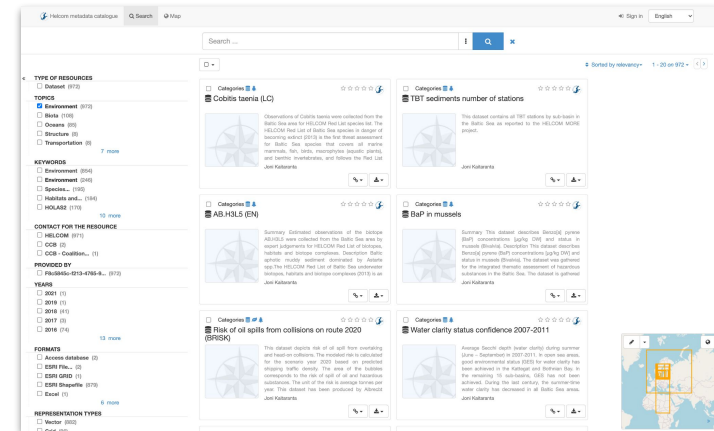
# Tasks

## Data Delivery and Hosting

An additional objective under this proposal is to develop a **project website** and **data discovery portal**. This will help meet several objectives within the project:

1. Facilitate science communication with regional stakeholders and the public
2. Aid with data discovery and interoperability with existing data programs

As a science communication platform, the site will house public-facing project documents and partner materials.



HELCOM Data Catalog  
<http://metadata.helcom.fi>

# Tasks

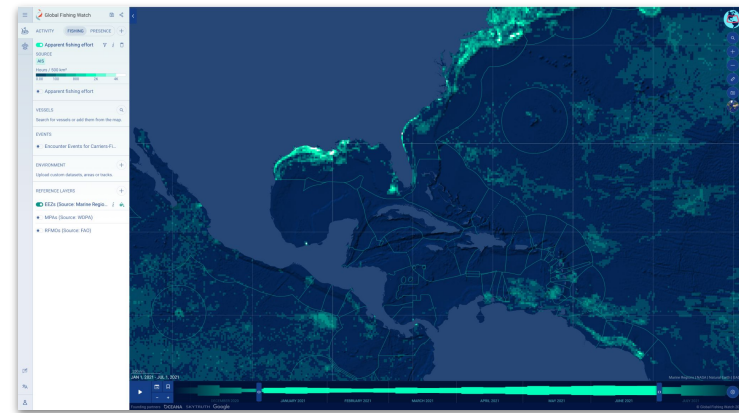
**MGEL & GFW**



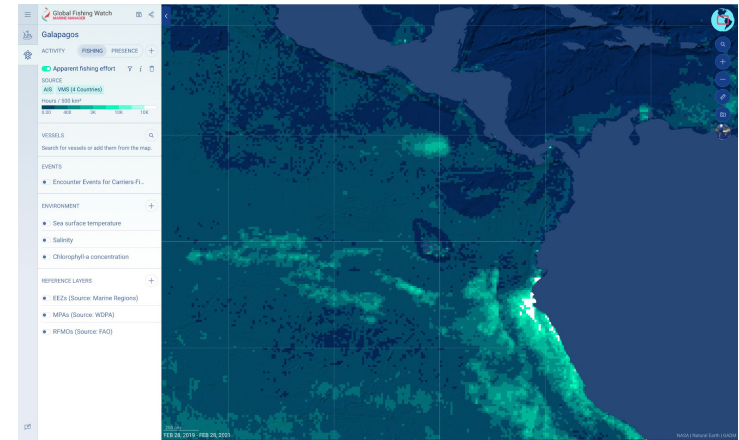
**Global Fishing Watch**

MGEL will work directly with Global Fishing Watch to generate any required **fishing effort** and **vessel traffic** data products for these regions, with subsets by vessel type and time of year.

MGEL will **explore** coordination with the new **Global Fishing Watch Marine Manager**



Fishing Effort, January - June 2021, from GFW Portal  
<https://globalfishingwatch.org/map>



Example: Marine Manager Galapagos Portal  
<https://globalfishingwatch.org/marine-manager>

VESEL ACTIVITY

Apparent Fishing Effort

SOURCE

AIS  VMS (4 countries)

Hours / ~120 km<sup>2</sup>



VESSELS

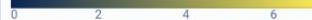
ENVIRONMENT

Sea surface temperature



Salinity

Chlorophyll concentration



CONTEXT AREAS

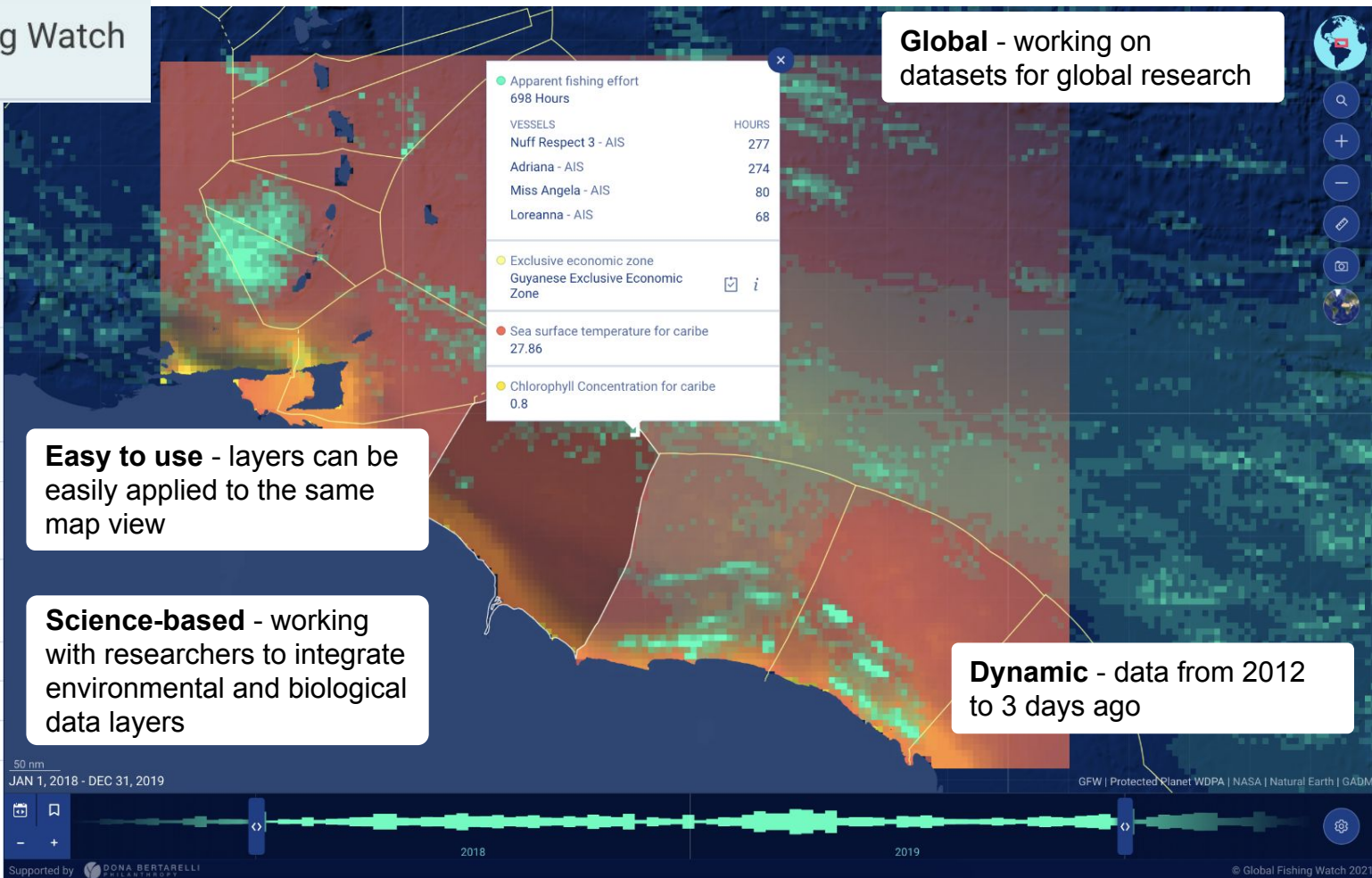
Exclusive economic zone

Marine Protected Areas

MPA - No take

MPA - Restricted

Tuna RFMO



Global - working on datasets for global research

Easy to use - layers can be easily applied to the same map view

Science-based - working with researchers to integrate environmental and biological data layers

Dynamic - data from 2012 to 3 days ago

VESSELS	HOURS
Nuff Respect 3 - AIS	277
Adriana - AIS	274
Miss Angela - AIS	80
Loreanna - AIS	68

# Marine Manager portal data layers



## Human Activity Data

AIS Fishing, VMS Fishing, Fishing vessel night lights (VIIRS), Shipping, Dark vessels, Seismic Resource Testing, Underwater Noise, Mining...



## Oceanographic Data

Sea Surface Temperature, Salinity, Bathymetry, Currents...



## Biological Data

Net Primary Productivity (Chlorophyll a), Migratory Patterns, Habitat Suitability, Animal Telemetry (upload capability)...

# Conclusions

The Sargasso Sea & Costa Rica Thermal Dome are two examples of **dynamic oceanographic ecosystems** in ABNJ. These **features** and their **uses** must be **defined** and **characterized** to be dynamically managed into the future.

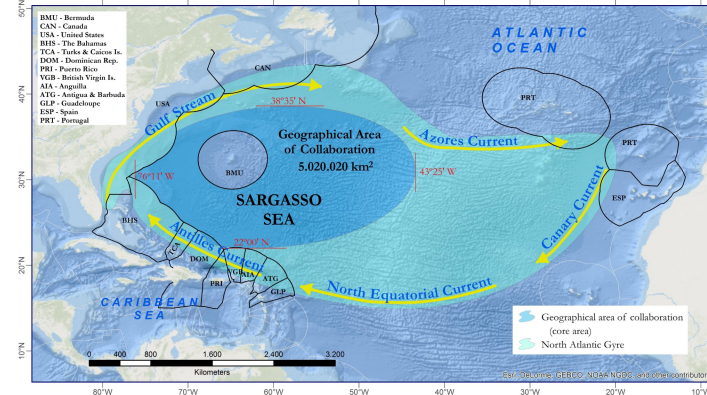
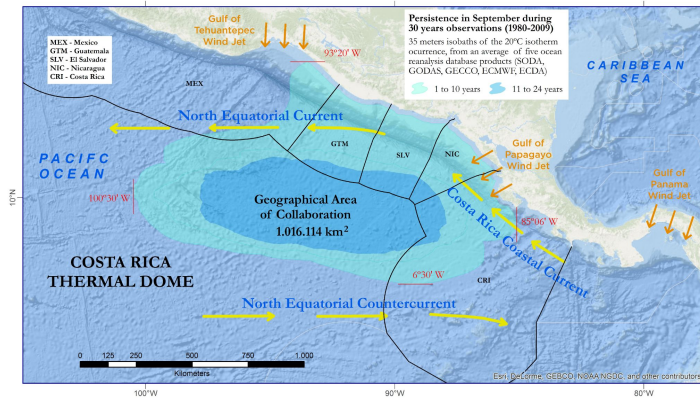
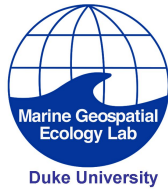


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# Questions



Global Fishing Watch



FONDS FRANÇAIS POUR  
L'ENVIRONNEMENT MONDIAL



SARGASSO SEA  
COMMISSION