



2023 Webinar Series



Understanding and Responding to Massive Sargassum Influxes

Mariana C. León-Pérez Ph.D.
Harte Research Institute at Texas A&M University-
Corpus Christi

May 30, 2023
3 PM EST

Housekeeping items

- Participants will be muted to reduce background noise. Please type questions into the chat at anytime. Participants may raise hand to ask question verbally during the Q&A at end.
- Webinar is being recorded and will be shared on the NSGLC's website following the webinar.
- <http://nsglc.olemiss.edu/>

About Us

- Founded in 2002
- Based at the University of Mississippi School of Law
- Established to provide non-advocacy legal research, outreach, and education services to Sea Grant network.
- One of 34 Sea Grant programs

Sea Grant **The National Sea Grant Law Center** **UNIVERSITY OF MISSISSIPPI**
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Providing Legal Research, Education, and Outreach Since 2002

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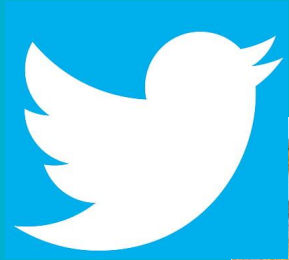
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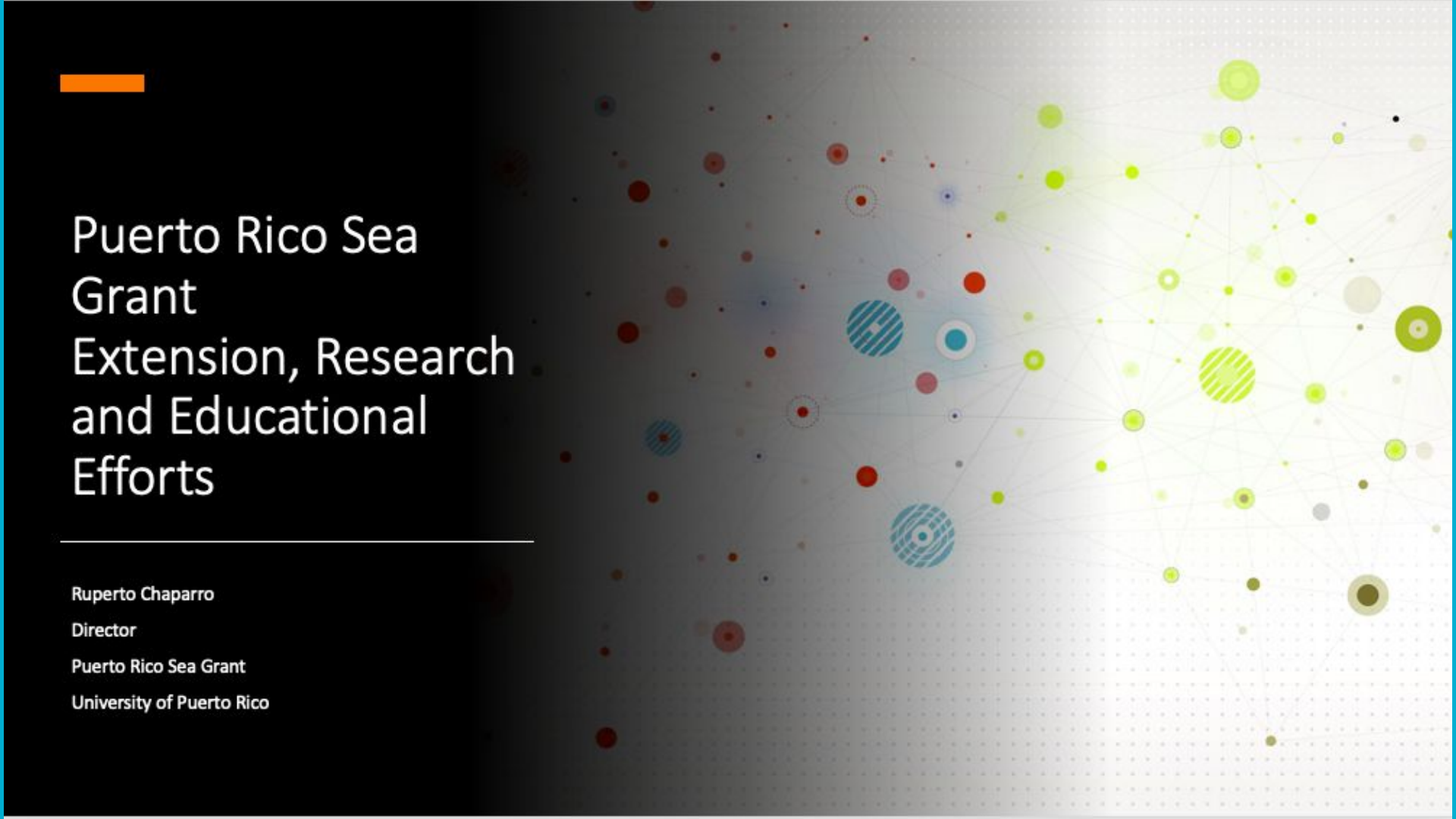
Puerto Rico Sea Grant Extension, Research and Educational Efforts

Ruperto Chaparro

Director

Puerto Rico Sea Grant

University of Puerto Rico

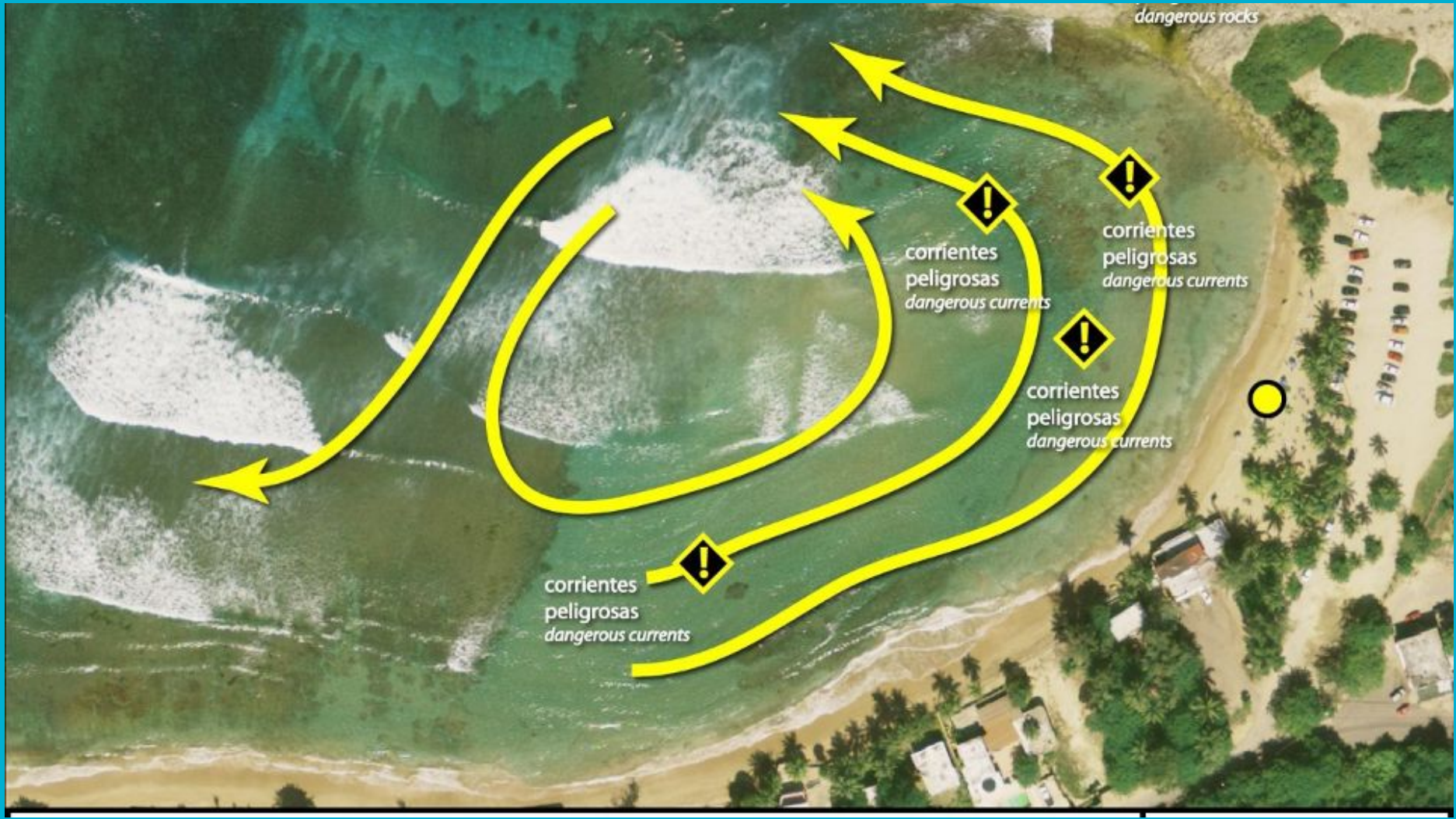








Elvira Figueroa
photography©



dangerous rocks

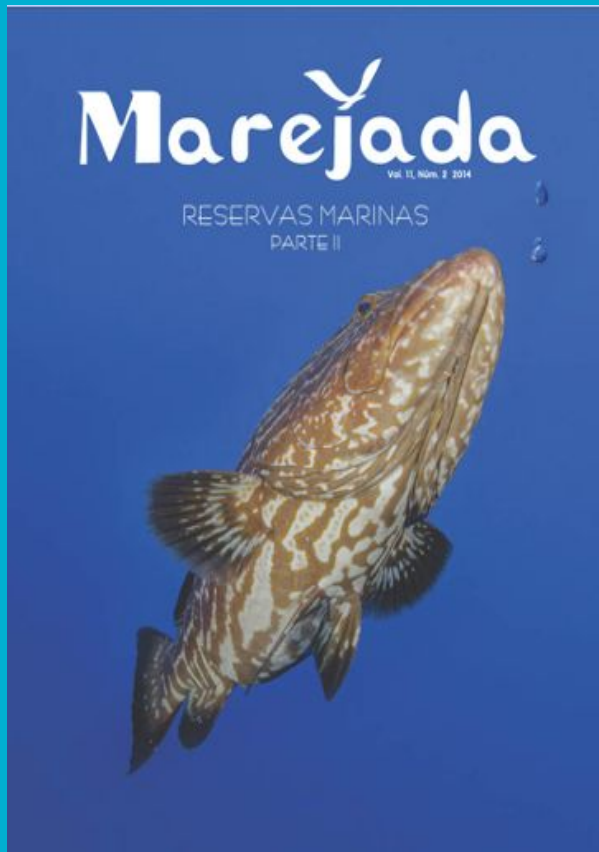
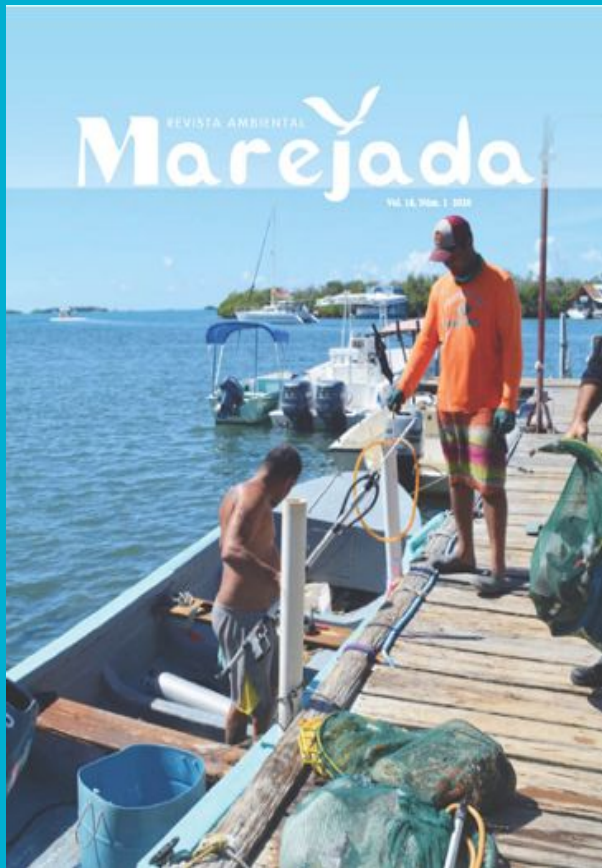
corrientes
peligrosas
dangerous currents

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dangerous currents

corrientes
peligrosas
dangerous currents







GUÍA EDUCATIVA PARA MAESTROS

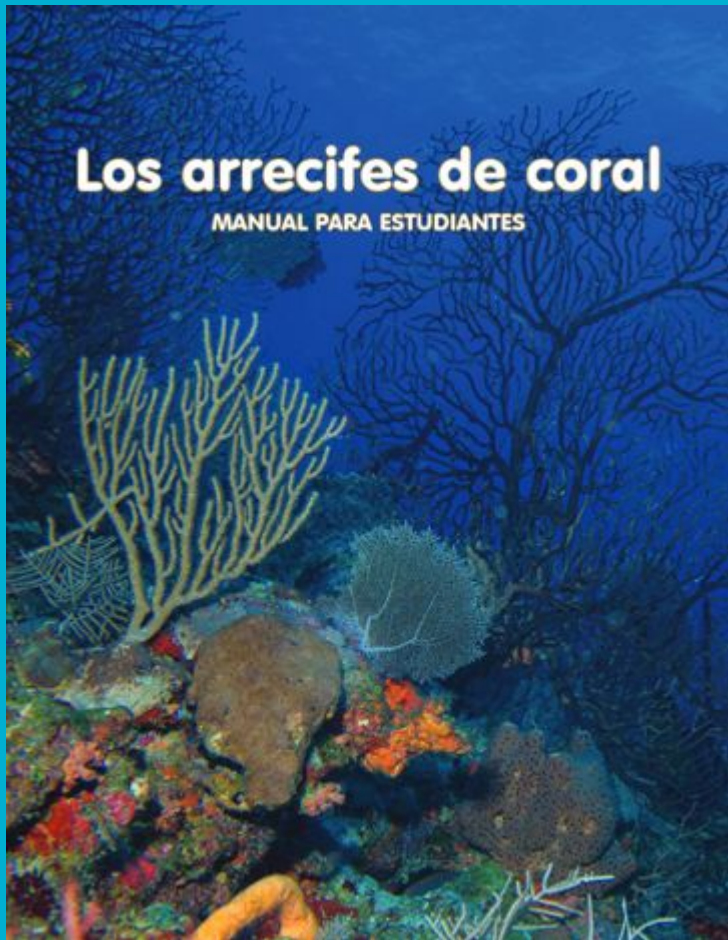
Las praderas de hierbas marinas



El manglar

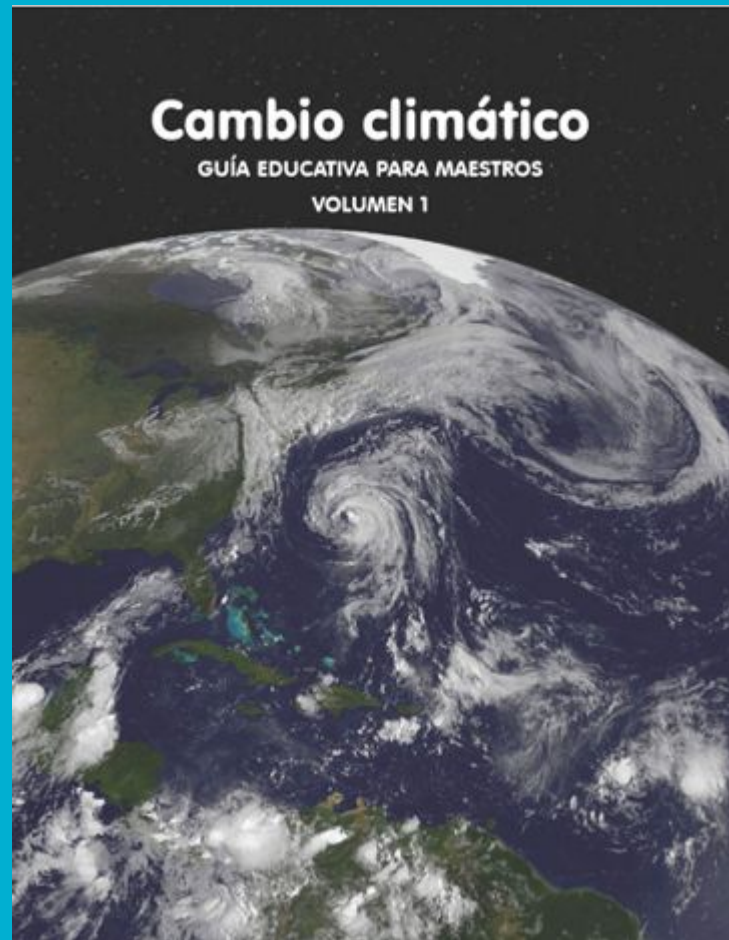
Guía educativa para maestros





Los arrecifes de coral

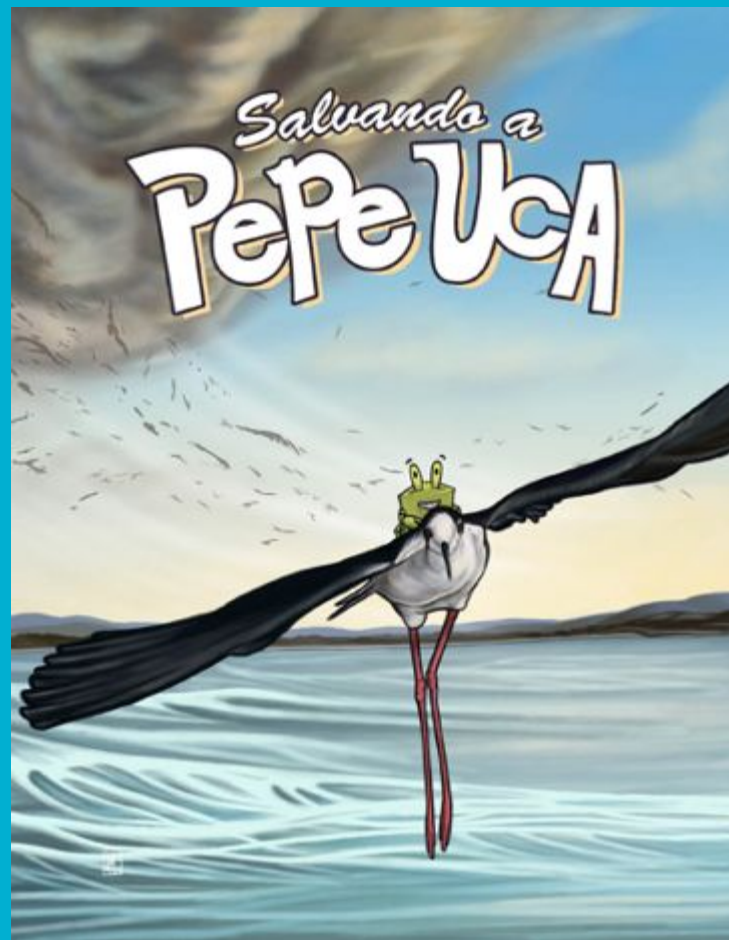
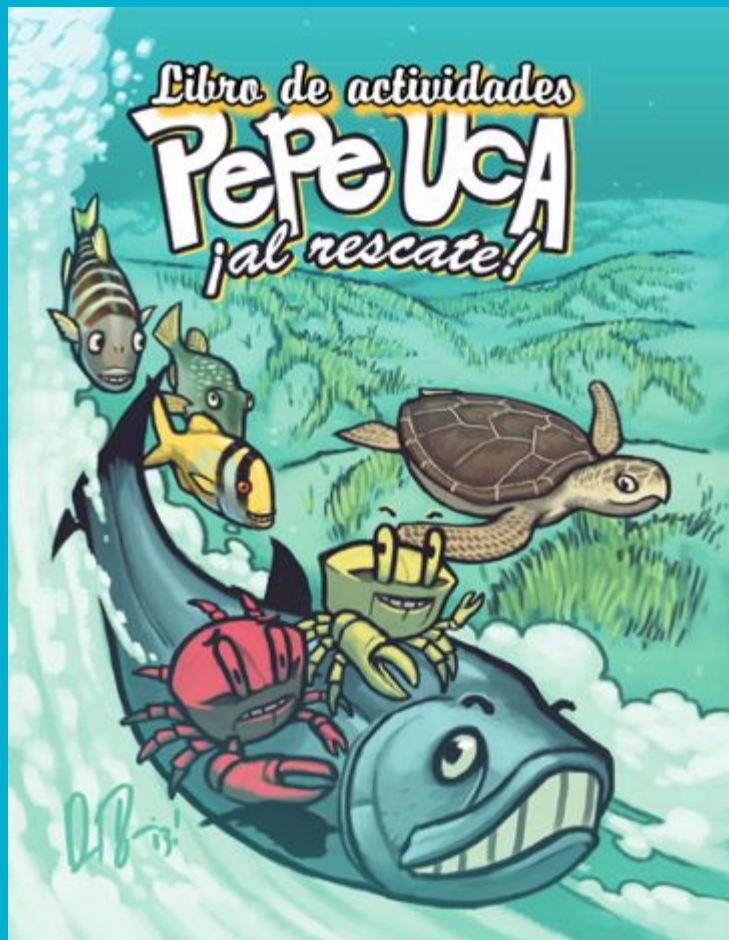
MANUAL PARA ESTUDIANTES



Cambio climático

GUÍA EDUCATIVA PARA MAESTROS

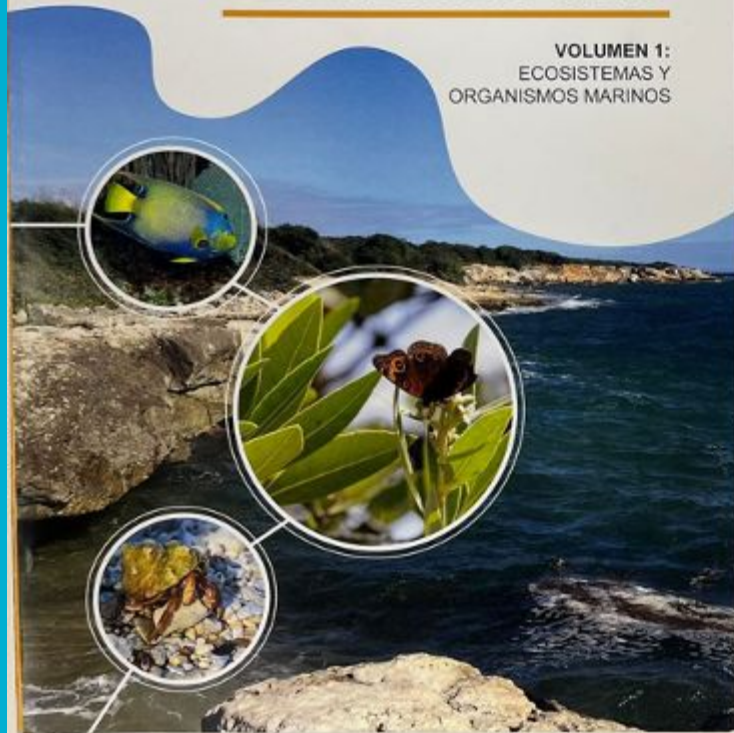
VOLUMEN 1



1

MANUAL DE LABORATORIO

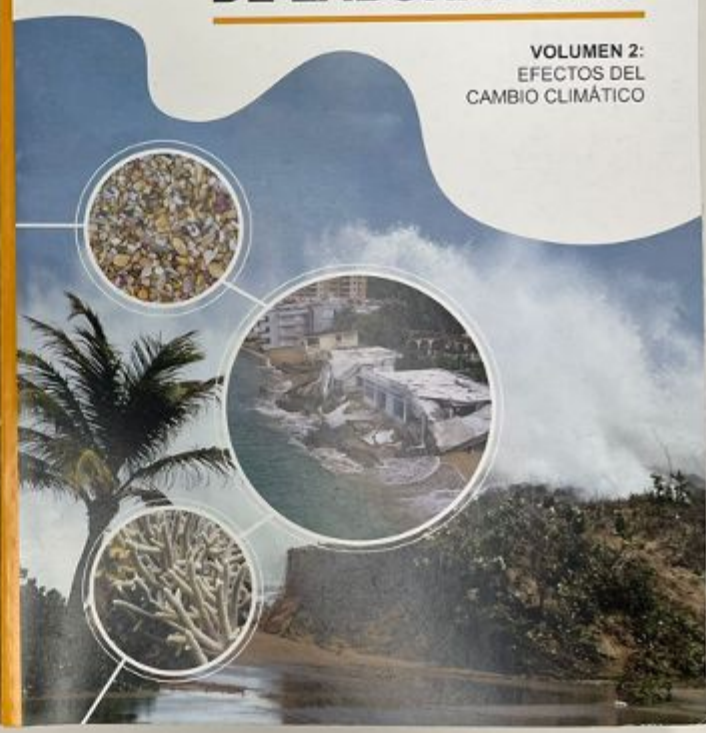
VOLUMEN 1:
ECOSISTEMAS Y
ORGANISMOS MARINOS



2

MANUAL DE LABORATORIO

VOLUMEN 2:
EFECTOS DEL
CAMBIO CLIMÁTICO



Manual educativo:
Olas



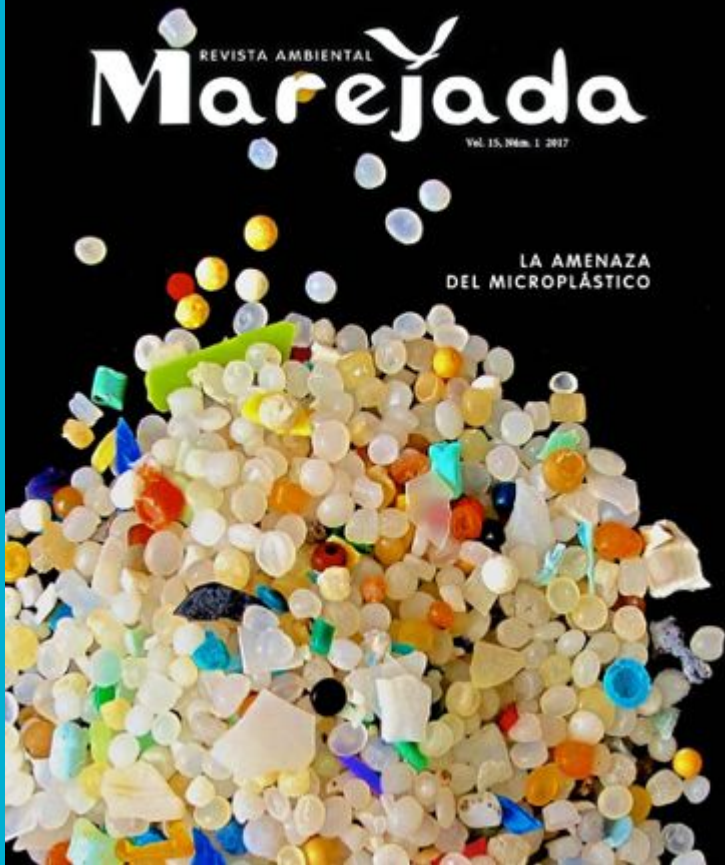
CARICOOS

REVISTA AMBIENTAL

Marejada

Vol. 15, Núm. 1 2017

LA AMENAZA
DEL MICROPLÁSTICO





GUÍA CURRICULAR: DESECHOS MARINOS

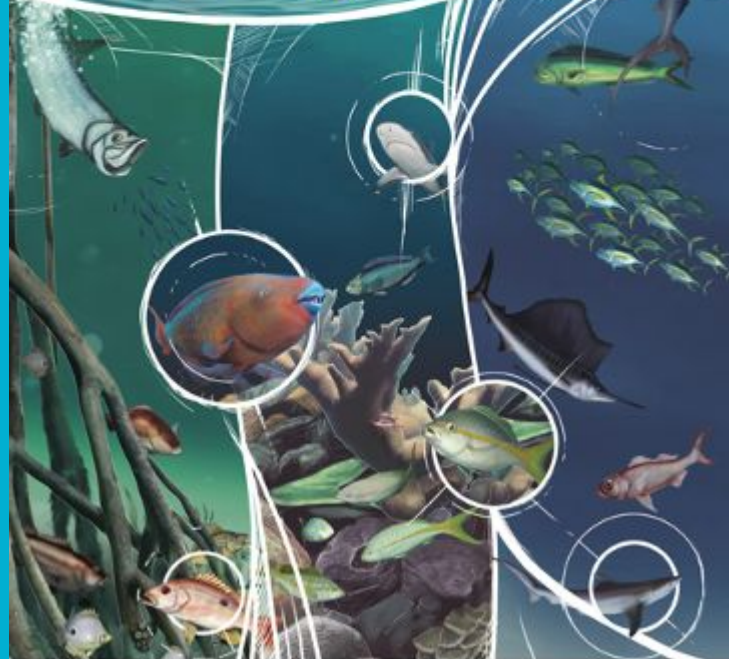
Delmis del C. Alicea Segarra, EdD
Especialista en Currículo y Evaluación


Sea Grant
PUERTO RICO

SEABIRDS
of PUERTO RICO



Fishes of Puerto Rico
and the US Virgin Islands



Fishes of Puerto Rico and the US Virgin Islands

Sea Grant
Project

Peces de Puerto Rico y de las Islas Virgenes EUA



PECES DE AGUA DULCE

NATIVOS DE PUERTO RICO



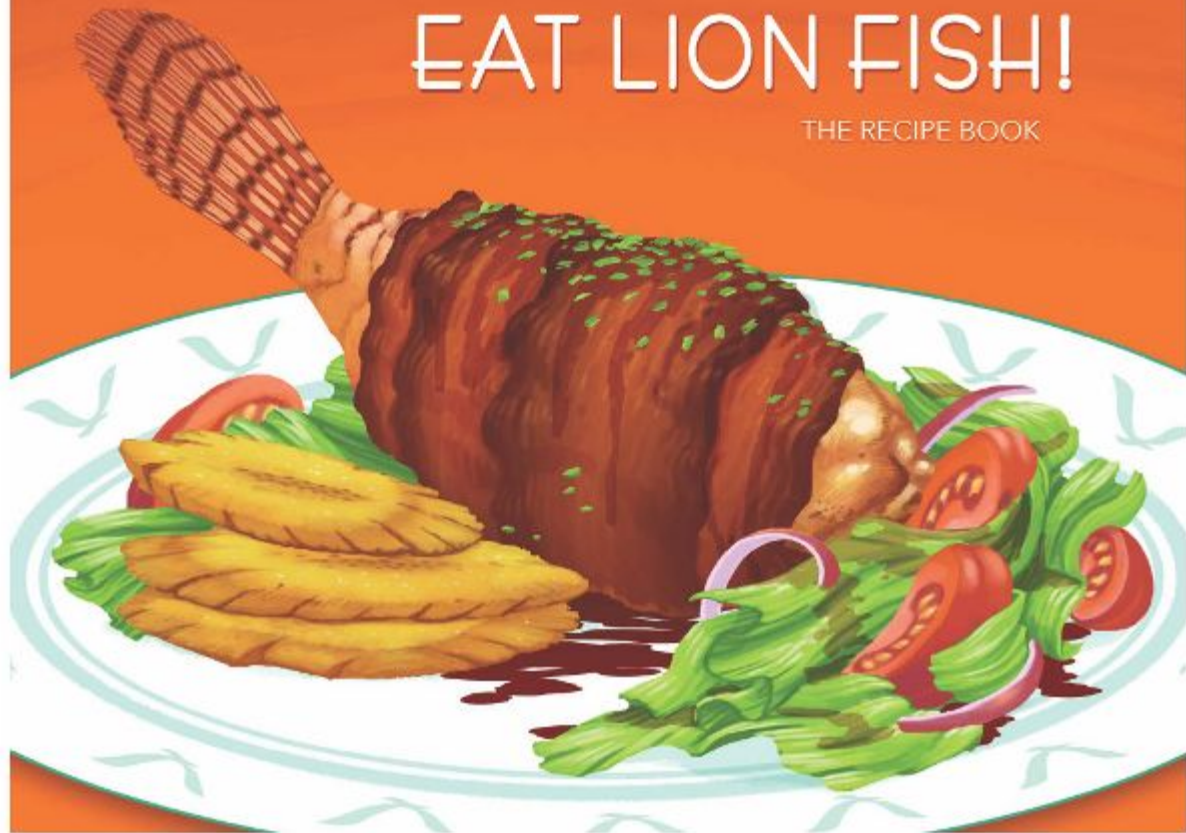
TIBURONES de PUERTO RICO



MAMÍFEROS MARÍÑOS

EAT LION FISH!

THE RECIPE BOOK



SURFEANDO PR, available now!

[Home](#) / [Noticias recientes y eventos](#) / 2023 / [February](#) / 28 / SURFEANDO PR, available now!

787.832.3585 seagrant@uprm.edu



The Communications Team at Puerto Rico's Sea Grant Program presents a new tool for surfers and novices alike. By clicking on our link, everyone can access our personalized map from their cell phones, laptops, tablets, etc.

SURFEANDO PR illustrates the locations and descriptions of some of the beaches that are known for surfing.

This map includes photography of the most optimal conditions for surfing, recommendations by skill level, forecast links updated by our collaborators at The Caribbean Coastal Ocean Observing System (CARCOOS), among other useful information.

This map is published for informational purposes only. The user of this map acknowledges that the information contained herein may not reflect the conditions existing at all times at the beaches included here, as these depend on the existing weather conditions at any given time. The user further acknowledges that the information contained herein may contain inaccuracies and errors. The use of the information contained in this map and the included notes should under no circumstances be interpreted as an invitation to use these beaches for surfing. The user relieves both the creator of the content and whoever publishes this information, whether natural or legal entity, its directors, representatives, agents and employees, from any liability for damages that may be suffered when using the identified beaches either for surfing or any other sporting, recreational or commercial activity.



Proyecto Sargazo
April 16, 2023



SURFEANDO PR, available now!
February 28, 2023



The 2024 Kinross Fellowship is now open
December 16, 2022



PUERTO RICO SEA GRANT APPLIED RESEARCH COMPETITION REQUEST FOR LETTERS OF INTENT AND FULL PROPOSALS (RFP) 2024-2026
December 15, 2022



Oportunidad de fondos US Coastal Research Program & NOAA & Sea Grant
May 31, 2022

Este mapa ilustra la ubicación y descripción de algunas de las playas dónde se practica el deporte del surf en Puerto Rico.
8,235 views
Published on March 27
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Rincón y Aguada

- Tres Palms
- Dogmans
- Pistons
- Indicador
- ... 9 more

Aguadilla y más allá

- La Cacula
- Bridge's
- Rompeolas
- Crash Boat
- ... 7 more

Isabela y Quebradillas

- Jobs
- Golondrinas
- Midlec
- Shore Island
- Casjstace
- Puerto Hermira

Camuy, Hatillo y Arecibo

- Margara
- Casay B...



App Store Preview

Open the Mac App Store to buy and download apps.



Pa' la Playa ^{EX}

Disenos del Arte, Inc.
Designed for iPhone

★★★★★ 4.7 / 34 Ratings

Free

[View in Mac App Store](#)

iPhone Screenshots



Pa' la Playa es la nueva solución para conocer las playas del Caribe y saber, al instante, como estará el clima con antelación, para poder planear tu diversión. Sólo busca la playa que te interesa visitar por su nombre, por su región, o por GPS, verá detallado su pronóstico climático, la altura promedio del oleaje y hasta las últimas mediciones de su calidad de agua. La aplicación también provee reseñas por usuarios y videos que presentan las cualidades del lugar. No lo pierdes y descarga el app para que puedas planear tu día de playa hoy mismo.

App Store Preview

Open the Mac App Store to buy and download apps.



Caricoos Boating App ^{EX}

Navigate PR and USVI with ease

Candela Creative Group

Designed for iPad

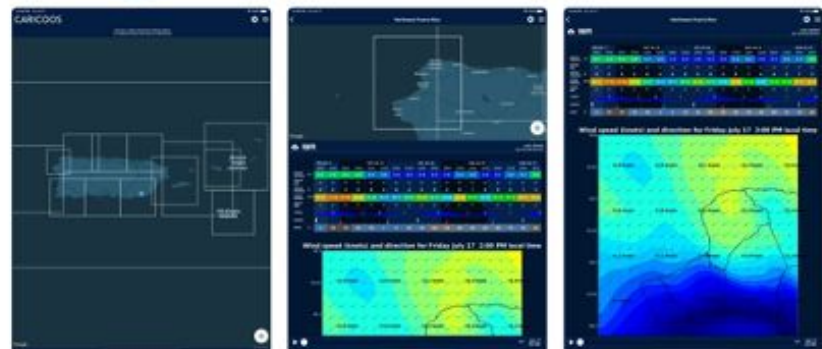
★★★★★ 4.9 / 7 Ratings

Free

[View in Mac App Store](#)

Screenshots

iPad iPhone



Everything you need to know before boating in coastal waters near Puerto Rico and the US Virgin Islands.


Features:

- Current Conditions: Wind, Waves, Tides, Moon Phase, Cloud Coverage and Rain Probability
- Forecasts: Wind and Wave Forecasts from Caricoos WRF and SWAN Models

[more](#)

Understanding and Responding to Massive — Sargassum Influxes

Mariana C. León-Pérez, Ph.D.



Understanding and Responding to Massive Sargassum Influxes

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National Sea Grant Law Center
Webinar Series
May 30, 2023

The Problem

Since 2011, massive influxes of pelagic *Sargassum spp.* have been arriving recurrently to the Wider Caribbean Region and West Africa coast



<https://www.elfinanciero.com.mx/cartones/rictus/sargazo/>

What is pelagic sargassum?

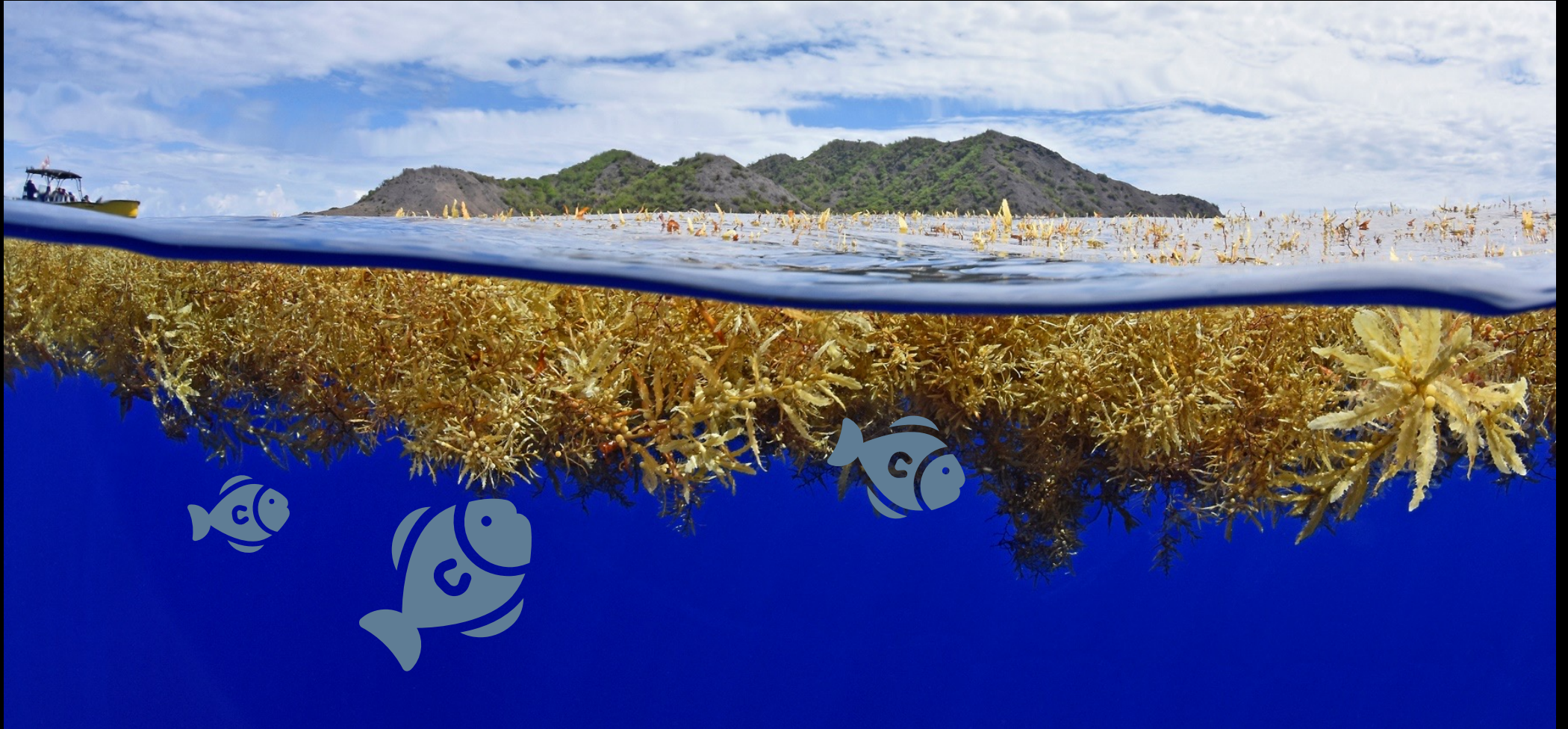


Sargassum natans

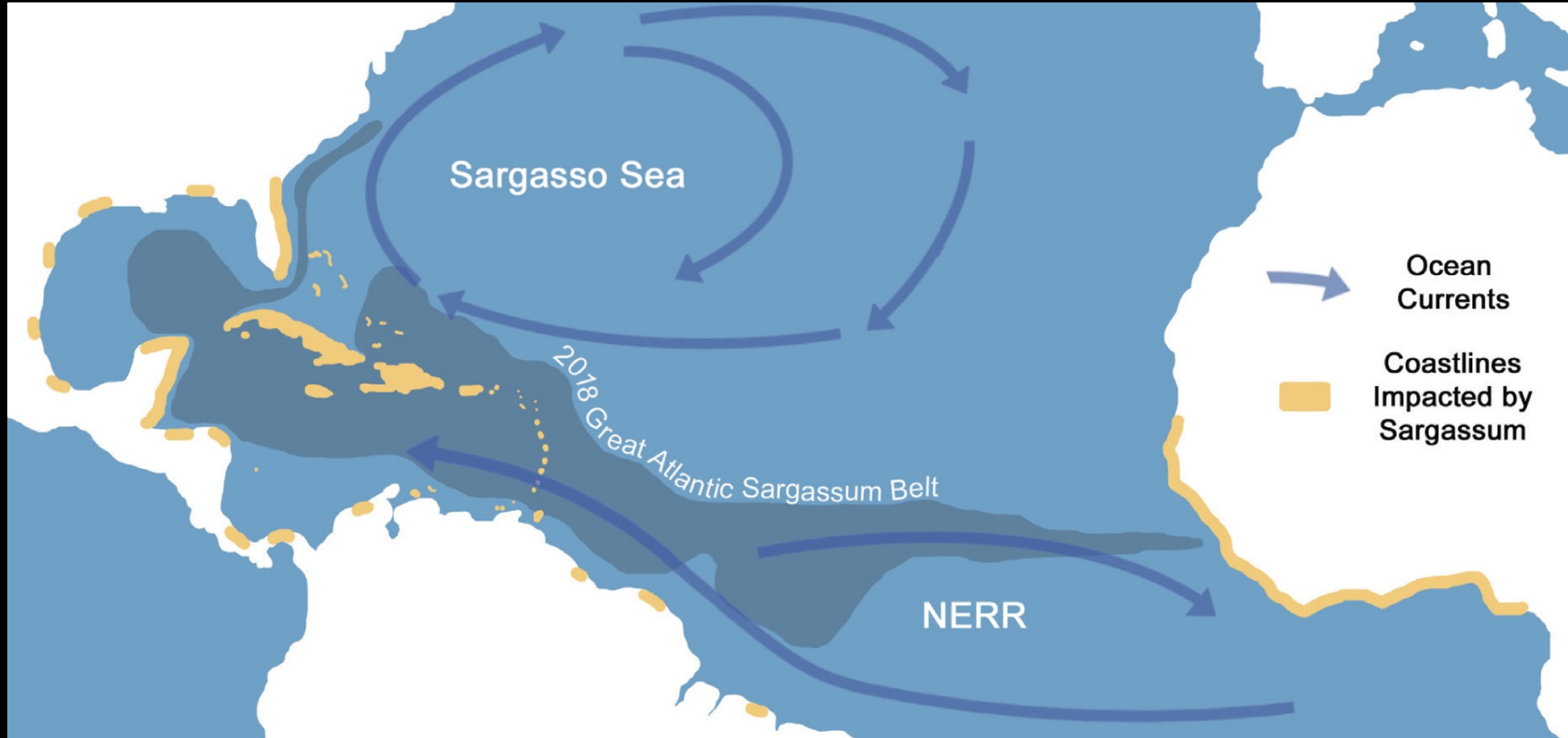


Sargassum fluitans

León-Pérez et al. 2021

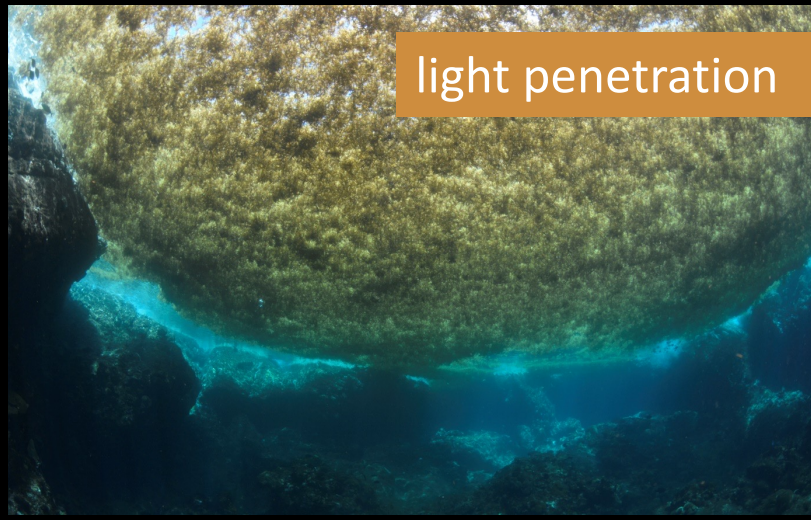
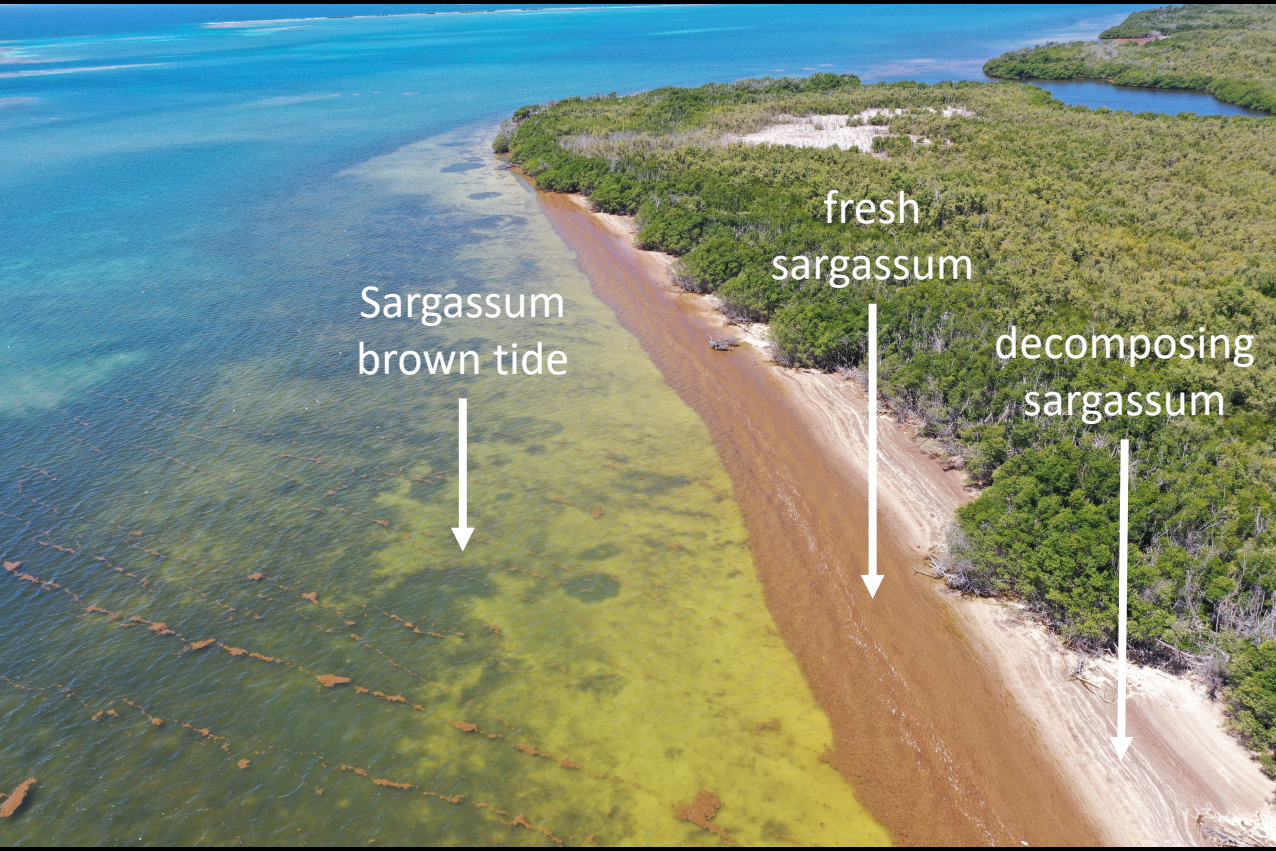


Where it comes from?



León-Pérez et al. 2021; Wang et al. 2019; <https://www.unep.org/events/unep-event/sargassum-caribbean-and-west-africa-key-challenges-responses-and-collaborations> <http://sargassummonitoring.com>

What are the impacts on the ecological system?



What are the impacts on the social system?



tourism industry

weather.com



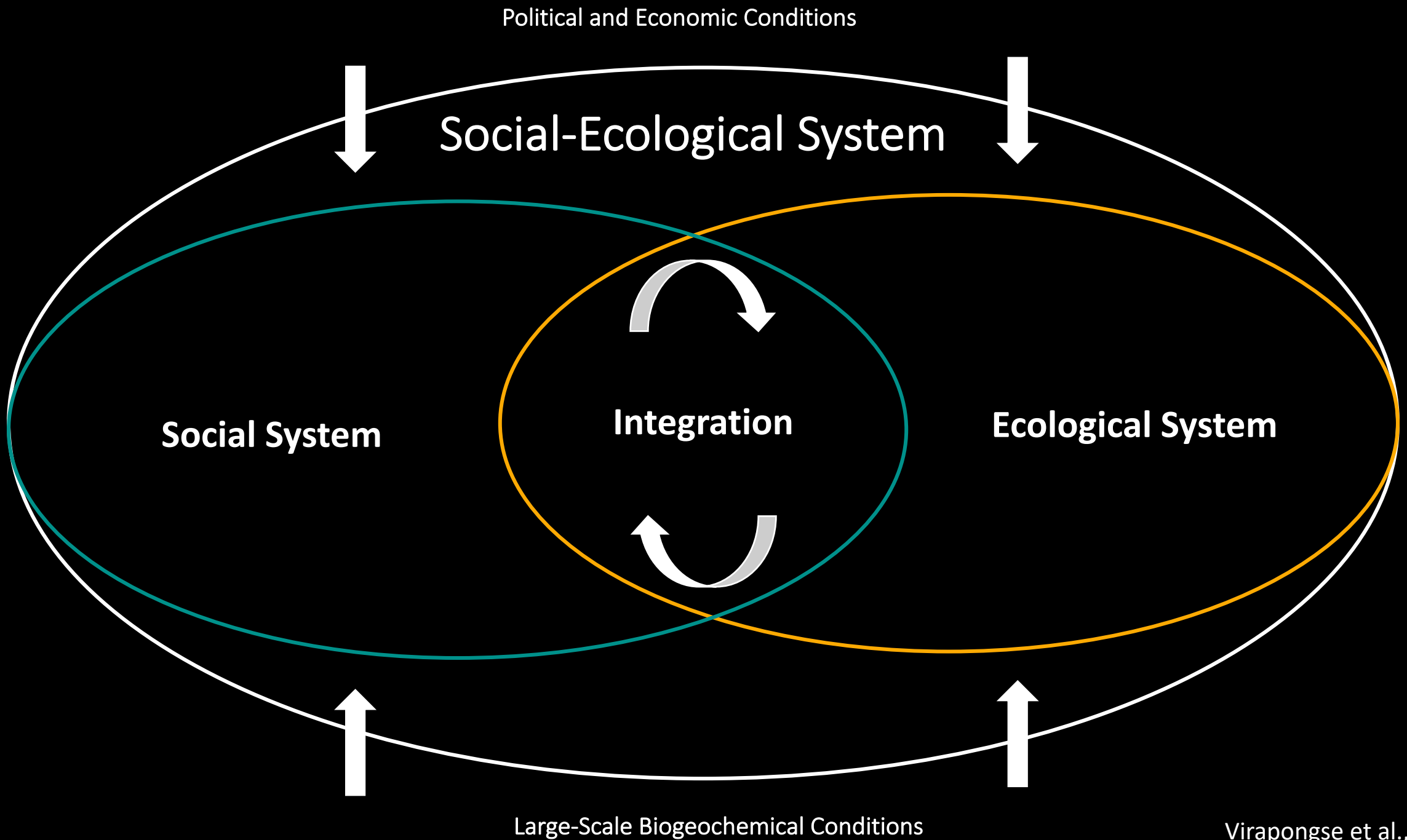
human health

www.sbhonline.com



fisheries

thevoiceslu.com





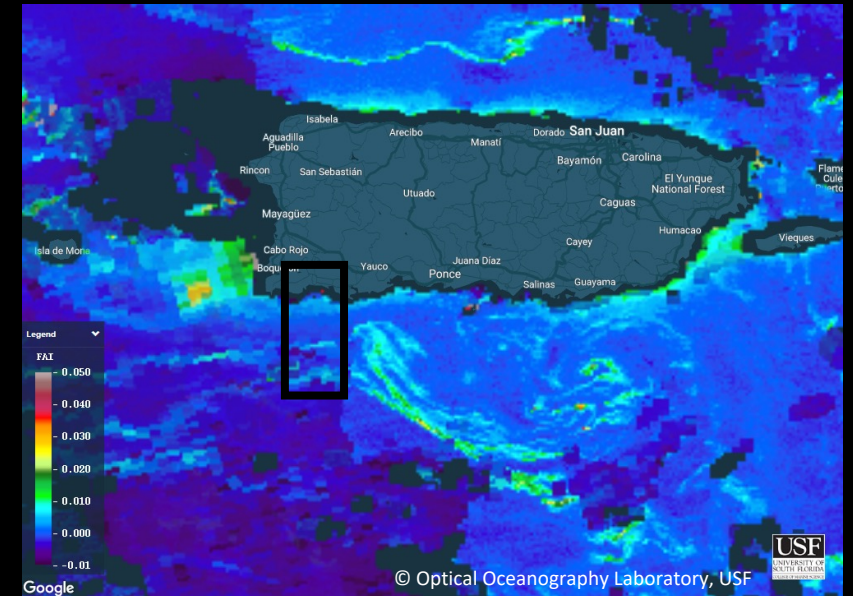
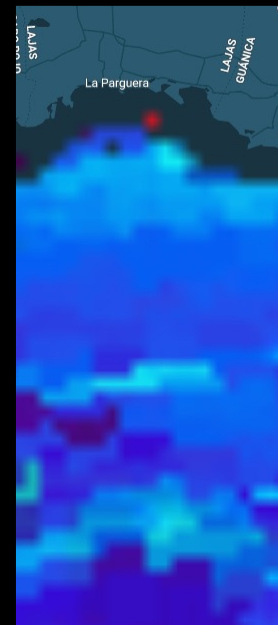
Purpose and Objectives

Provide information for the management and decision-making processes regarding sargassum accumulations on the coasts of Puerto Rico

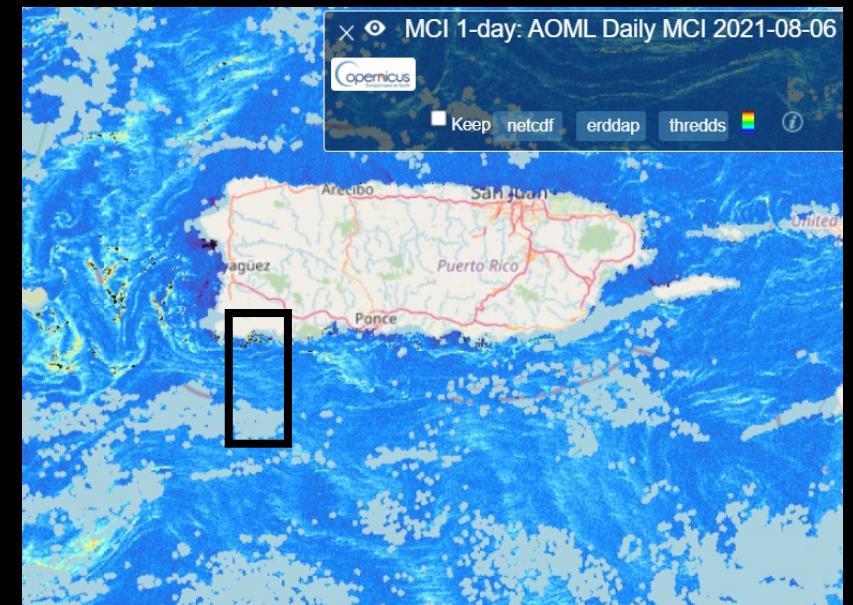
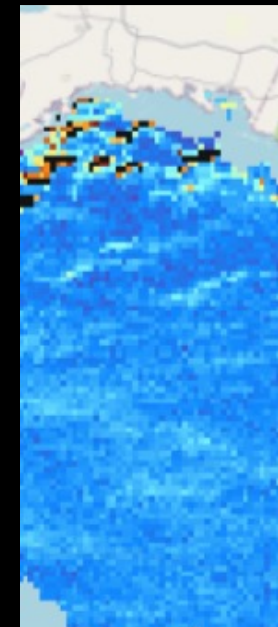
- Ch1: Develop a method for using multispectral satellite data to identify sargassum influxes on the coast, and temporally and spatially characterize these occurrences in La Parguera.
- Ch2: Understand and map the social vulnerability of Palmas del Mar SESs to sargassum influxes.
- Ch3: Describe the sargassum legal framework in Puerto Rico to understand the jurisdiction of federal and local agencies regarding sargassum removal and its disposal in the ocean, and to identify legal barriers for implementing effective mitigation strategies.

Detection of offshore sargassum masses

- Sensors
 - MODIS
 - Sentinel-3 OLCI
- Spatial resolution
 - 1 km
 - 300 m
- Algorithms
 - Alternate Floating Algae Index (FAI)
 - Maximum Chlorophyll Index (MCI)
- Coastal areas are masked out



https://www.caricoos.org/oceans/observation/modis_aqua/ECARIBE/afai



<https://cwcgom.aoml.noaa.gov/cgom/OceanViewer/>

An aerial photograph showing a coastline. The top left corner shows clear, turquoise water. A large, irregularly shaped area of brown, turbid water extends from the top left towards the bottom right, representing a sargassum influx. Below the brown water, there is a dense forest of green trees. The background of the slide is dark grey.

Objective

- Develop a method for using multispectral satellite data to identify sargassum influxes on the coast, and temporally and spatially characterize these occurrences in La Parguera



Study Area

La Parguera
Nature
Reserve



Method

Google Earth Engine

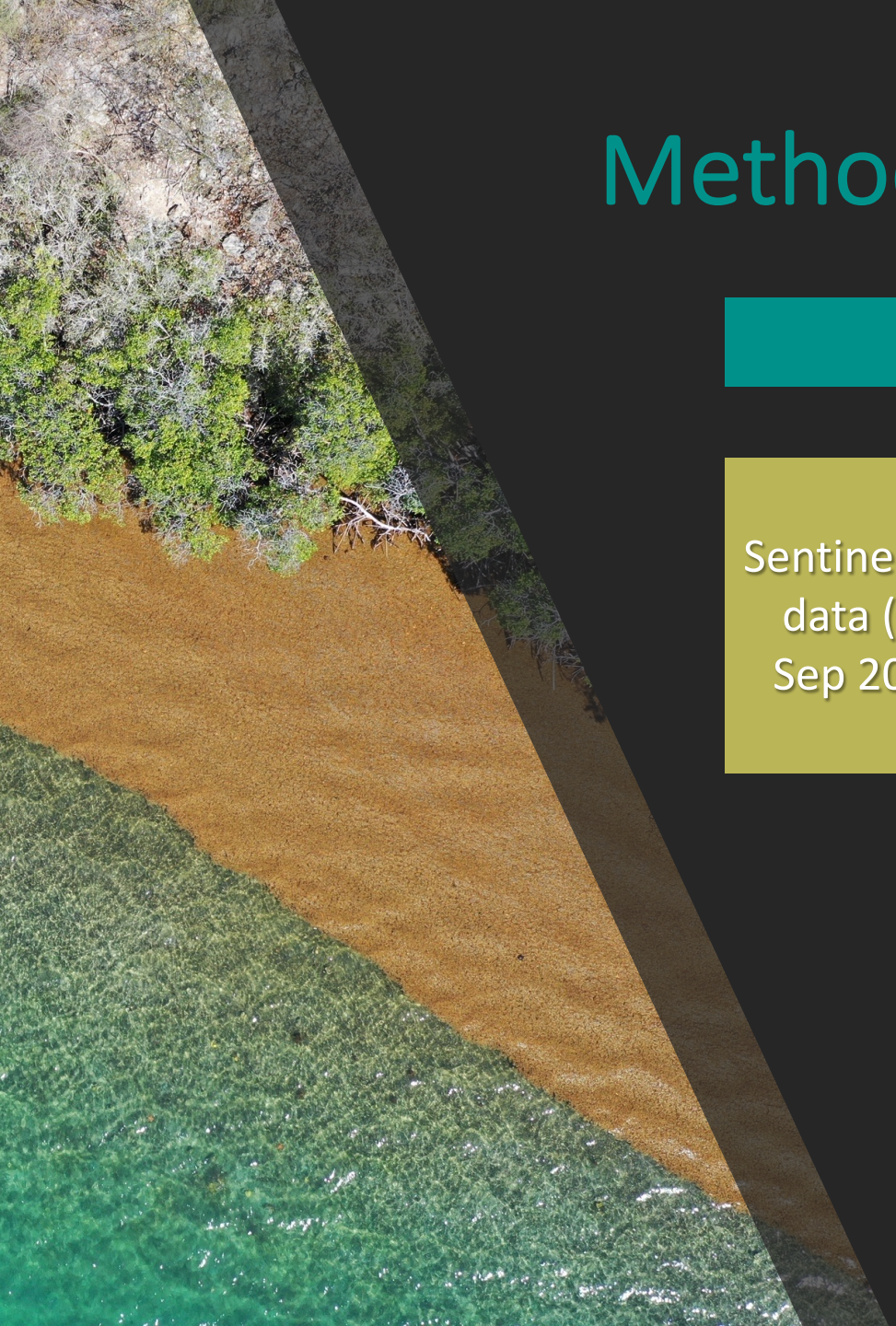
Sentinel-2 MSI sensor
data (443 images)
Sep 2015-Jan 2022

Multi-index
approach

Random Forest
supervised
classification

Training and
validation

Analysis of
temporal and
spatial dynamics
of sargassum
hotspots



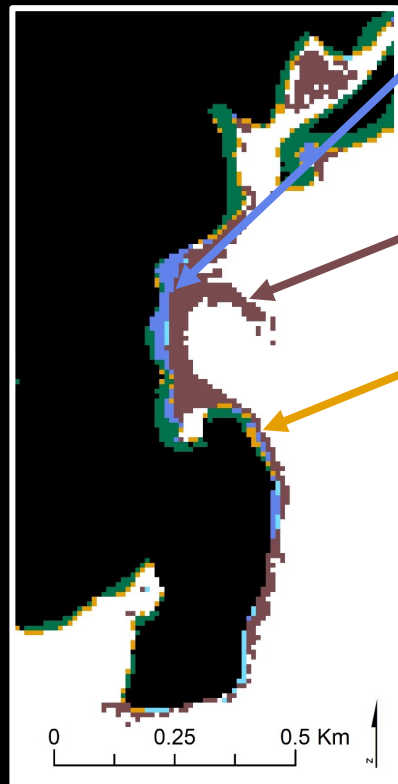
Classification of Sargassum



+ 3 non-sargassum classes

All classes were equally well detected (above 87%) for an overall accuracy of 97%

Classification of Sargassum

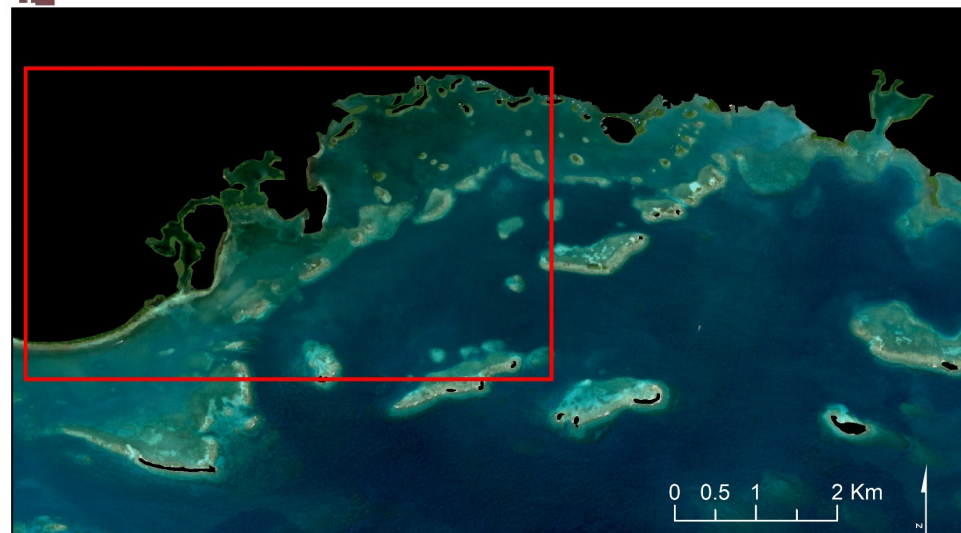
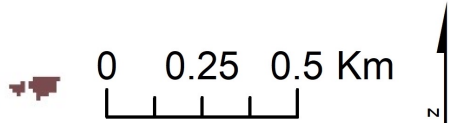


decomposing sargassum

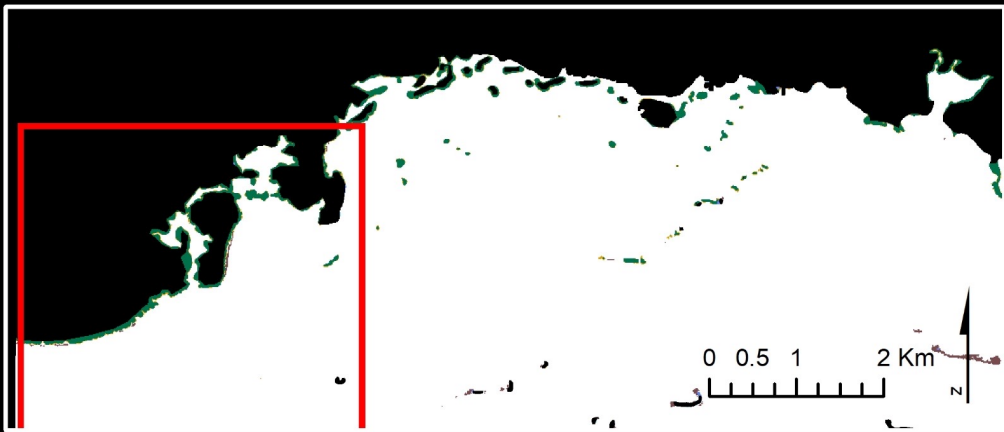
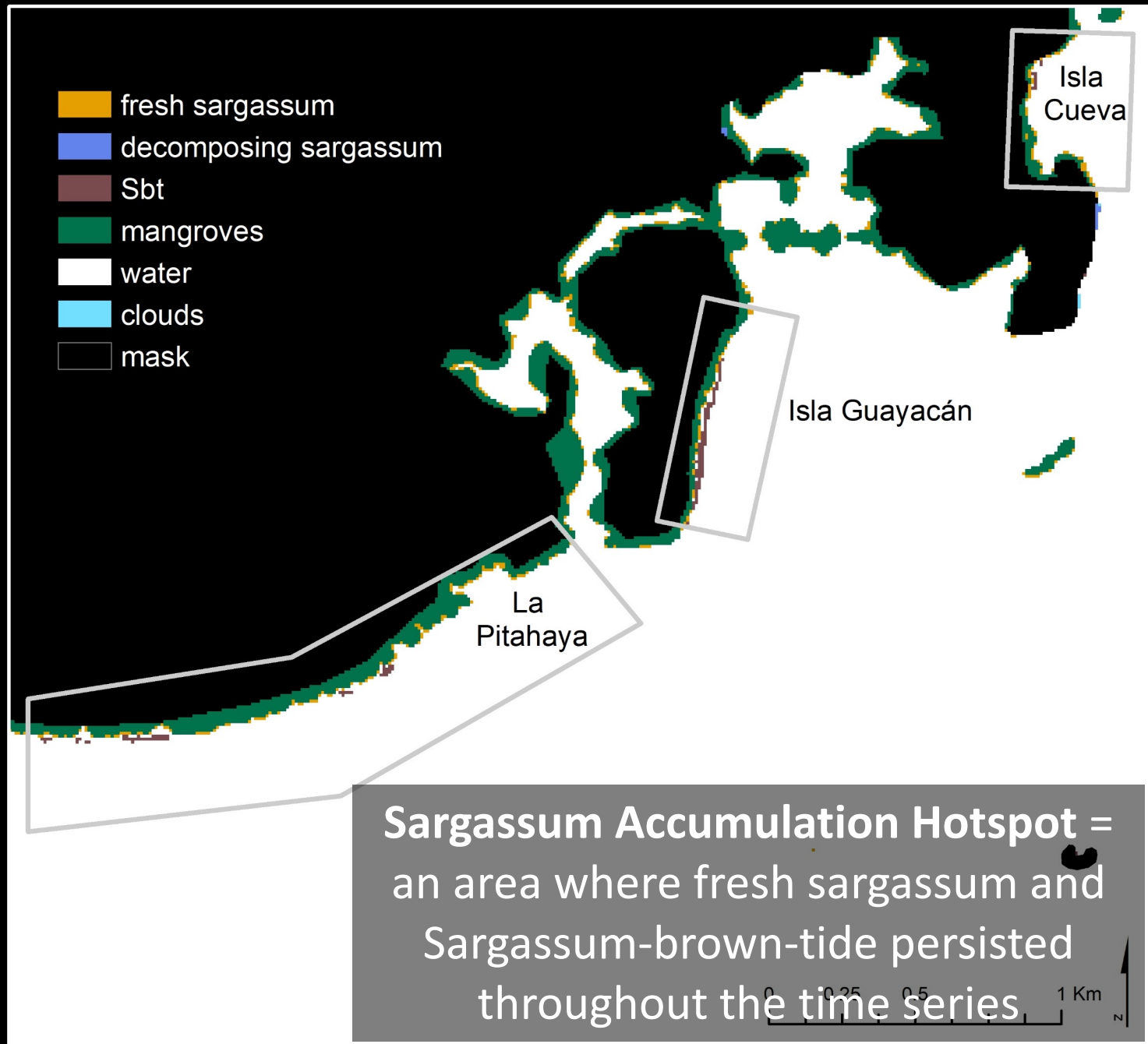
Sargassum-brown-tide

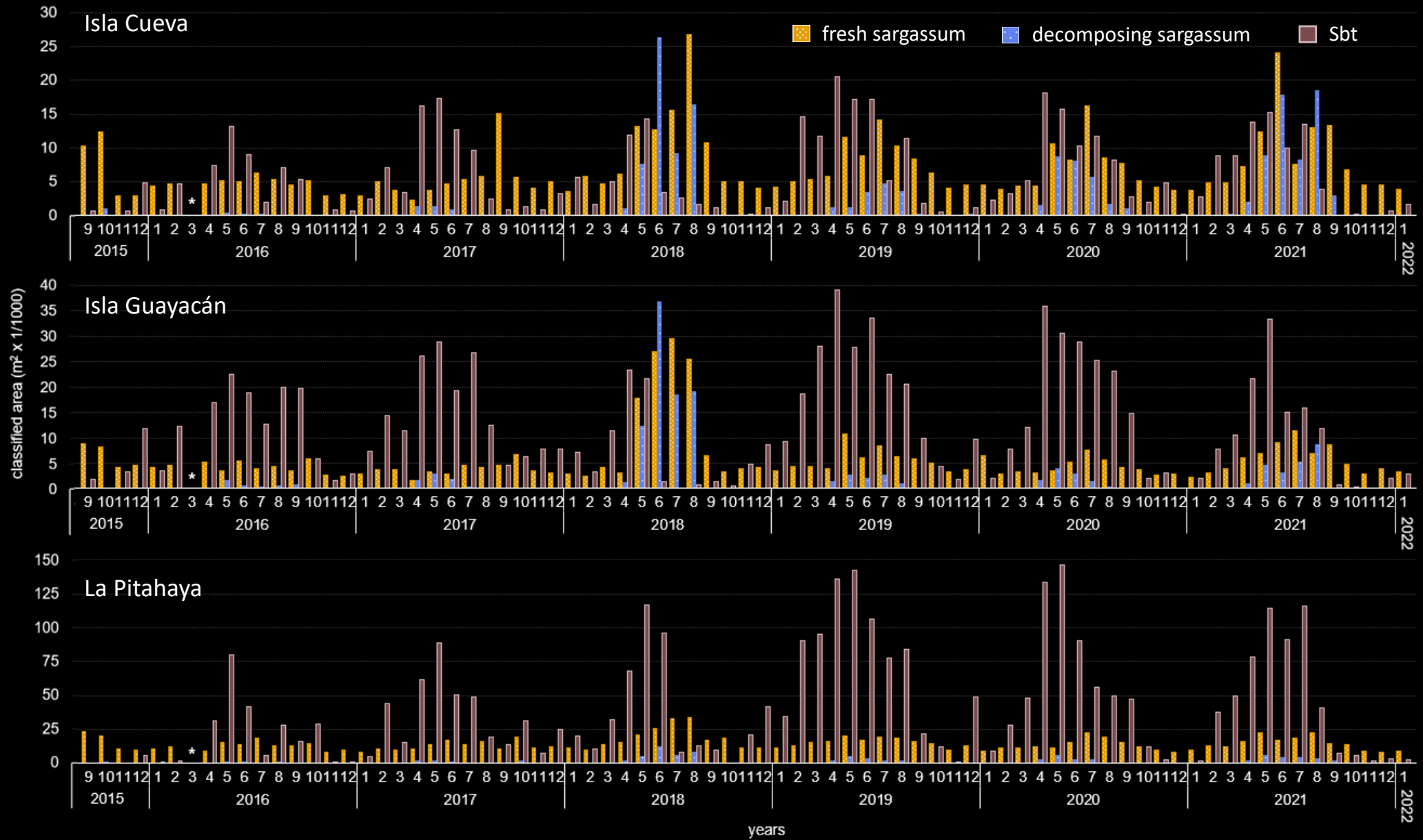
fresh sargassum

- fresh sargassum
- decomposing sargassum
- Sbt
- mangroves
- water
- clouds
- mask

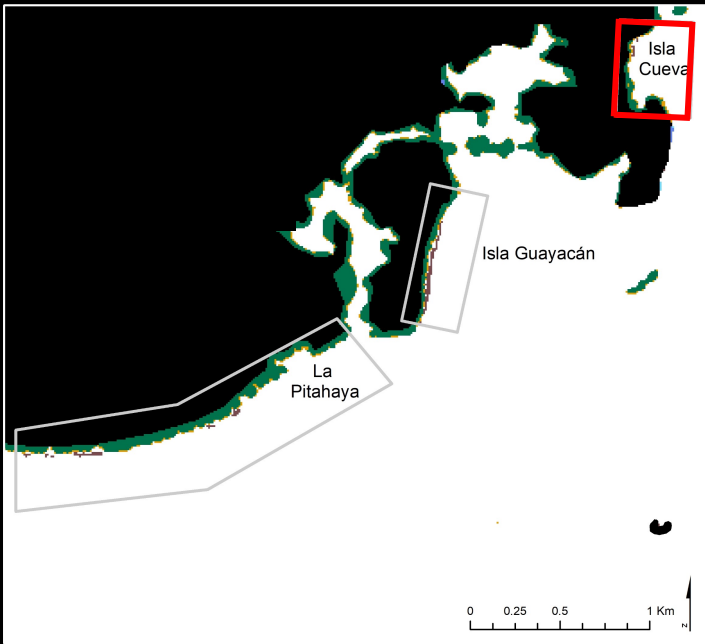


Persistence Analysis to Identify Sargassum Accumulation Hotspots

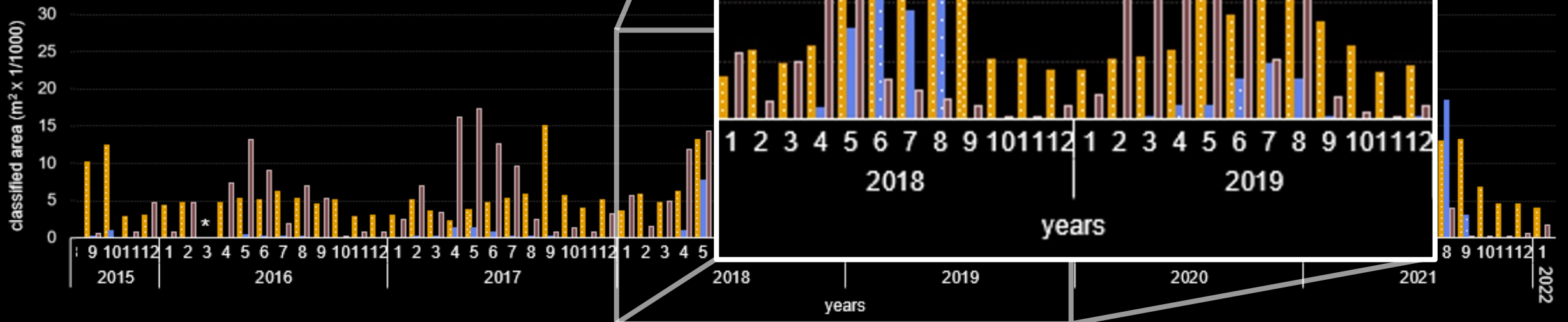


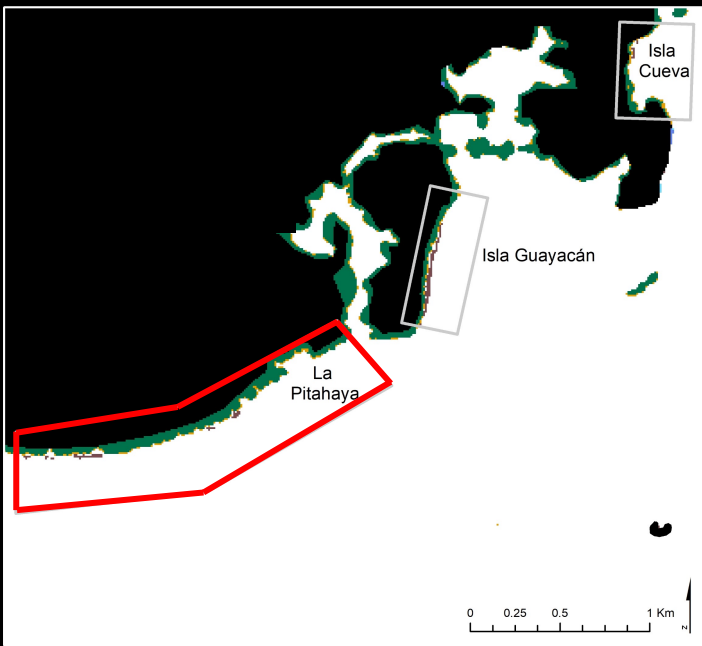


Monthly Average Area

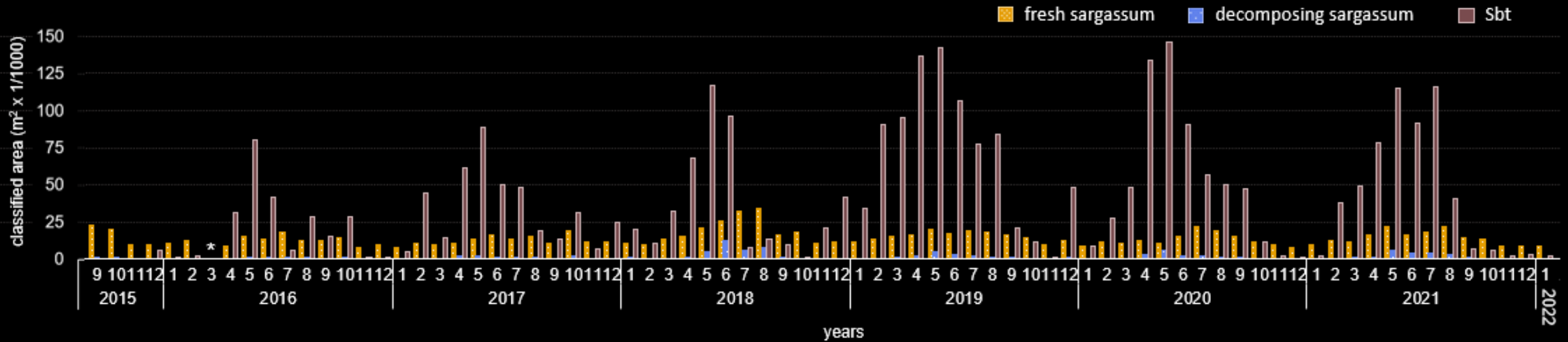


Isla Cueva SAH





La Pitahaya SAH

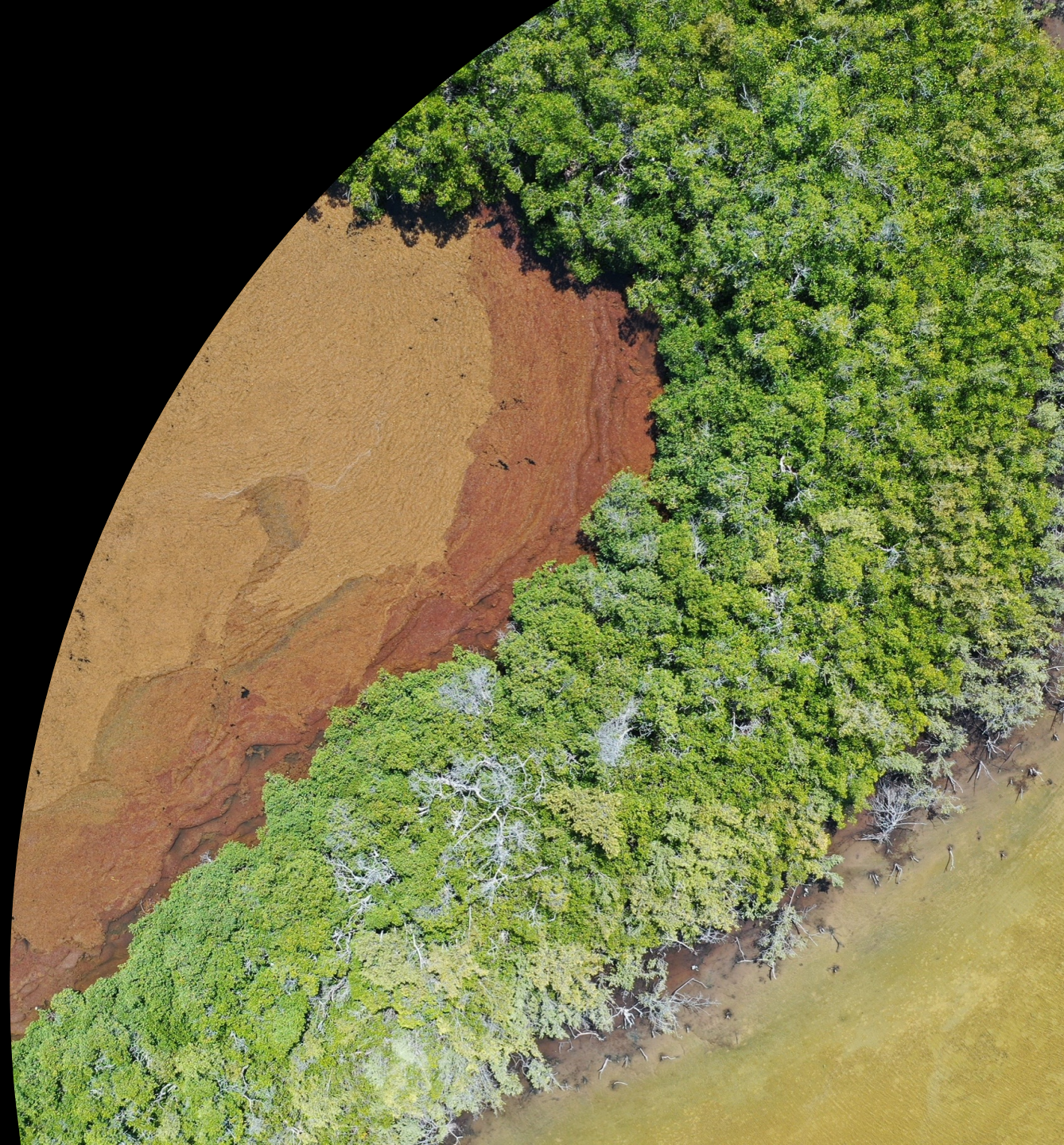


Takeaways

- Temporal and spatial dynamics of sargassum hotspots shows year-round impacts to the coastal system
- Geomorphological characteristics of the shoreline along with prevailing currents and wind direction drive accumulation hotspots

For more information:

León-Pérez, M.C., Reisinger, A.S., Gibeaut, J.C., 2023. Spatial-temporal dynamics of decaying stages of pelagic *Sargassum spp.* along shorelines in Puerto Rico using Google Earth Engine. Marine Pollution Bulletin 188.



Social Vulnerability Assessment

- Understand and map the social vulnerability of Palmas del Mar SESs to sargassum influxes

Exposure



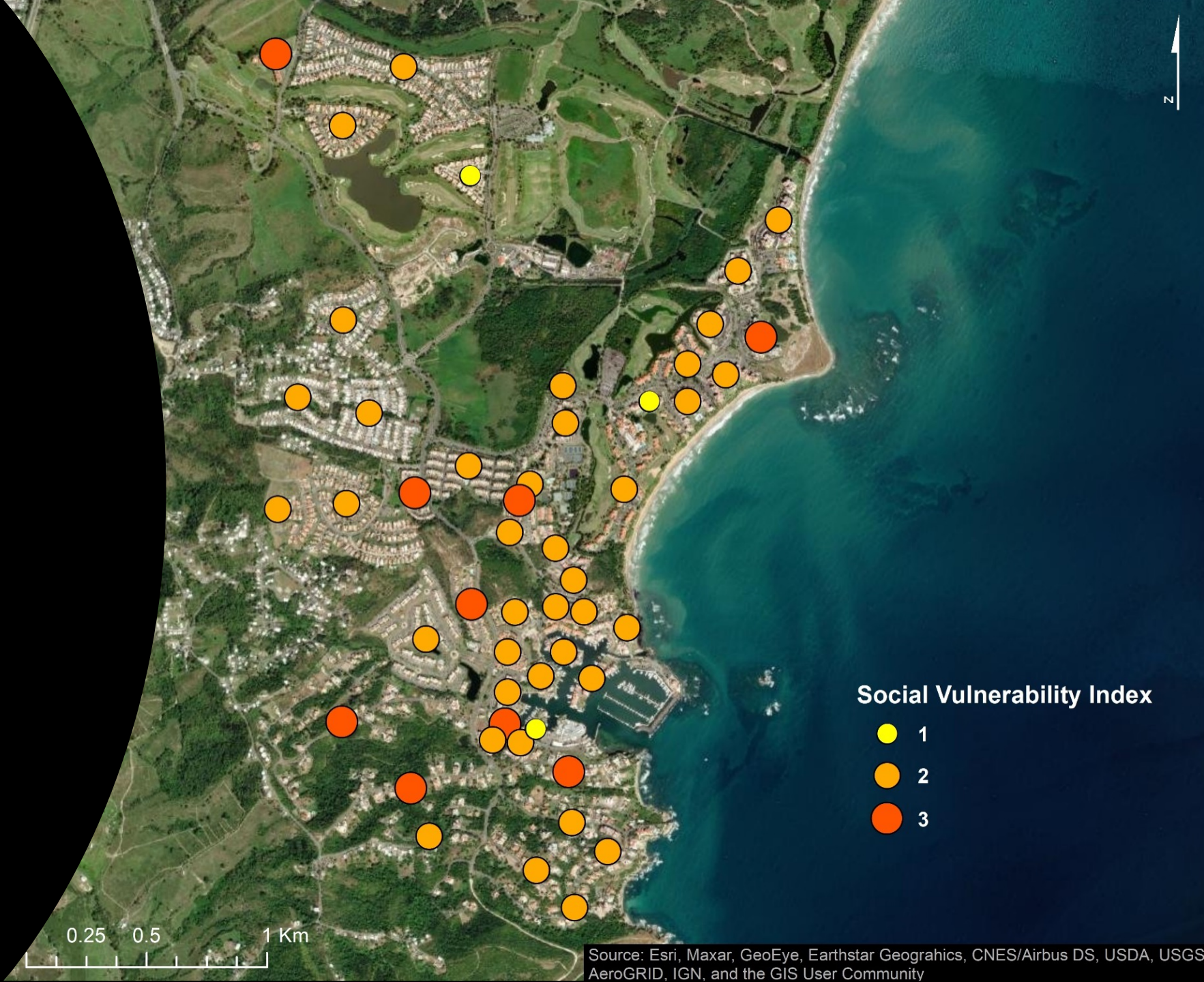
Sensitivity



Adaptive Capacity



0.25 0.5 1 Km





Installation of booms



Manual removal using boats



Mechanized removal at the beach



No action

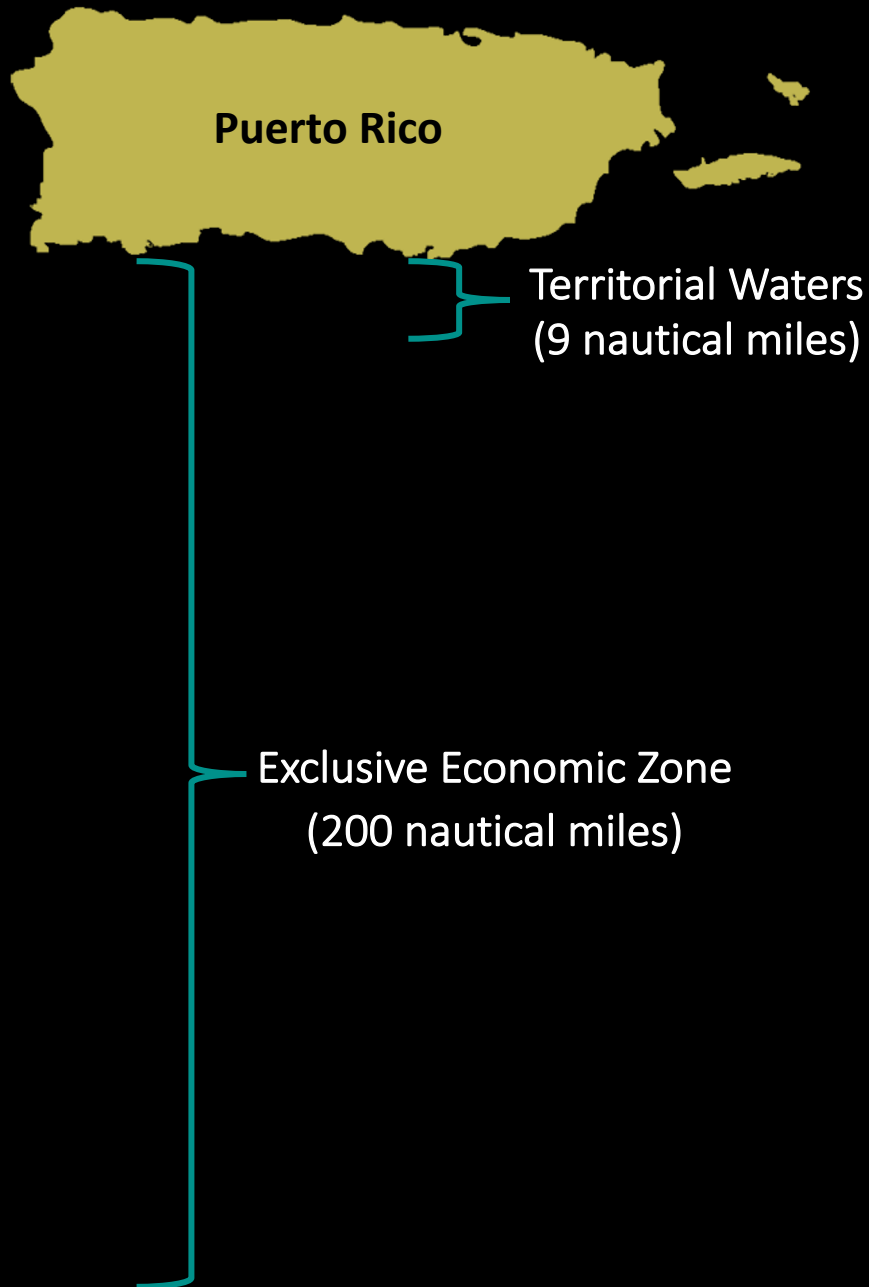


Mechanized removal using boats



Manual removal at the beach

Mitigation Strategies



Puerto Rico's Law and Policy

- Unincorporated territory of the USA
- Joint responsibility between the Commonwealth and US federal governments
- Puerto Rico
 - Department of Natural and Environmental Resources (DNER)
 - 2015: Protocol for the Handling of Extreme Accumulations of *Sargassum* on the Coasts of Puerto Rico

Objectives

Knowledge Co-Production

Describe the sargassum legal framework in Puerto Rico

Specific Objectives

- Clarify the jurisdiction of federal and local agencies in Puerto Rico for:
 - sargassum removal (in the coast and ocean)
 - sargassum ocean disposal
- Clarify the permits needed for these activities
 - Identify obstacles between government processes and relevant groups' needs
 - Identify potential solutions to facilitate the permit application process

Methods

Literature Review

- Federal and Commonwealth laws and regulations

Semi-Structured Interviews

Virtual Workshop

In collaboration with



Introduction and legal background

- Learn about how sargassum is impacting the coasts of Puerto Rico
- Learn about the laws and regulations that apply to sargassum removal and its disposal in the ocean
 - Relevant groups and agencies presentations



Activity #1: Sargassum removal permits

- Clarify the jurisdiction and role of agencies in permits processing
 - Co-develop a permitting process flowchart



Activity #2: Ideas to facilitate the permitting process

- Provide ideas for overcoming identified obstacles and for facilitating the permitting process
 - Relevant groups and agencies breakout rooms

Participation

Agencies	Semi-structured interviews	Workshop
US Army Corps of Engineers (USACE)	✓	✓
National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) -Protected Resources Division -Habitat Conservation Division -Office of General Counsel	 ✓ ✓ ✓	 ✓ ✓
Caribbean Fisheries Management Council (CFMC)	✓	
US Fish and Wildlife Service (USFWS)	✓	✓
US Environmental Protection Agency (EPA)	✓	✓
Puerto Rico Department of Natural and Environmental Resources (DNER)	✓	

Laws and Regulations

U.S. Federal

Puerto Rico Commonwealth

Constitution of the Commonwealth of Puerto Rico (1952)

Organic Act of the Department of Natural and Environmental Resources (1972)

Regulation for the Use, Surveillance, Conservation and Management of the Territorial Waters, Submerged Lands Thereunder and the Maritime Zone (1992)

Regulations for the Environmental Assessment Process (2016)

Clean Water Act (1977)

Coastal Zone Management Act (1972)

Dock and Harbor Law of Puerto Rico (1968)

Endangered Species Act (1973)

Magnuson-Stevens Fishery Conservation and Management Act (2007)

Marine Mammal Protection Act (1972)

Marine Protection, Research, and Sanctuaries Act (1972)

National Environmental Policy Act (1970)

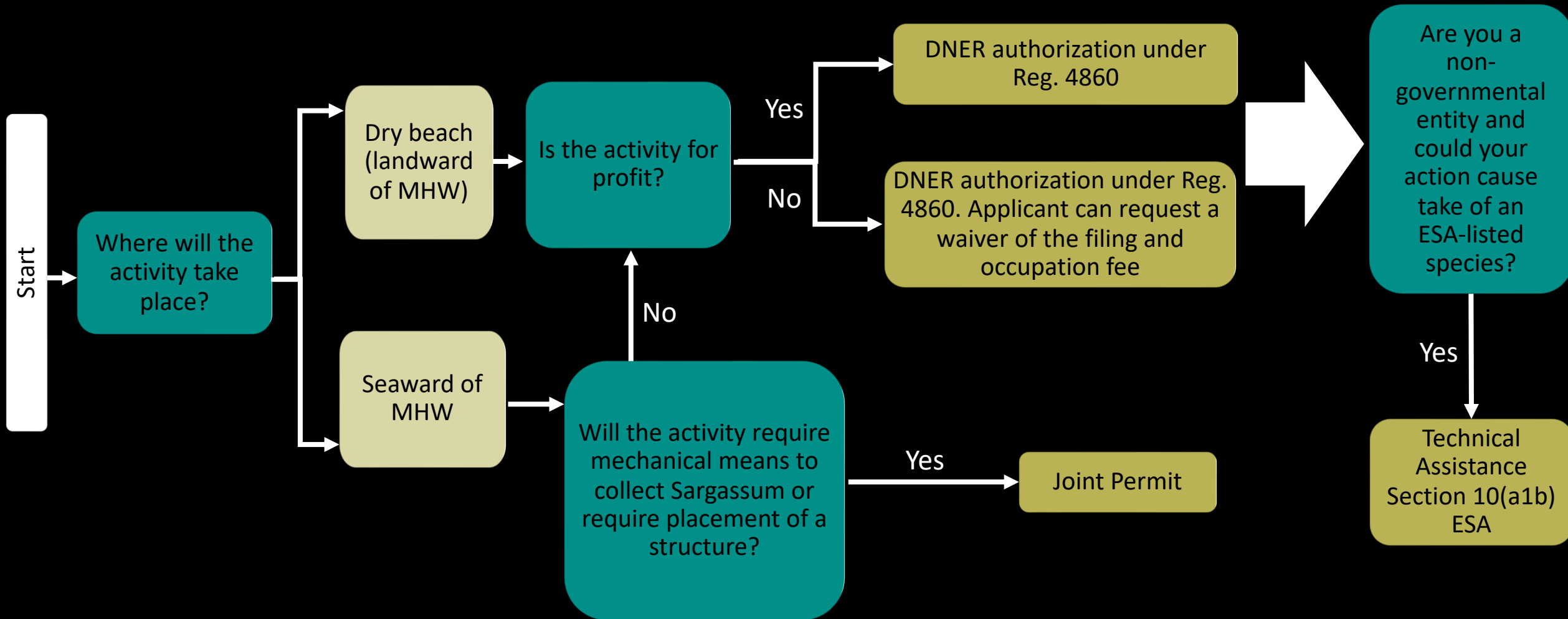
National Historic Preservation Act (1966)

Ports and Waterways Safety Act (1972)

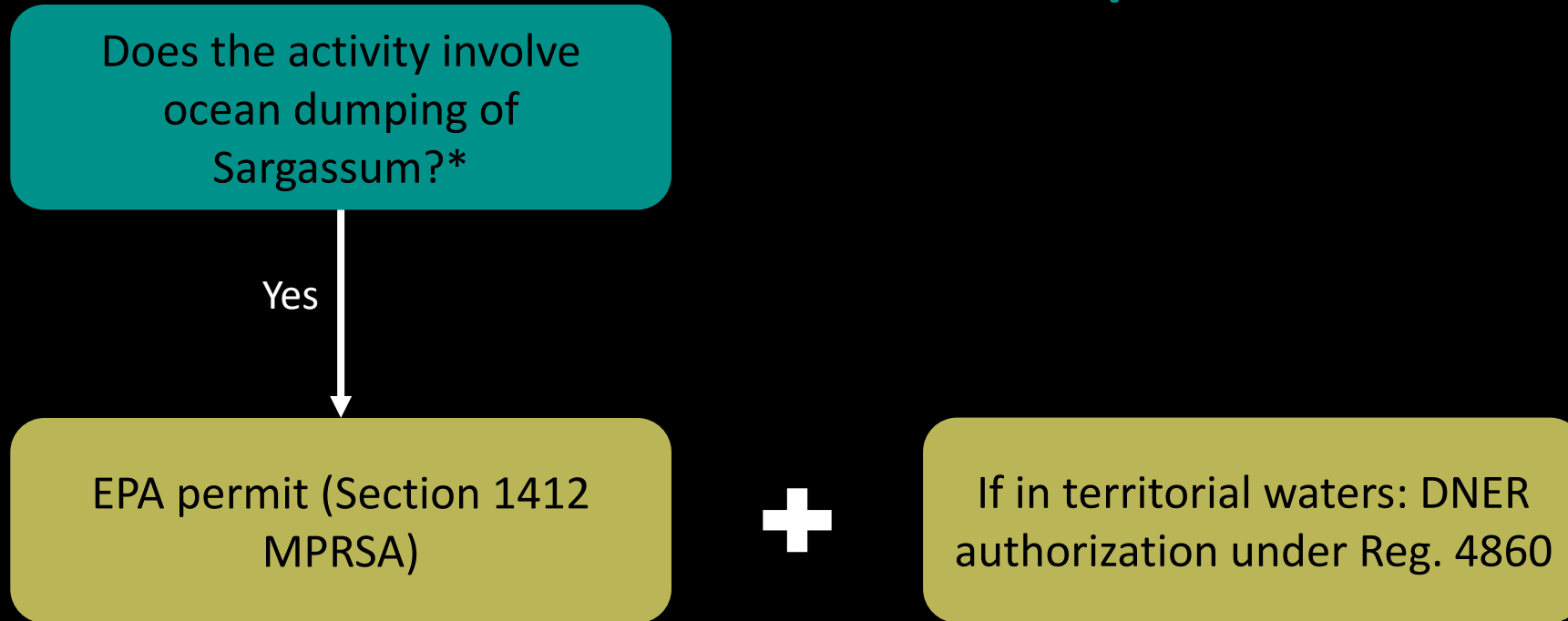
Rivers and Harbors Act (1899)

Robert T. Stafford Disaster Relief and Emergency Assistance Act (1988)

Sargassum Removal Flowchart



Sargassum Ocean Disposal Flowchart



* Does not include the transportation and ocean dumping of dredged material as defined by USACE and EPA. If the activity involves dredging of sediments from the seabed it may require USACE permits from CWA Section 404 and MPRSA Section 103.



THE UNITED STATES VIRGIN ISLANDS
OFFICE OF THE GOVERNOR
GOVERNMENT HOUSE
Charlotte Amalie, V.I. 00802
340-774-0001

EXECUTIVE ORDER NO. 523 – 2022

ORDER AND PROCLAMATION
BY THE GOVERNOR
OF THE UNITED STATES VIRGIN ISLANDS
DECLARING A STATE OF EMERGENCY IN THE
UNITED STATES VIRGIN ISLANDS
DUE TO UNPRECEDENTED INFLUX OF SARGASSUM SEAWEEED
AFFECTING THE TERRITORY'S WATER SUPPLY

WHEREAS, Title 23, Section 1005(a), Virgin Islands Code, vests in the Governor the responsibility for meeting the dangers to the Territory of the United States Virgin Islands and its people presented by emergencies or major disasters; and

WHEREAS, sargassum is a free-floating pelagic seaweed which has had an unprecedented blooming due to the deforestation of the northern Amazon basin combined with the rapid expansion of agricultural fertilizers and nitrogen, and documented changes in sea temperatures; and

WHEREAS, the United Nations and the European Union through the One Shared Ocean Initiative predicts the level of nitrogen in the North Brazil Shelf will remain high in the coming decades promoting increased sargassum seaweed production; and

WHEREAS, the massive influx of sargassum seaweed on and around July 15 has had a negative impact on the Water Production Facility at the Virgin Islands Water and Power Authority (VIWAPA) Estate Richmond Plant on the island of St. Croix, resulting in challenged intake pump efficiency from clogging, maximum filter backwashing, increased chlorine injection and threatened membrane and equipment failure; and

WHEREAS, the V.I. Water and Power Authority is at the maximum capacity in water production in gallons per day due to a 2022 long-standing drought in the territory and sargassum influx threatens production and the planned territorial management storage of water for the community for the 2022 hurricane season; and

WHEREAS, the Juan Luis Hospital requires a high standard of potable water for their dialysis patients and that standard is threatened by the sargassum influx; and

Robert T. Stafford Disaster Relief and Emergency Assistance Act

- Enacted in 1988 to provide assistance by the federal government to state and local governments in the case of an emergency or major disaster
- Criteria:
 - 1) an emergency or major disaster has occurred,
 - 2) needs exceed local government capabilities and resources,
 - 3) the local government has exhausted its emergency plan, dedicated its resources to respond, and agreed to cost-sharing requirements with the federal government.

Obstacles Between Agencies' Processes and Relevant Groups' Needs

Lack of knowledge of
required permits

Participants' Main Recommendations

Create a territory-wide plan to respond to sargassum influxes

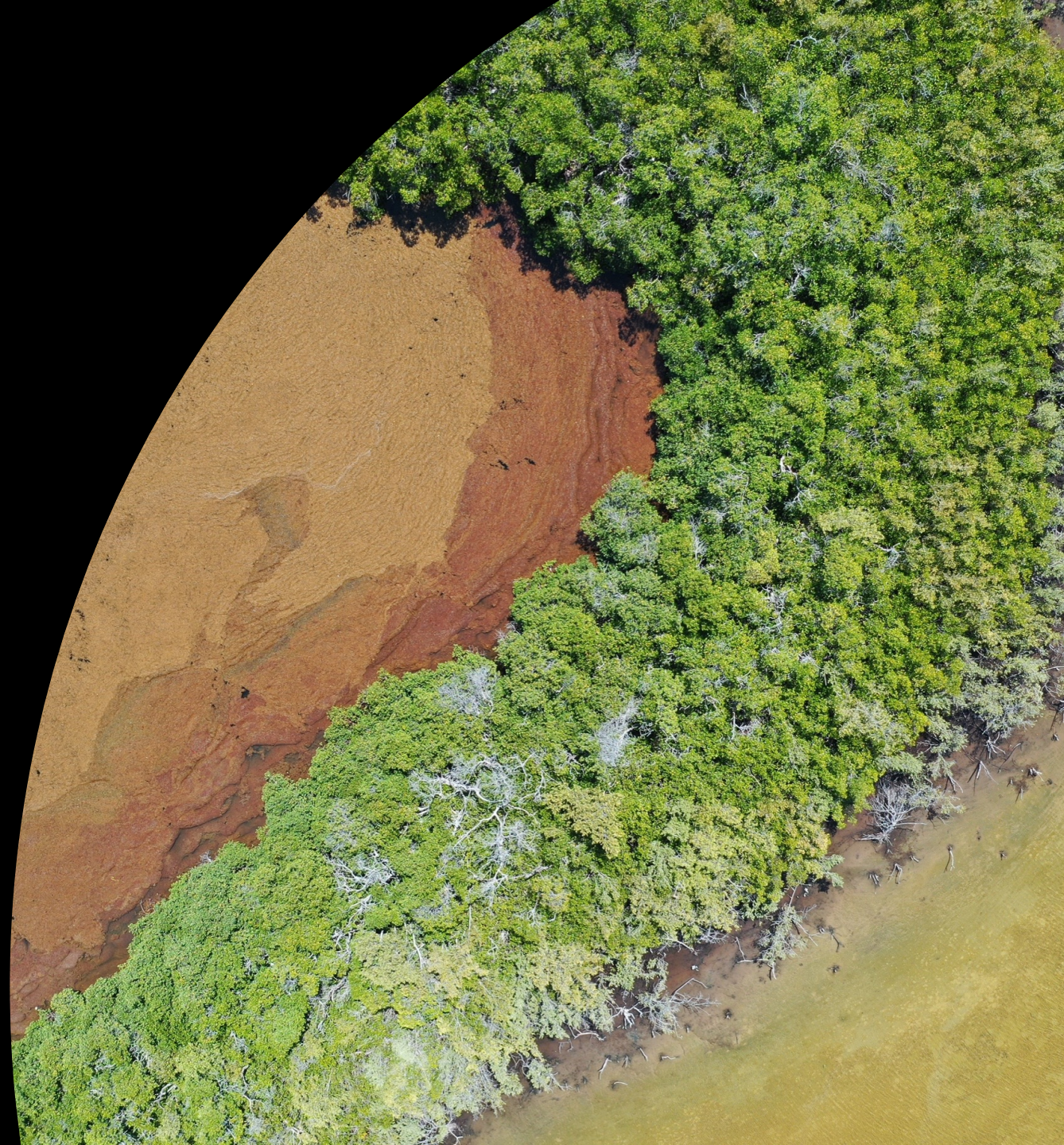
Develop plans and permits application packages for priority areas where sargassum is a recurrent issue

Conduct workshops and round tables with agencies to further clarify the sargassum legal regime in Puerto Rico

Create a website (one-stop-portal) to share permitting information about sargassum

Next Steps

- Legal aspects of sargassum disposal on land and sargassum processing
- Manuscript in collaboration with agencies and other relevant groups
- Short/summarized publication with Puerto Rico Sea Grant



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