GOOS webinar

Seagrass Synergy: Collaborate for Global Observing and Understanding

27 March 2024 | 15:00 CET

Emmett Duffy
Smithsonian Institution

Lina Mtwana Nordlund
Uppsala University

Join at
slido.com
#1907 922

The Global Ocean Observing System

UPPSALA UNIVERSITET

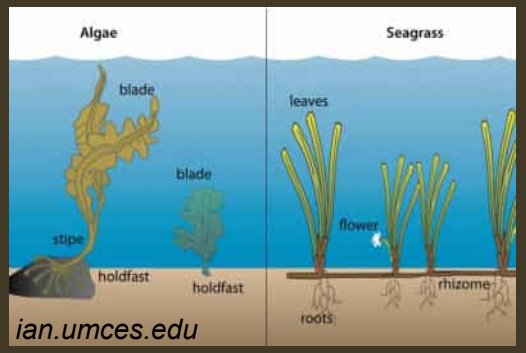
Smithsonian

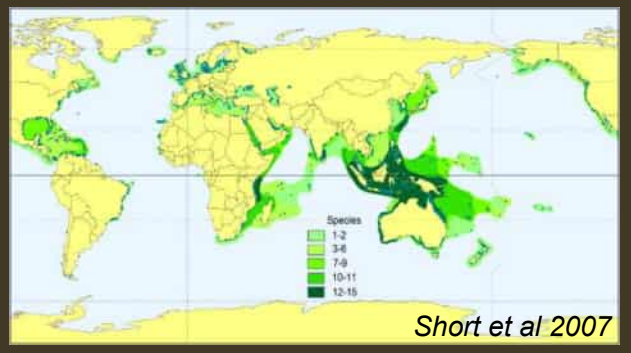
MarineGEO
THE TENNENBAUM MARINE OBSERVATORIES NETWORK

MBON
Marine Biodiversity Observation Network

BioEcOcean

Seagrass


Algae
Seagrass
blade
blade
stipe
holdfast
holdfast
leaves
flower
rhizome
roots
ian.umces.edu


Species
1-2
3-6
7-9
10-11
12-15
Short et al 2007

Seagrass is important to nature and people

Photos by Benjamin L. Jones on Unsplash

Seagrass is important to nature and people

Biodiversity

Fisheries

Effective carbon sequestration and storage

Seagrass is important to nature and people

Biodiversity

Fisheries

Effective carbon sequestration and storage

Coastal protection

Improved water quality

Credit: Ben Jones / Ocean Image Bank

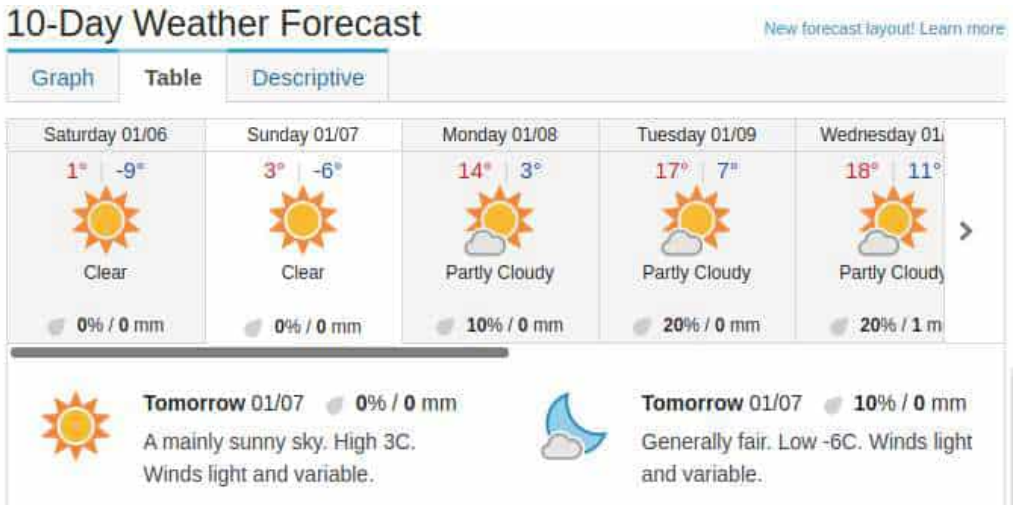

#bugDreamer
Credit: Marcelo Johan Ogata / Ocean Image Bank

Imagine…

What if…
…we had comparable seagrass data around the world?

Credit: Ben Jones / Ocean Image Bank

Essential Variables
Did you check the weather?



What if we didn't have open temperature data?

Essential Variables

Measuring everything at all times is just not feasible

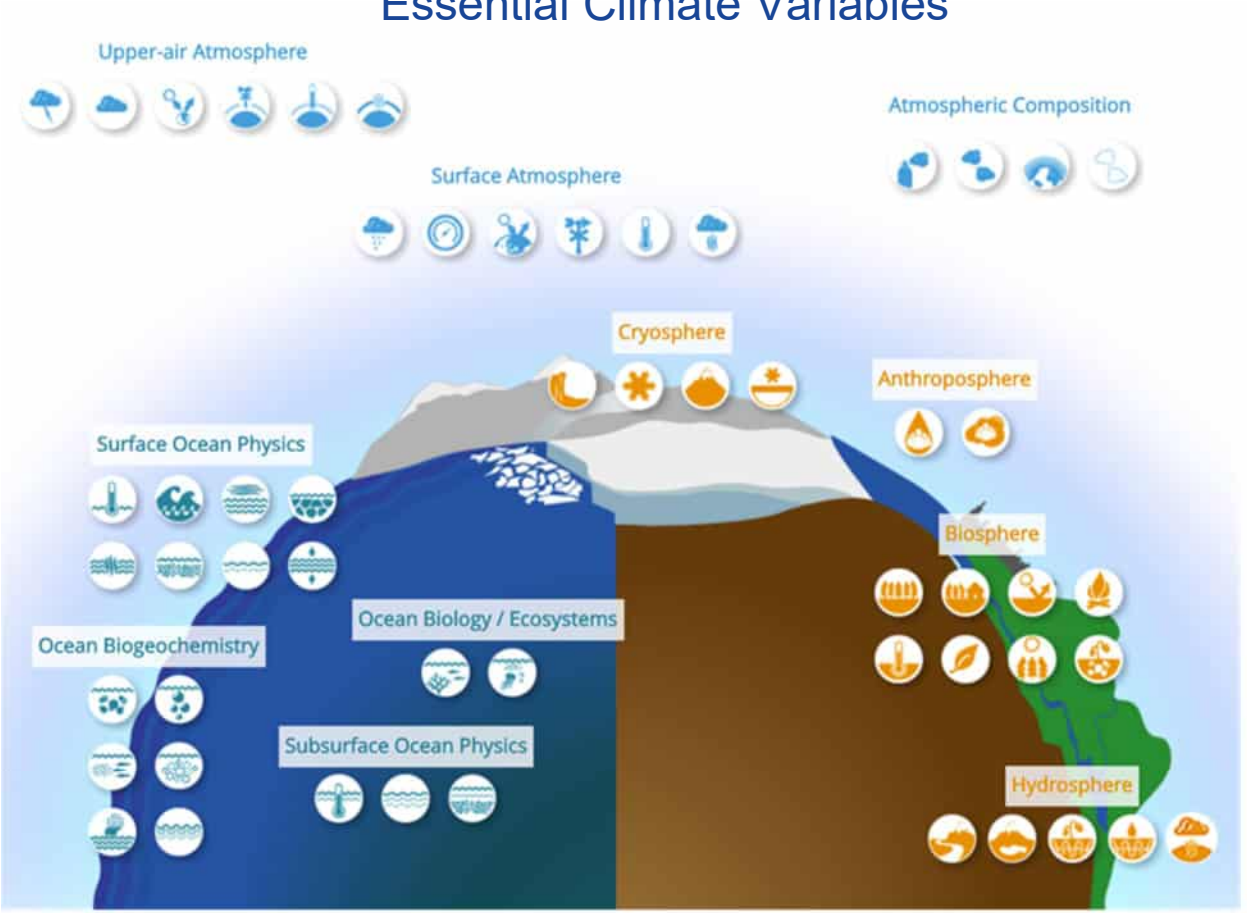
Too expensive

Too time consuming

The Essential Variables are a (representative) selection

Essential **Ocean** Variables

Specific for the ocean



The Global Ocean Observing System (GOOS), IOC-UNESCO

The Essential Ocean Variable (EOV) framework aspires to make a coordinated system by delivering specification sheets instructing which variables to measure and highlighting the importance of transparency of data

Sponsored by

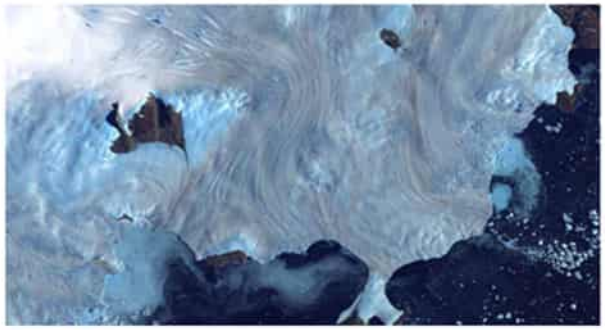
unesco Intergovernmental Oceanographic Commission

WORLD METEOROLOGICAL ORGANIZATION

UN environment programme

International Science Council

The Global Ocean Observing System (GOOS), IOC-UNESCO



Physics and climate

Focuses on physical processes and their role in forecasting ocean conditions inc. circulation patterns, interactions with the atmosphere and heat transport and storage.

Biogeochemistry

Aims to establish the qualitative and quantitative role of the marine carbon and biogeochemistry system and its impact on climate and ocean life.

Biology and ecosystems

Provides a better, clearer understanding of ocean ecosystems and helps create a fit-for-purpose global biological and ecosystem observation network.

Biology and Ecosystems

Biology and Ecosystems Panel

Seagrass Cover and Composition

Seagrass is an Essential Ocean Variable

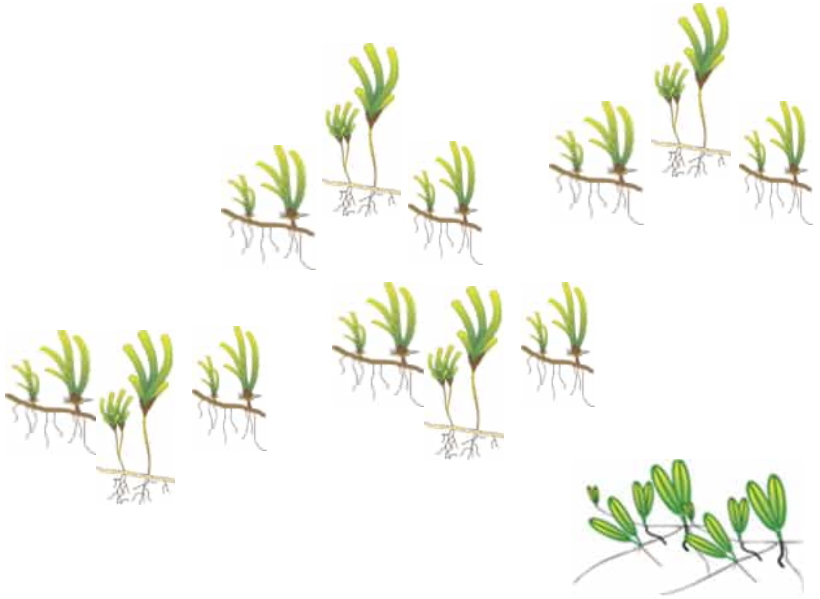
Seagrass meadows are excellent ecosystem engineers and promote biodiversity

Seagrass is an Essential Ocean Variable

The Seagrass Essential Ocean Variable is established and under further development
Led by Emmett Duffy and Lina Mtwana Nordlund + interested stakeholders

Seagrass % cover
Seagrass species composition

+ other recommended variables



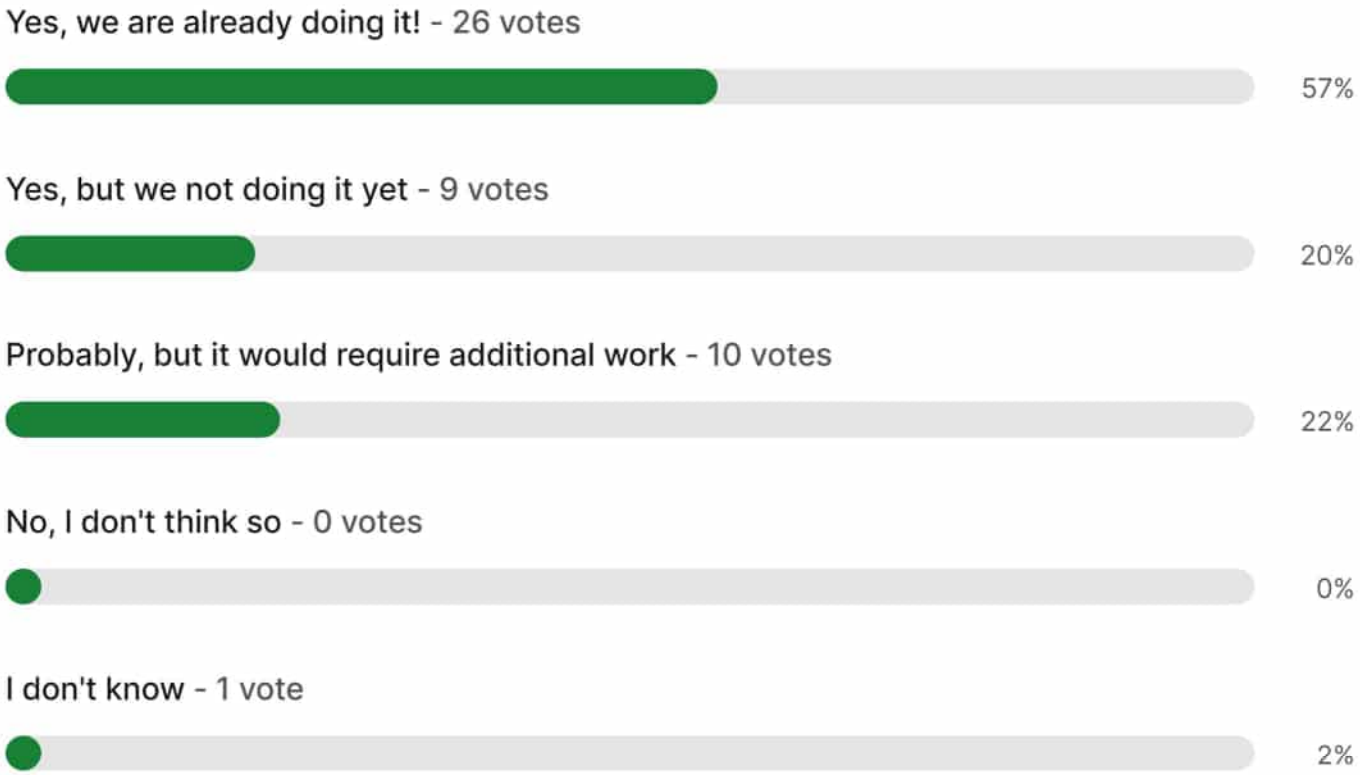
slido

Do you think it is possible to measure seagrass % cover and species composition in your environment and setting?

ⓘ Start presenting to display the poll results on this slide.

Do you think it is possible to measure seagrass % cover and species composition in your environment and setting?

Multiple Choice Poll | 46 votes | 46 participants

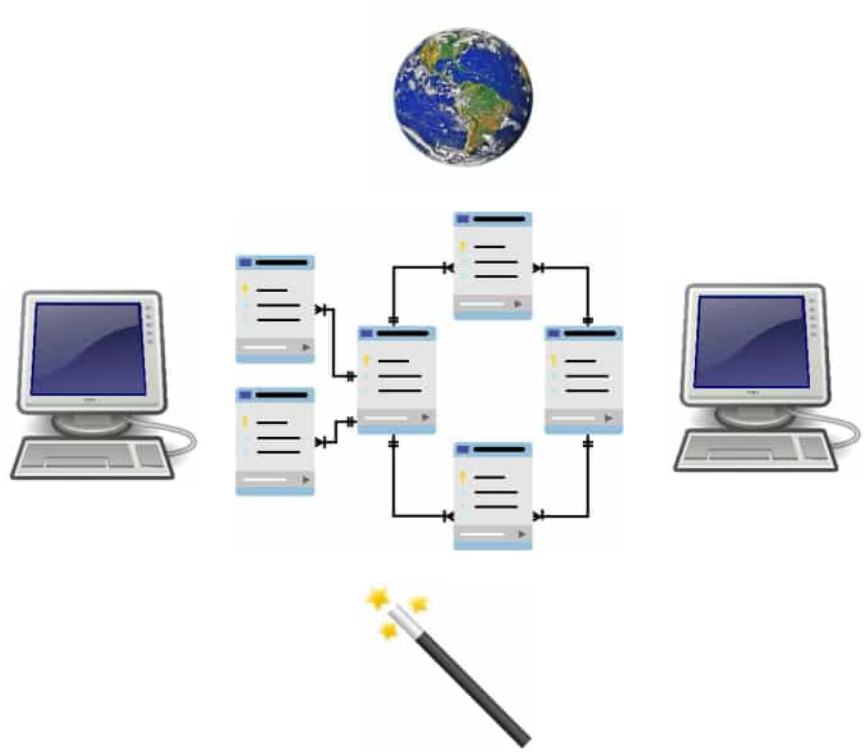


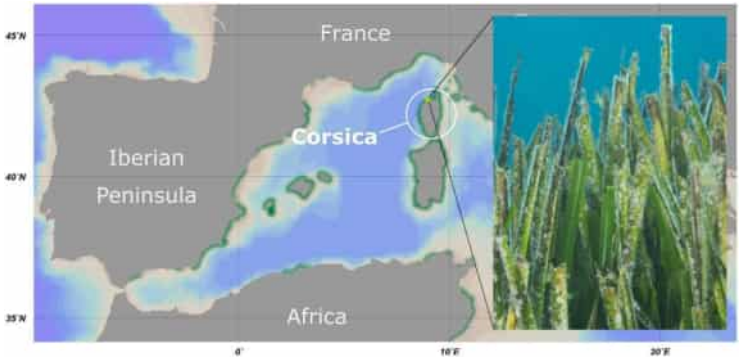
Imagine…

What if…
…we had comparable seagrass data around the world?

Credit: Ben Jones / Ocean Image Bank

Sustained monitoring
All observations





Seagrass % cover
Seagrass species composition
+ other variables

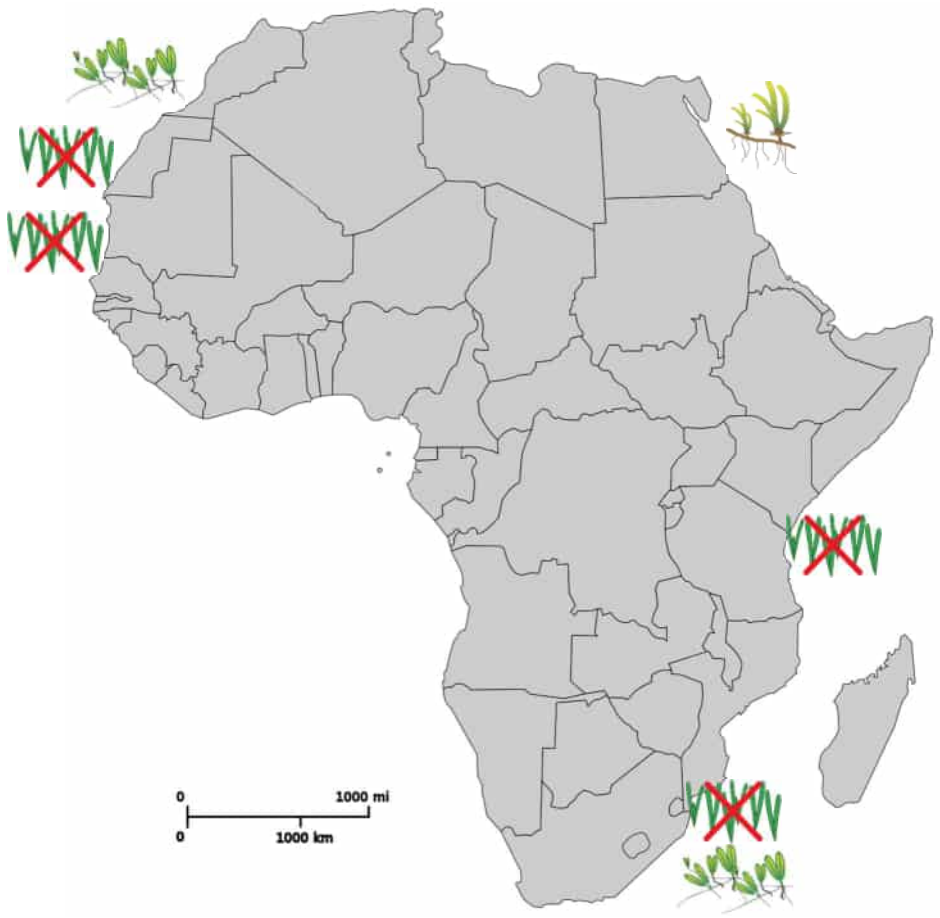
Why Collaborate?

Why not?
- Already established monitoring program…

But the benefits!

Sustained monitoring + observations
Early signals
National and regional understanding

Come together as a global community!

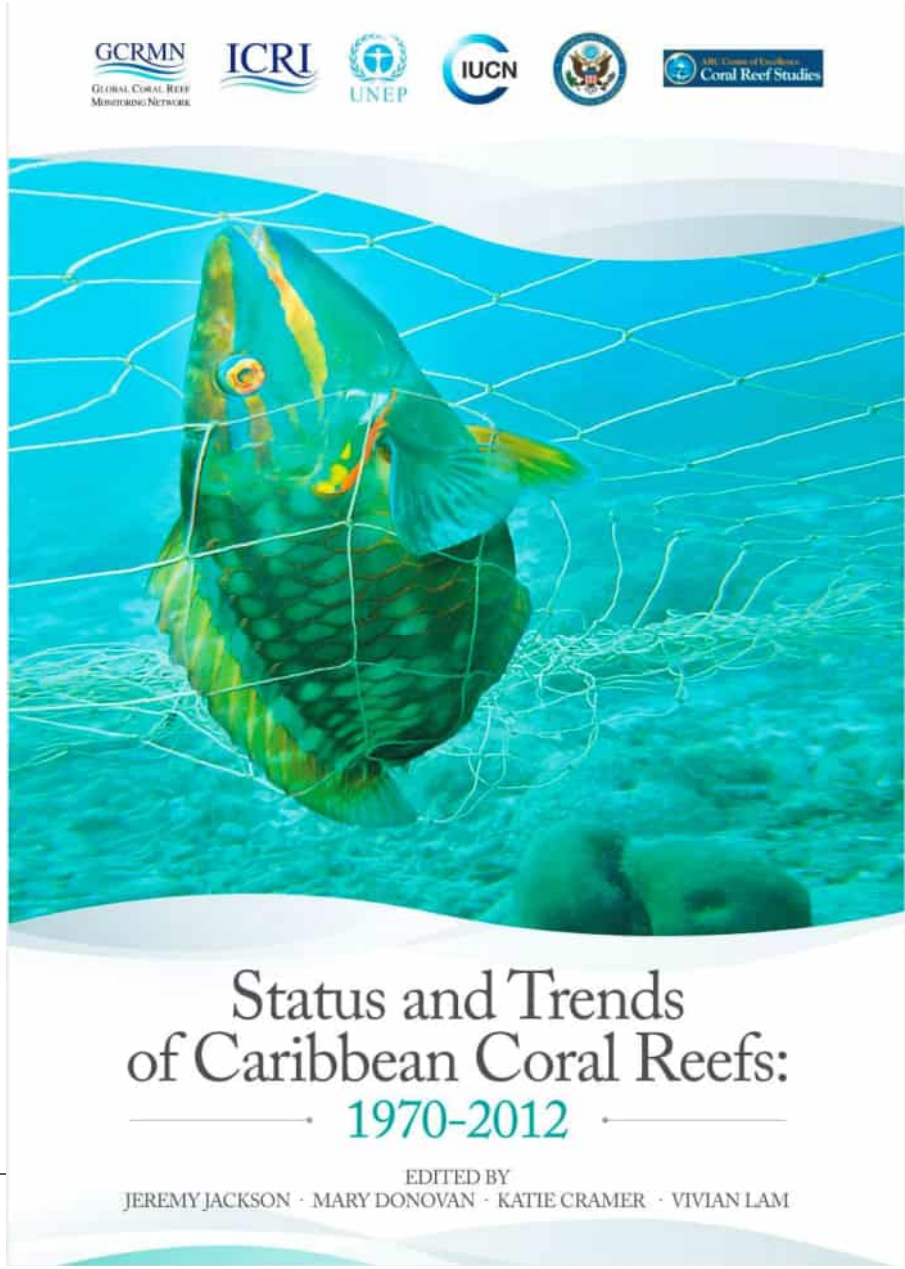


We need bio-eco standards

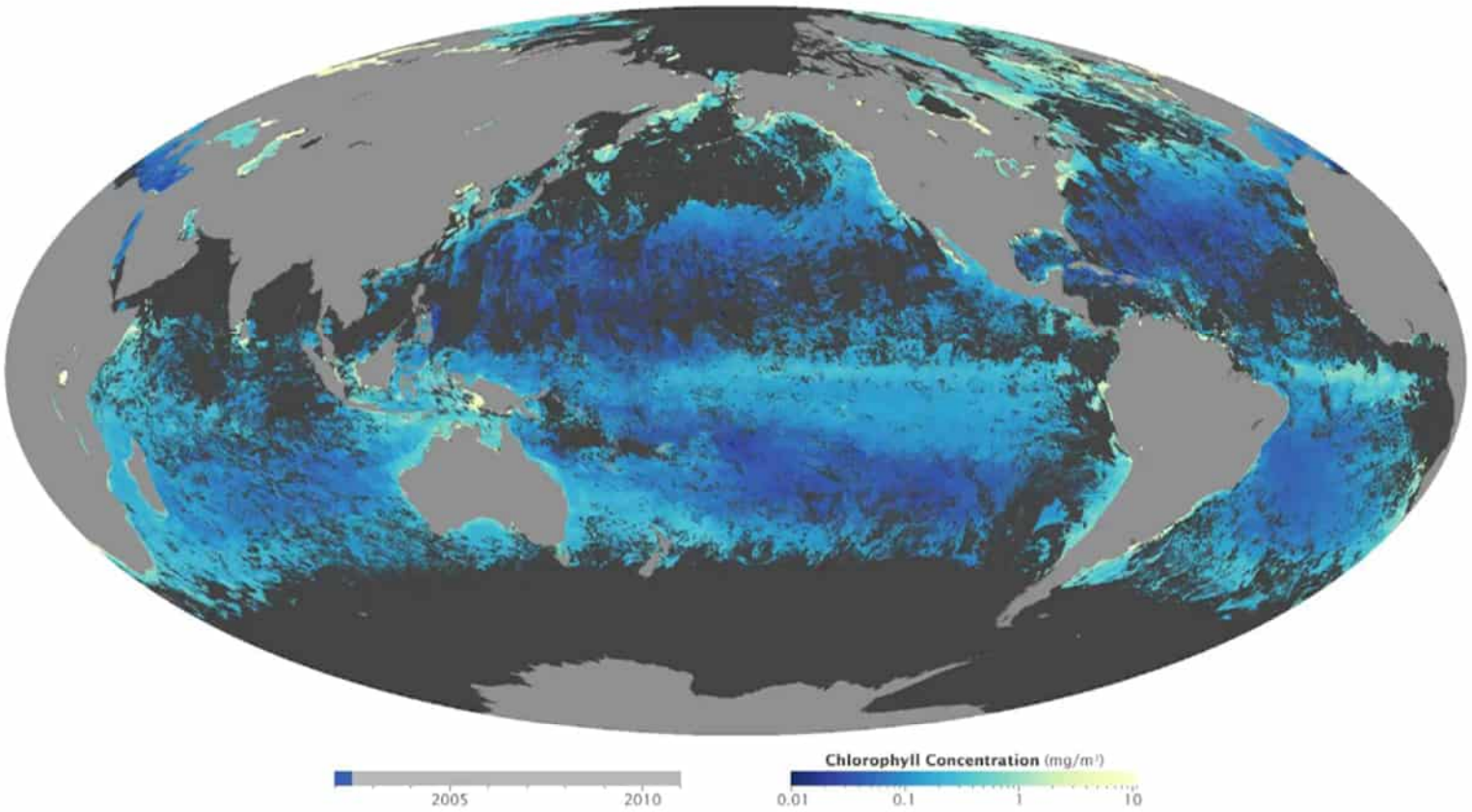
"There is an urgent need to develop simple, standardized monitoring protocols to assess in real time the condition of reefs …

it took nearly two years to begin to use [the data] reliably because of the diversity of metrics, formatting errors, and internal inconsistencies. ***Much of the data was unusable*** because we could not verify locations, depths, and missing metadata. ***The situation is inexcusable and no one should ever have to go through such an exercise again.***"

Jackson et al. 2014
Status and trends of Caribbean Coral Reefs, 1970-2012



Standards revolutionized ocean understanding



The vision: C-GRASS

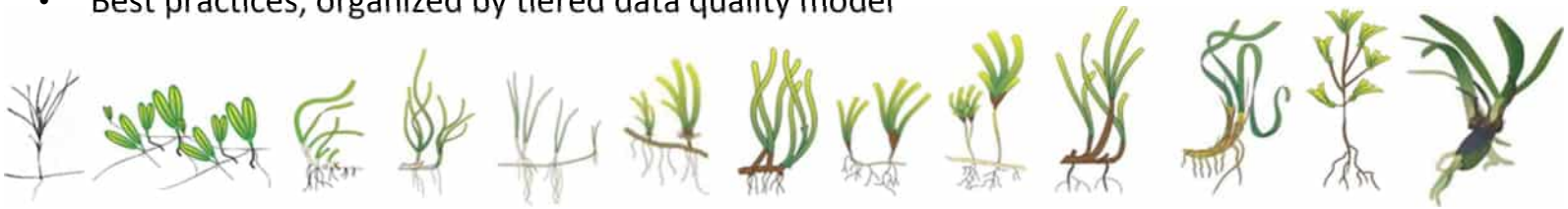
(Coordinated Global Research Assessment of Seagrass Systems)

A rigorous, dynamic picture of global seagrass status and trends …

and a global Community of Practice that stewards it for the public good.

History of progress on seagrass standards

- **Seagrass networks established, coordinating standardized surveys**
  - Seagrass-Watch (1998)
  - SeagrassNet (2000)
  - Smithsonian MarineGEO (2013)
- **Essential Ocean Variable (EOV) concept developed**
  - Framework for Ocean Observing proposes EOVs (2009)
  - Global Ocean Observing System (GOOS) Biology & Ecosystem panel established (2015)
  - Biological and ecosystem EOVs drafted (2016)
- **Global coordination and consultation around seagrass cover and composition" EOV**
  - Coordinated Global Research Assessment of Seagrass Systems (C-GRASS) funded by SCOR (2019)
  - C-GRASS group proposes seagrass data schema, best practices, Community of Practice
  - Consultations with seagrass community: OceanObs (2019), SeaPlants (2019), ISBW (2022)
- **Proposed global standards for seagrass cover and composition EOV (MS in prep)**
  - Data schema linked to OBIS
  - Best practices, organized by tiered data quality model

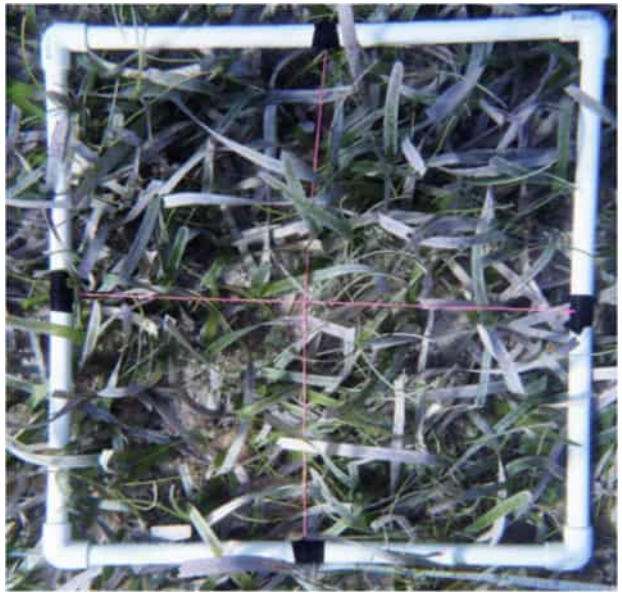


Seagrass EOV: Minimum requirements

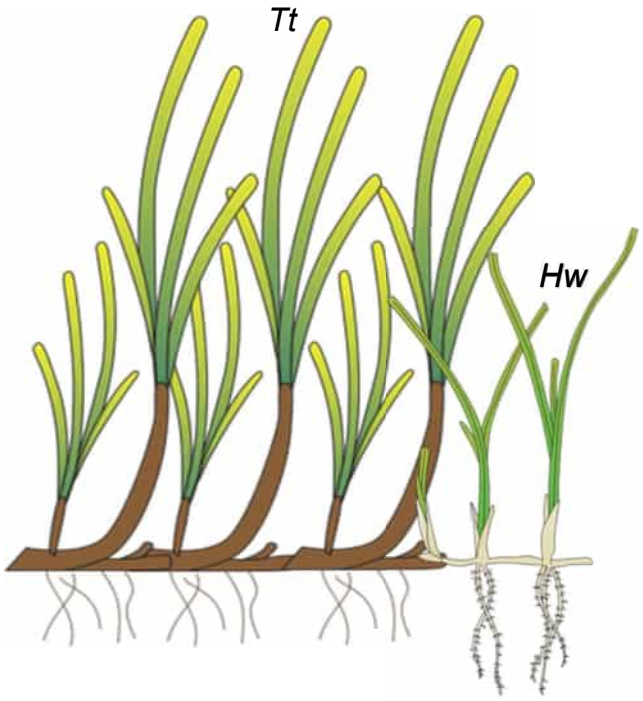
Quality level 1: Seagrass cover and species composition

Seagrass
Cover and composition

Percent cover



Species composition

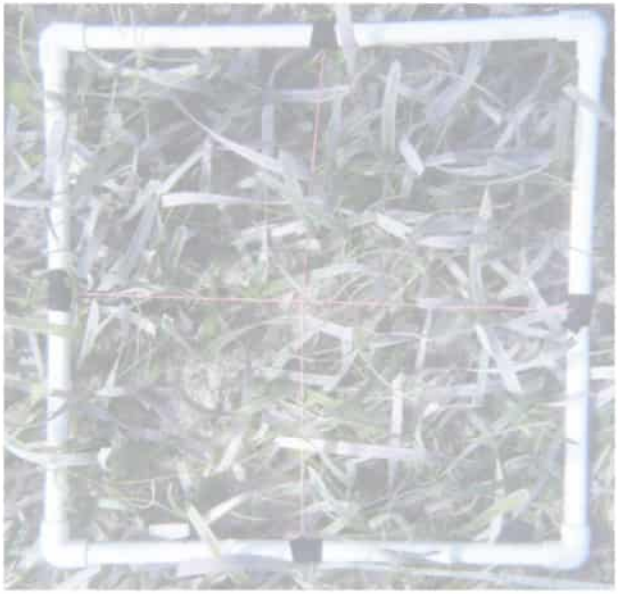


Measuring seagrass EOV: Refinement

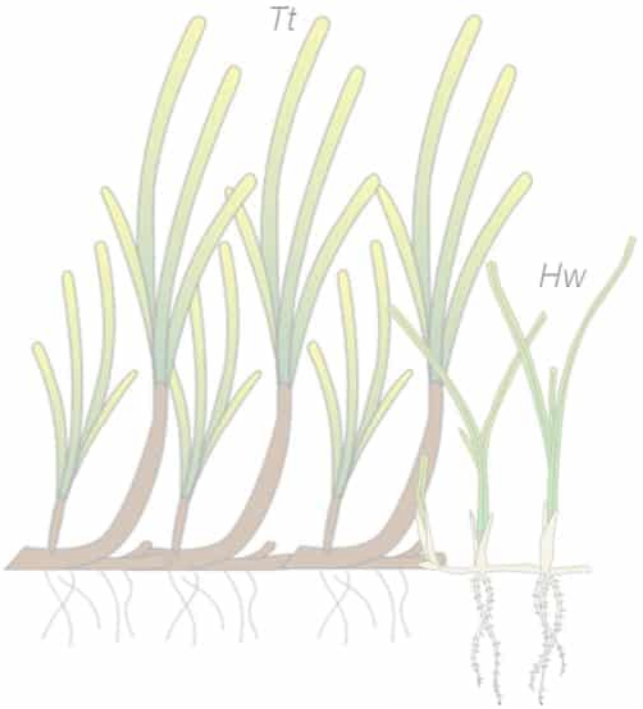
Quality level 2: (+) *Seagrass density and canopy height*

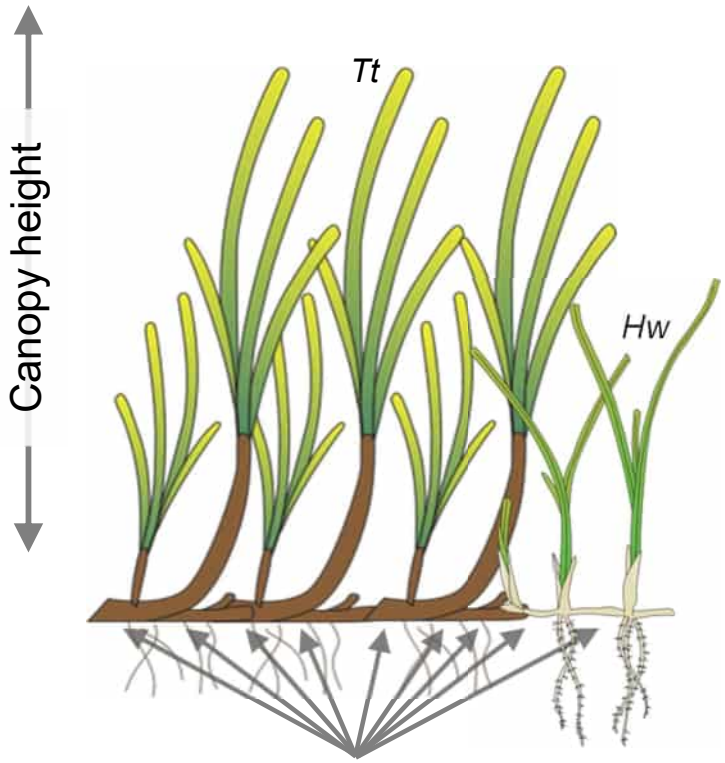
Seagrass
Cover and composition

Percent cover



Species composition





Measuring seagrass EOV: The ecosystem

(+) EOVs for *macroalgae, fishes, invertebrates ...*

Measuring seagrass EOV: Data quality model

EOV name	Description	Data quality levels
EOV: Seagrass cover and composition	• Seagrasses are the key indicator of seagrass ecosystem health. • Habitat value determined by species, and their three-dimensional growth form	1. **Total seagrass cover** (%), proportional cover by **species** or functional group 2. + Seagrass habitat structure: shoot **density** and **canopy height**
EOV: Algal cover and composition (*in development*)	• Algae compete with seagrasses and provide food for animals. Algal cover is the aggregated cover of all algal forms. • Fleshy, macro and turf algae are competitors of seagrasses. • Abundance of algae is sometimes measured destructively as biomass.	1. Suggested: **Total algal cover** (%) 2. + Suggested: cover by **functional group** (fleshy/macro, micro/filamentous, and calcareous) 3. + Suggested: **Biomass of algae**
EOV: Fish abundance and diversity (*in development*)	• Fish play many functional roles. • Monitoring programs often focus on a subset of families or target species depending on monitoring aims.	• Levels not yet assigned. Most basic is **abundance of key taxa**, most complex is abundance and biomass of all species.

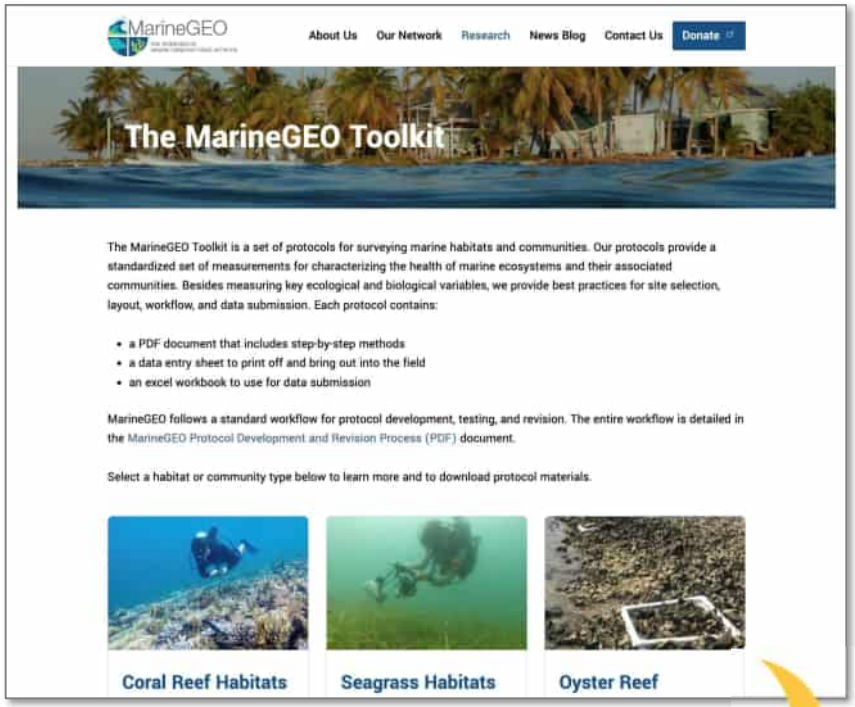
Adapted from: Obura et al. 2019. *Frontiers in Marine Science 6*: 580.

How to measure the seagrass EOV?

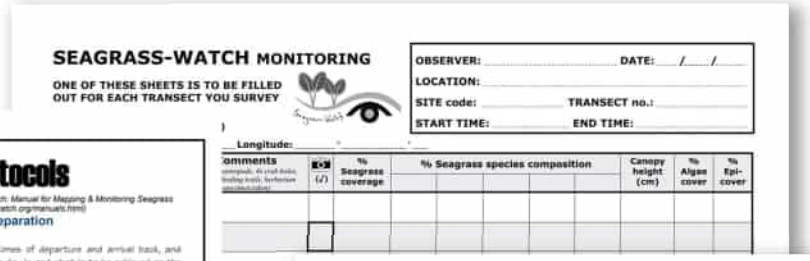
Seagrass
Cover and composition

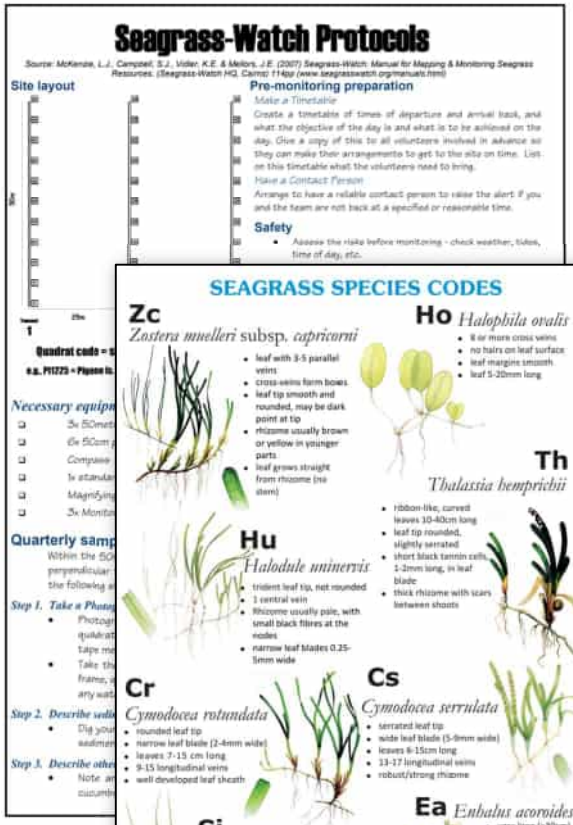
Standard seagrass protocols

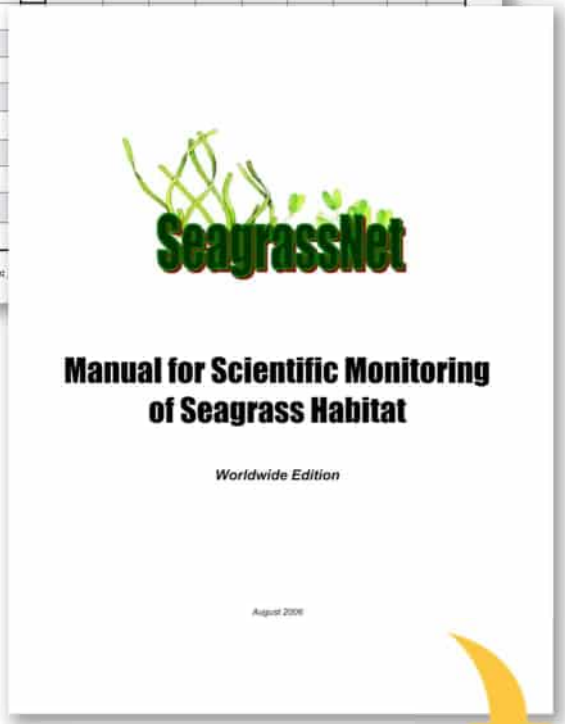
https://www.seagrasswatch.org/manuals



https://marinegeo.si.edu/research/marinegeo-toolkit







https://www.seagrassnet.org/

Seagrass protocols made (*somewhat*) easy

Protocol (SOP)

MarineGEO

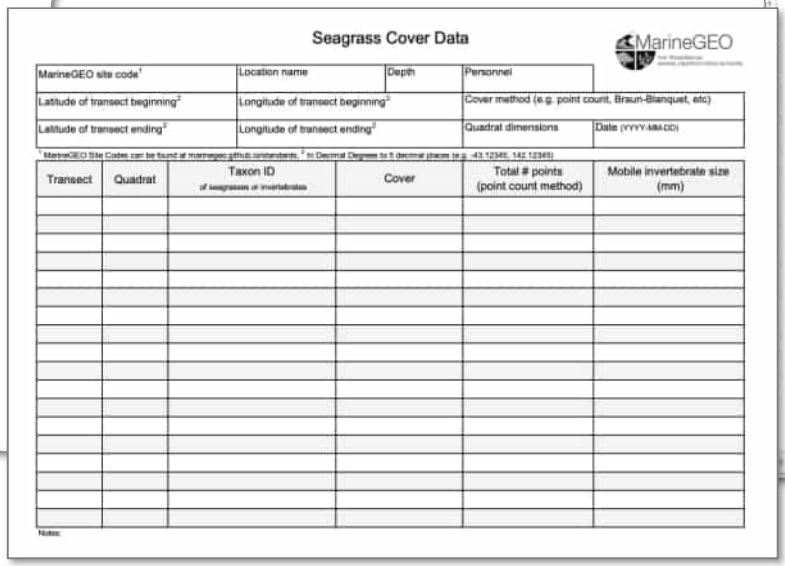
Seagrass Cover and Density

MarineGEO Seagrass Cover and Density Protocol

How to cite this work: Seagrass Habitat Monitoring Protocol (2021) Lefcheck, Jonathan, Tennenbaum MarineObservatories Network, MarineGEO, Smithsonian Institution.
https://doi.org/10.25573/serc.14925114.v1

MarineGEO
THE TENNENBAUM MARINE OBSERVATORIES NETWORK
Smithsonian Institution

Field data sheet



Seagrass Cover Data

MarineGEO

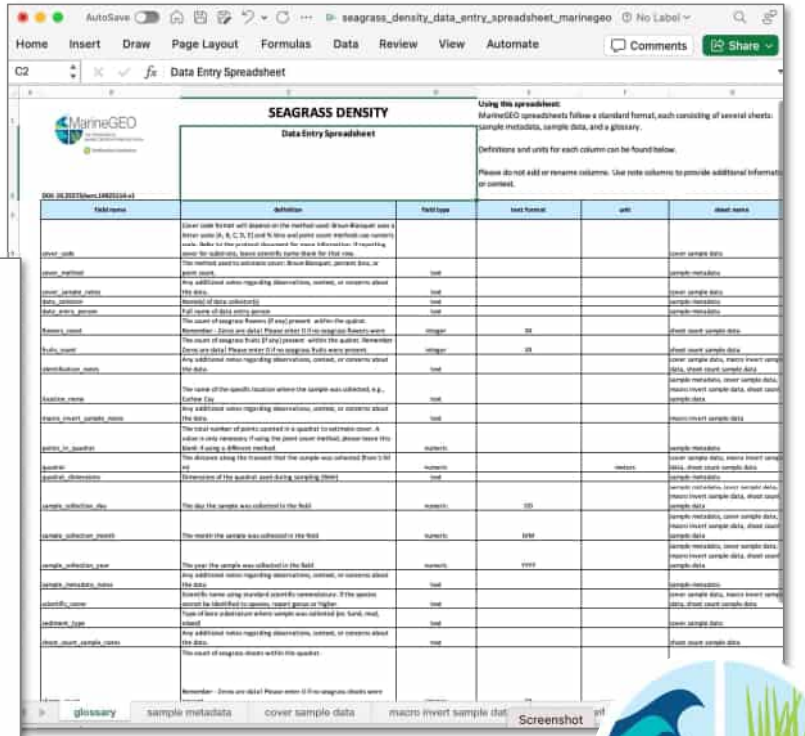
MarineGEO site code[1]	Location name	Depth	Personnel
Latitude of transect beginning[2]	Longitude of transect beginning[2]	Cover method (e.g. point count, Braun-Blanquet, etc)	
Latitude of transect ending[2]	Longitude of transect ending[2]	Quadrat dimensions	Date (YYYY-MM-DD)

[1] MarineGEO Site Codes can be found at marinegeo.github.io/standards. [2] In Decimal Degrees to 5 decimal places (e.g. -43.12345, 142.12345)

Transect	Quadrat	Taxon ID (of seagrasses or invertebrates)	Cover	Total # points (point count method)	Mobile invertebrate size (mm)

Notes:

Data entry sheet



AutoSave seagrass_density_data_entry_spreadsheet_marinegeo

Home Insert Draw Page Layout Formulas Data Review View Automate Comments Share

C2 Data Entry Spreadsheet

SEAGRASS DENSITY

Data Entry Spreadsheet

Using this spreadsheet:
MarineGEO spreadsheets follow a standard format, each consisting of several sheets: sample metadata, sample data, and a glossary.

Definitions and units for each column can be found below.

Please do not add or rename columns. Use note columns to provide additional information or context.

glossary sample metadata cover sample data macro invert sample dat

Screenshot

Sharing: The seagrass EOV data schema*

** In development*

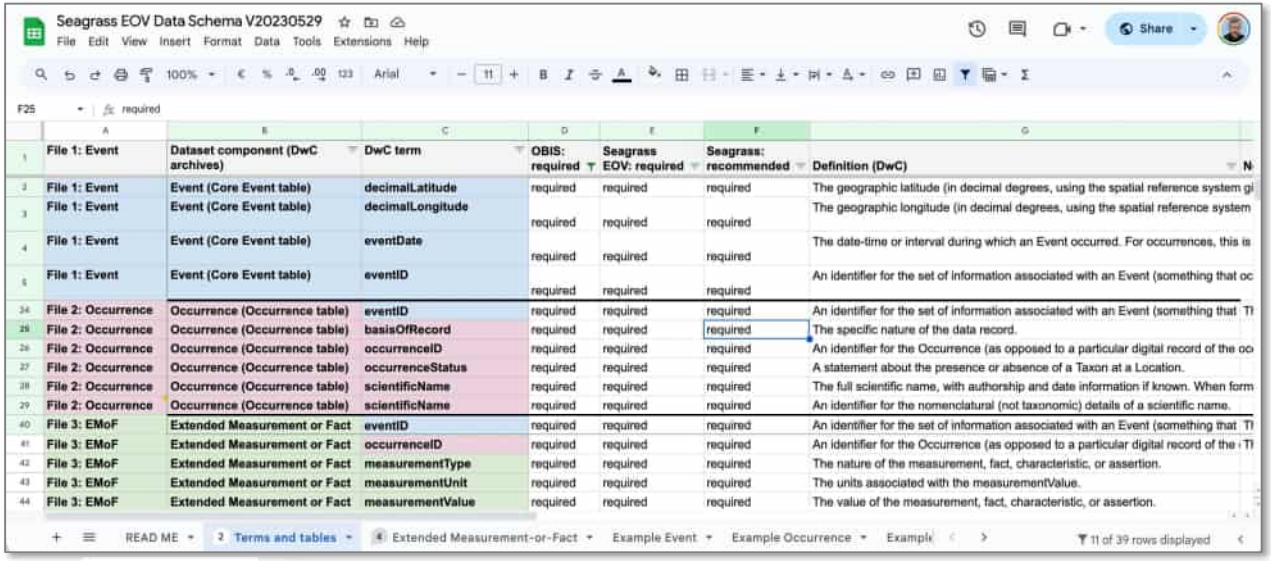
OBIS OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

Data submission pipeline

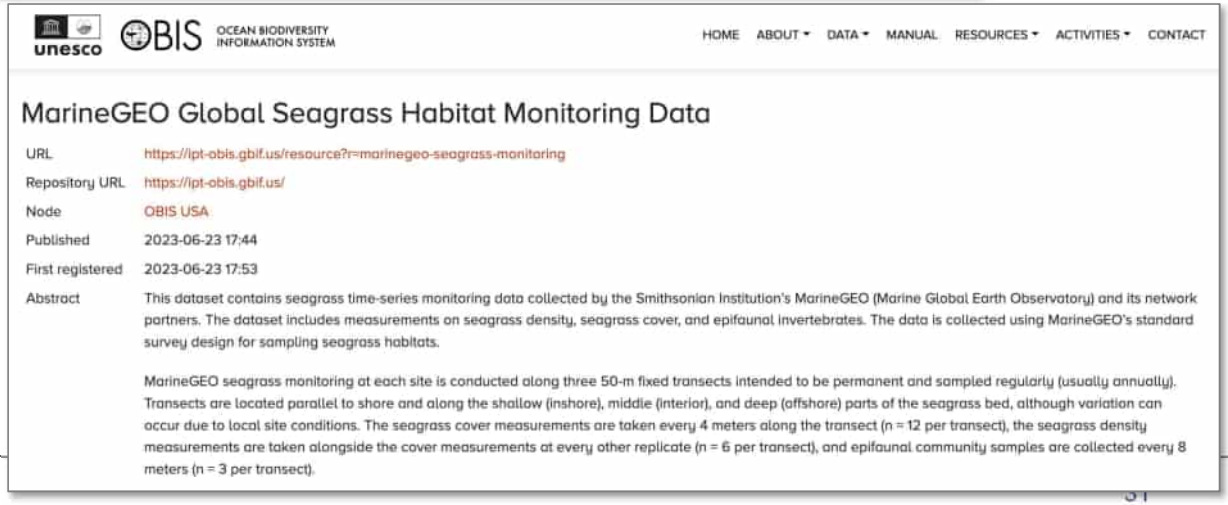
- Field > upload
- DwC-compliant
- Pairs w/ spec sheet
- Supports upload to OBIS

Components (tabs)

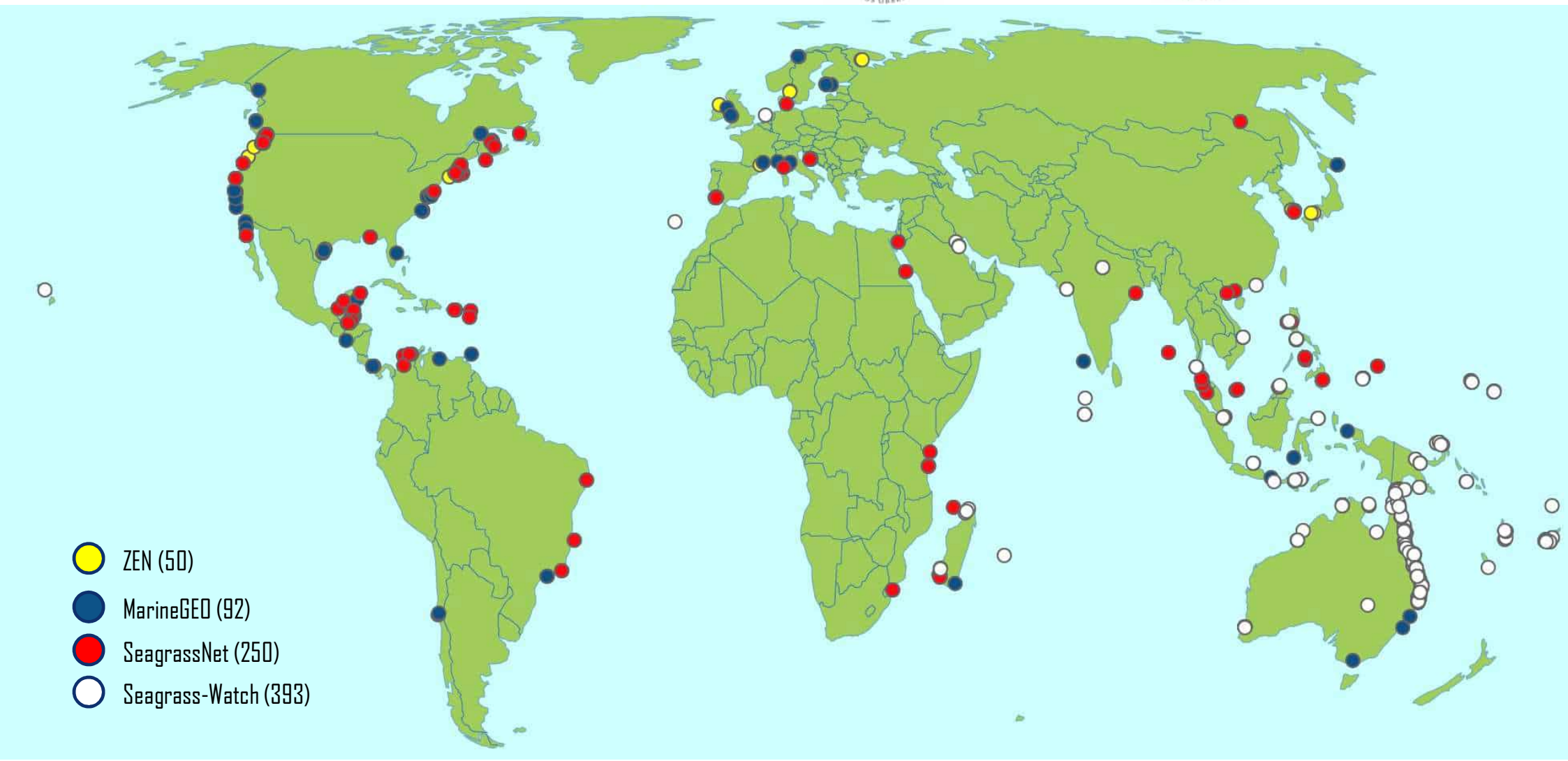
- Read Me
- Terms & tables
- Seagrass EMoF (traits)
- Examples



	File 1: Event	Dataset component (DwC archives)	DwC term	OBIS: required	Seagrass EOV: required	Seagrass: recommended	Definition (DwC)
2	File 1: Event	Event (Core Event table)	decimalLatitude	required	required	required	The geographic latitude (in decimal degrees, using the spatial reference system gi
3	File 1: Event	Event (Core Event table)	decimalLongitude	required	required	required	The geographic longitude (in decimal degrees, using the spatial reference system
4	File 1: Event	Event (Core Event table)	eventDate	required	required	required	The date-time or interval during which an Event occurred. For occurrences, this is
5	File 1: Event	Event (Core Event table)	eventID	required	required	required	An identifier for the set of information associated with an Event (something that oc
24	File 2: Occurrence	Occurrence (Occurrence table)	eventID	required	required	required	An identifier for the set of information associated with an Event (something that TI
25	File 2: Occurrence	Occurrence (Occurrence table)	basisOfRecord	required	required	required	The specific nature of the data record.
26	File 2: Occurrence	Occurrence (Occurrence table)	occurrenceID	required	required	required	An identifier for the Occurrence (as opposed to a particular digital record of the oc
27	File 2: Occurrence	Occurrence (Occurrence table)	occurrenceStatus	required	required	required	A statement about the presence or absence of a Taxon at a Location.
28	File 2: Occurrence	Occurrence (Occurrence table)	scientificName	required	required	required	The full scientific name, with authorship and date information if known. When form
29	File 2: Occurrence	Occurrence (Occurrence table)	scientificName	required	required	required	An identifier for the nomenclatural (not taxonomic) details of a scientific name.
40	File 3: EMoF	Extended Measurement or Fact	eventID	required	required	required	An identifier for the set of information associated with an Event (something that TI
41	File 3: EMoF	Extended Measurement or Fact	occurrenceID	required	required	required	An identifier for the Occurrence (as opposed to a particular digital record of the TI
42	File 3: EMoF	Extended Measurement or Fact	measurementType	required	required	required	The nature of the measurement, fact, characteristic, or assertion.
43	File 3: EMoF	Extended Measurement or Fact	measurementUnit	required	required	required	The units associated with the measurementValue.
44	File 3: EMoF	Extended Measurement or Fact	measurementValue	required	required	required	The value of the measurement, fact, characteristic, or assertion.



Linking: Network power!



Linking: *More networks!*

Going global: Community science

Seagrass Spotter

https://seagrassspotter.org/

Pipeline: Standards > Data system > Application

Standardized protocols


MarineGEO

Seagrass Cover and Density

MarineGEO Seagrass Cover and Density Protocol

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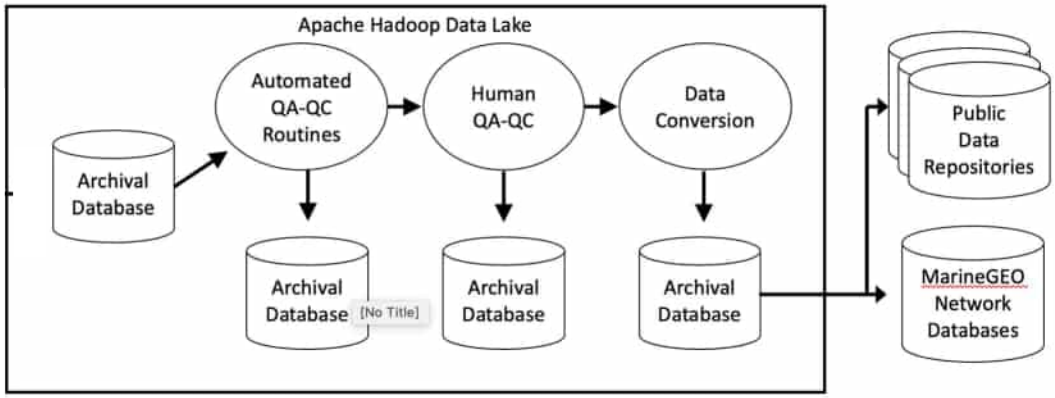
MarineGEO

THE TENNENBAUM MARINE OBSERVATORIES NETWORK

Smithsonian Institution

Shared data system

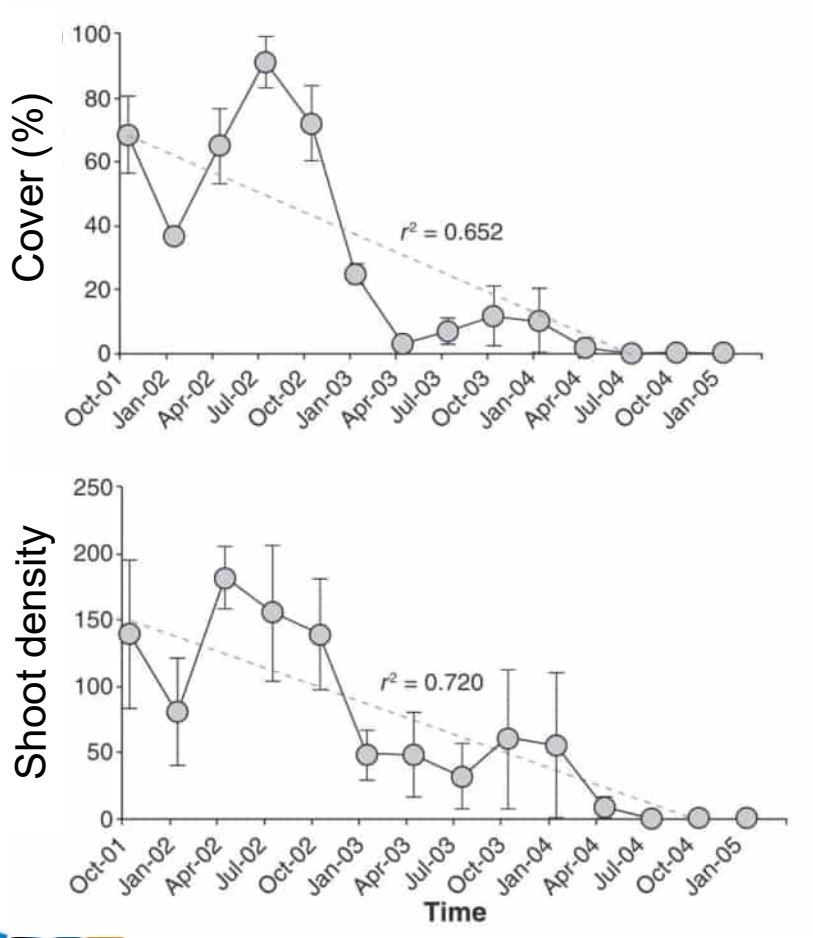


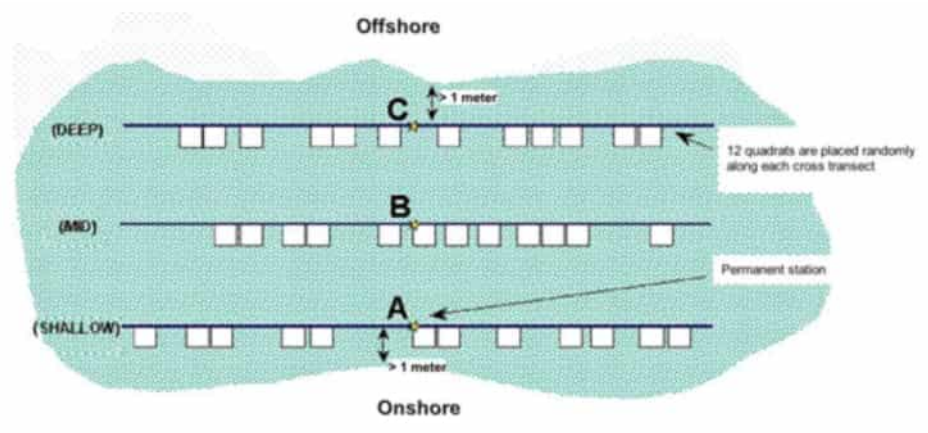
Global Science!

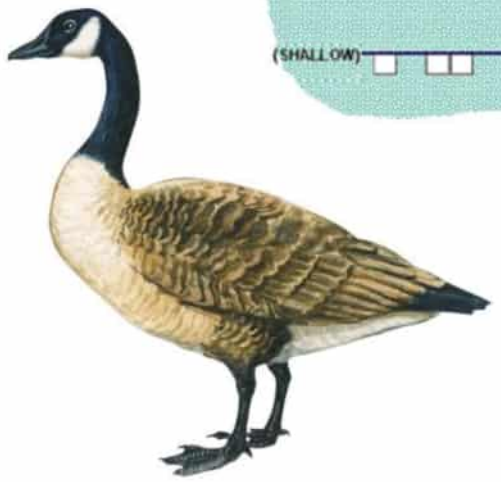
How can we use this data?

Results: Geese cause seagrass decline

SeagrassNet standard sampling: New Hampshire, USA, 4 yr



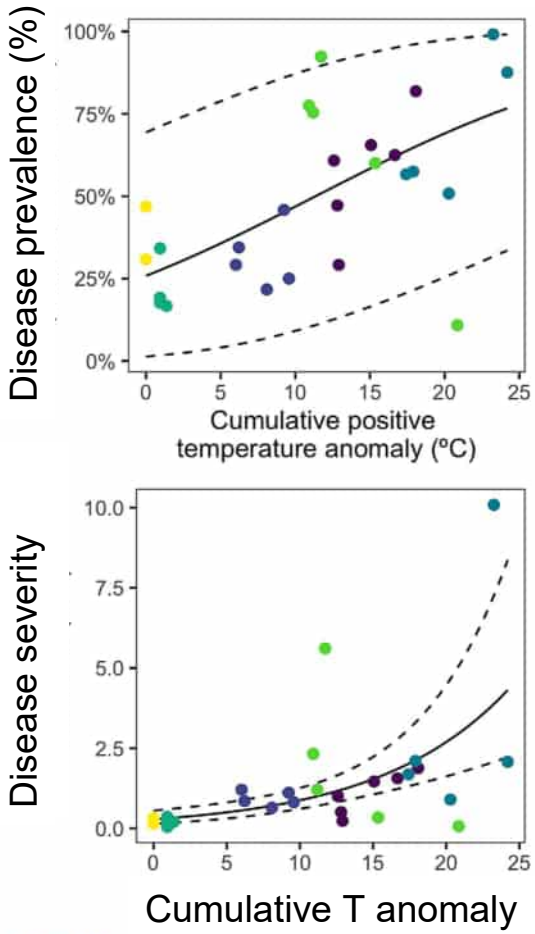


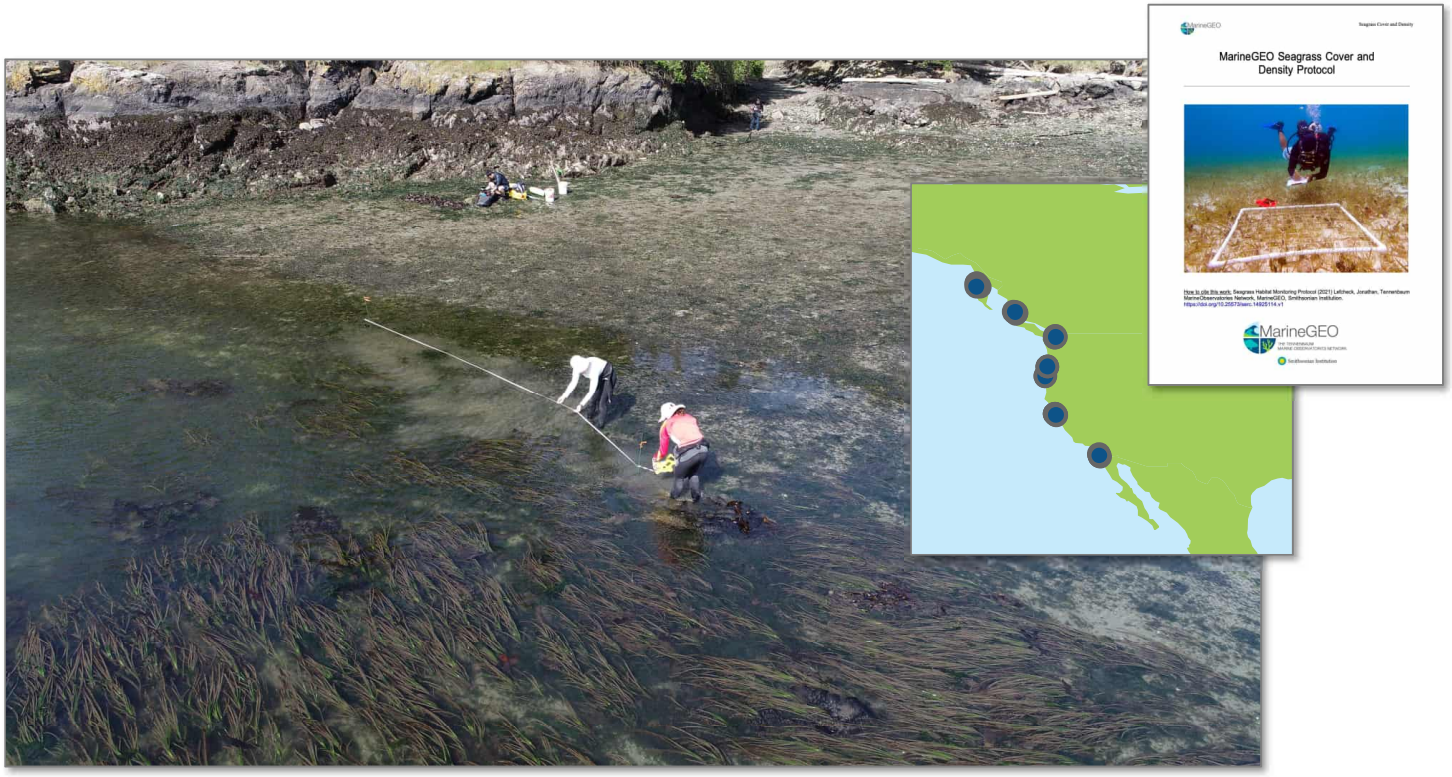


Short et al. 2006. *Marine Ecology* 27:277–289.

Results: Warming boosts eelgrass disease

MarineGEO standard sampling: W North America, 30 sites, 3 yr





Aoki et al. 2022. *Limnology and Oceanography* 67:1577-1589.

Go with the flow…

Standardized protocols

Seagrass EOV

Shared data system

Products & Benefits!

Invasive species alert

Seagrass degradation alert

Regional and global science

The Global Ocean Observing System

Thank you!

goosocean.org

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Smithsonian MarineGEO THE TENNENBAUM MARINE OBSERVATORIES NETWORK

BioEcOcean

unesco Intergovernmental Oceanographic Commission

WORLD METEOROLOGICAL ORGANIZATION

UN environment programme

International Science Council

MarineGEO toolkit

SeagrassNet manual

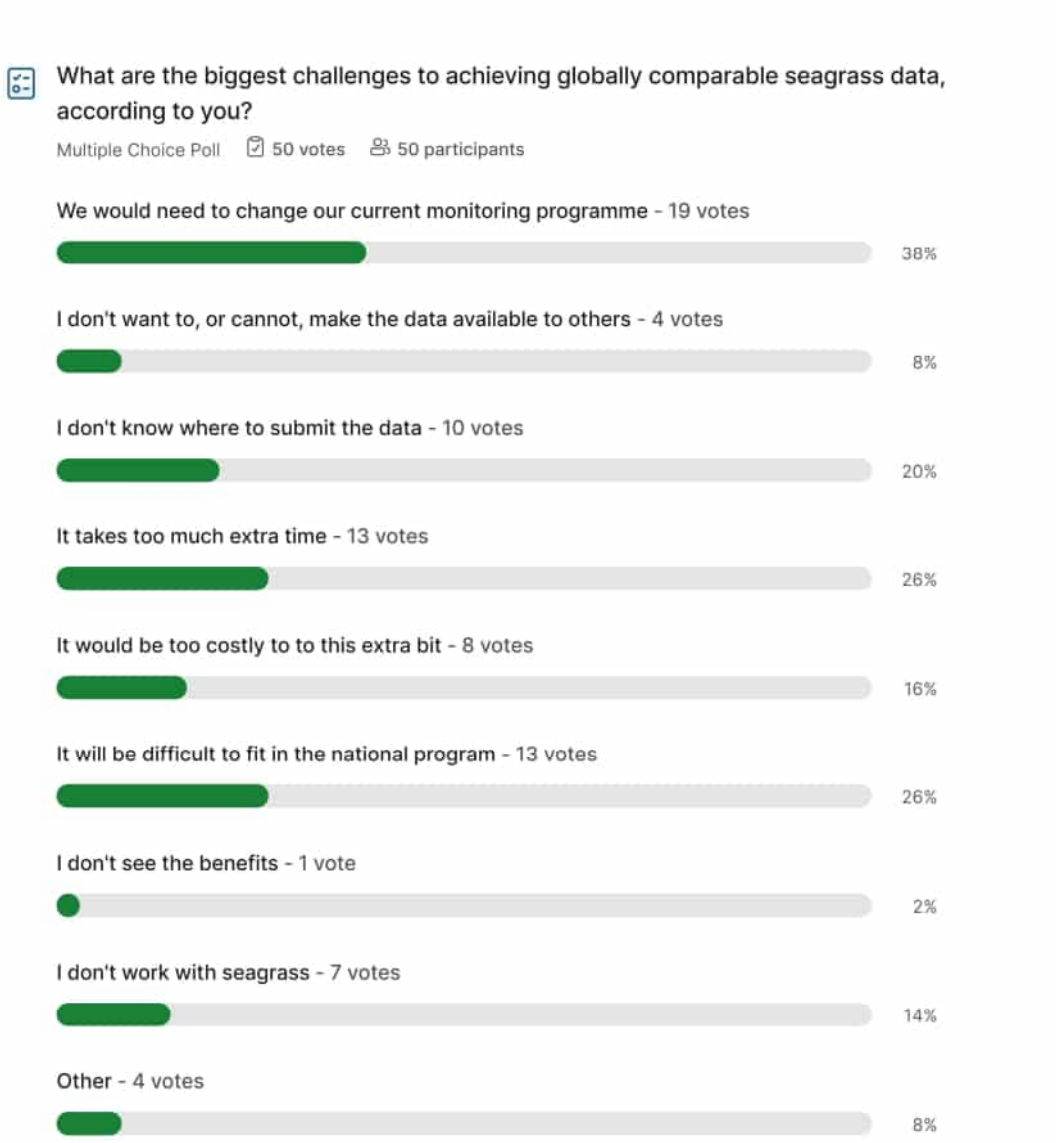
Seagrass-Watch manual

Seagrass Spotter app

slido

What are the biggest challenges to achieving globally comparable seagrass data, according to you?

ⓘ Start presenting to display the poll results on this slide.


What are the biggest challenges to achieving globally comparable seagrass data, according to you?
Multiple Choice Poll
50 votes
50 participants
We would need to change our current monitoring programme - 19 votes
38%
I don't want to, or cannot, make the data available to others - 4 votes
8%
I don't know where to submit the data - 10 votes
20%
It takes too much extra time - 13 votes
26%
It would be too costly to to this extra bit - 8 votes
16%
It will be difficult to fit in the national program - 13 votes
26%
I don't see the benefits - 1 vote
2%
I don't work with seagrass - 7 votes
14%
Other - 4 votes
8%

The benefits!

Think positive!

Dream big and bold!

Think about **seagrass**!

slido

What do you think is the biggest benefit of globally comparable seagrass data?

ⓘ Start presenting to display the poll results on this slide.

What do you think is the biggest benefit of globally comparable seagrass data?

Open text poll | 59 responses | 49 participants

Anonymous
Track changes globally and locally and enhancing our understanding of carbon cycling

Anonymous
Interpret local results (like variability and temporal trends) in a larger context

Anonymous
Seagrass data is important for marine organisms. And also reduce global sea problems.

Anonymous
Convince local policy makers that their conservation challenges might be shared with others.

Anonymous
We can solve problems much better working together

Anonymous
Global and regional patterns will emerge. So that we don't have a one-size-fits-all view of seagrass in management.

Anonymous
Groundtruthing tool

Anonymous
Feeding into climate adaptation targets, getting seagrass ecosystems recognised internationally, understanding national, regional and global extent. Huge benefit to this project in many ways

Anonymous
Understanding connecticity among local regional and global variations

Anonymous
Advantages in monitoring acrivities and consequent adaptive management plans

Anonymous
Use available data to support future proposal for projects in the area.

Anonymous
High resolution hyperspectral satellite imagery to map seagrass globally! This may also enable to map and identify threats such as macroalgae , often detrimental to seagrass.

Anonymous
Better communicate the importance of seagrass beds and raise awarness about disastrous consequences of their decline and take actions

Anonymous
I think it's a good opportunity to have a large-scale view of the global situation of seagrasses.

Anonymous
Climate change driven ecosystem shifts and concurrent species movement/displacement

Anonymous
To protect coastal marine biodivetsity, save the coastal ecosytem interactions beterden teresstrial and marine components

S
Spyros Christofilakos
Insight for flobal decision and policy-making

Anonymous
Can we compare different groups ? Posidonia vs Cymodocea vs Zostera vs Halophila? Different traits, demands, etc ...

Anonymous
Solving big problems together anda sen the trends compera standard data

Anonymous
It will be important to identified trends over time and maybe a early warning system for future changes in the seagrass community.

Q & A

Biology and Ecosystems Panel

Credit: Dimitris Poursanidis / Ocean Image Bank

The Global Ocean Observing System

Thank you!

goosocean.org

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BioEcOcean

unesco Intergovernmental Oceanographic Commission

WORLD METEOROLOGICAL ORGANIZATION

UN environment programme

International Science Council

Credit: Ben Jones / Ocean Image Bank