

A quantitative and reproducible approach to evaluate trends in seagrass indicators

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Managing coastal waters

How do we use data?

The foundation of most management programs is a strong monitoring network [National Research Council, 1990]

Monitoring provides information for decision-making based on apparent trends...

What are the changes in environmental condition over time?

Are these changes ‘good’ or ‘bad’ based on our management objectives?

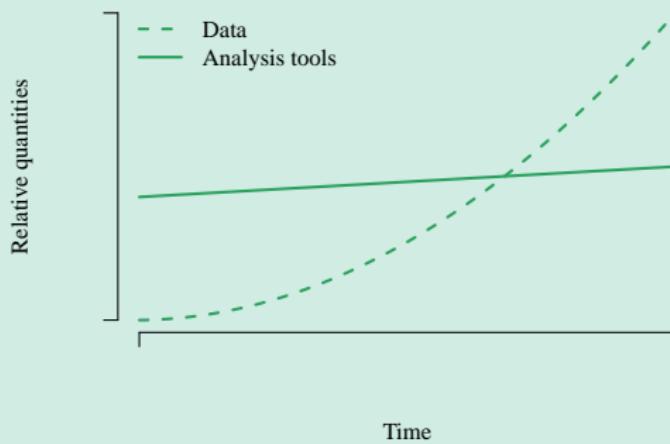
What may have caused these changes?

Managing coastal waters

How do we use data?

The good news: We are getting better at monitoring - standardized, automated, increased coverage, real-time/continuous

The bad news: Our ability to use these data for decision-making has not kept pace with availability!



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How do we use data?

We have the data but...

Challenge 1: We may not know how to use the information for decision-making

Challenge 2: We often lack appropriate tools to unambiguously and quantitatively characterize trends

Challenge 3: We may not have indicators to assess progress towards management goals

Managing coastal waters

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These challenges are not impossible... [Kelling et al., 2009]

Solution: The use of open-science tools can facilitate data integration, assessment, and communication!

Seagrasses and water quality

Making the most of data

Seagrasses have long been considered sentinels of water quality
[Short and Wyllie-Echeverria, 1996]

Numerous ecosystem services - healthy seagrass, healthy estuary

The following example illustrates the use of open-science tools to *integrate, assess, and communicate* data for evaluating seagrass indicators

Seagrasses and water quality

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The following example illustrates the use of open-science tools to *integrate*, *assess*, and *communicate* data for evaluating seagrass indicators

Open-science is *reproducible*, *transparent*, and *collaborative*
[Molloy, 2009]



Seagrasses and water quality

Making the most of data

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Often used as a basis for establishing nutrient criteria

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Problem 1: No consensus on the best way to measure depth of colonization

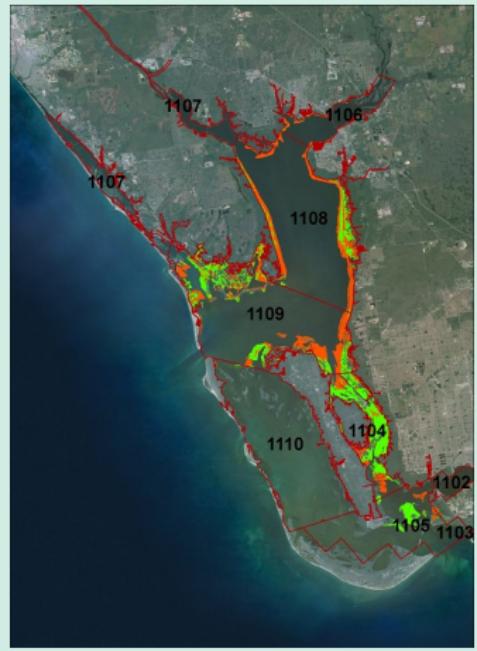
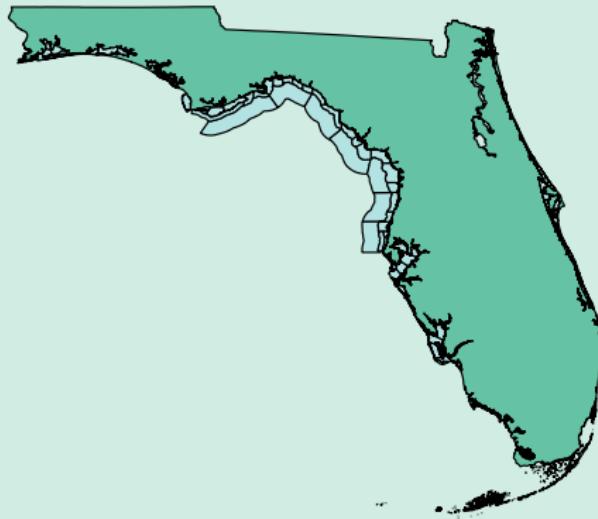
Problem 2: Plenty of data are available but standardized and flexible techniques have not been developed

Seagrasses and water quality

Making the most of data

Objective: Develop a reproducible and empirical method for estimating depth of colonization, builds on ideas in [Hagy, 2014]

Segment-based approach



Seagrasses and water quality

Making the most of data

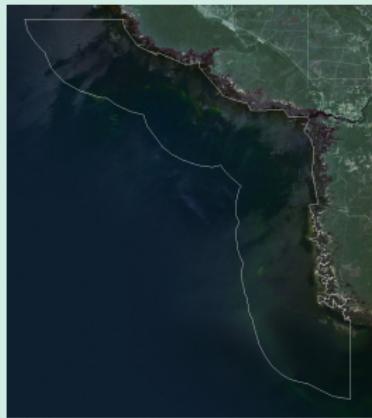
How can we estimate depth of colonization?

Seagrasses and water quality

Making the most of data

How can we estimate depth of colonization?

Pick a segment

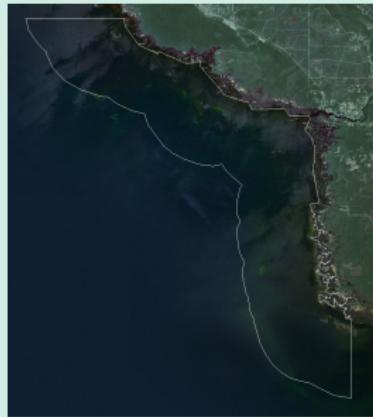


Seagrasses and water quality

Making the most of data

How can we estimate depth of colonization?

Pick a segment



Get seagrass coverage

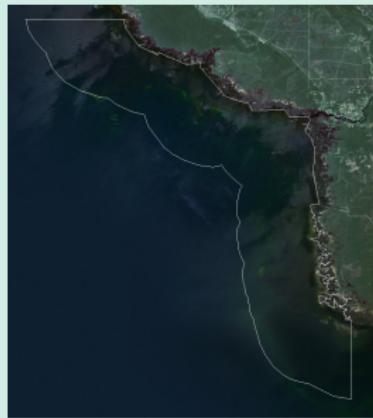


Seagrasses and water quality

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How can we estimate depth of colonization?

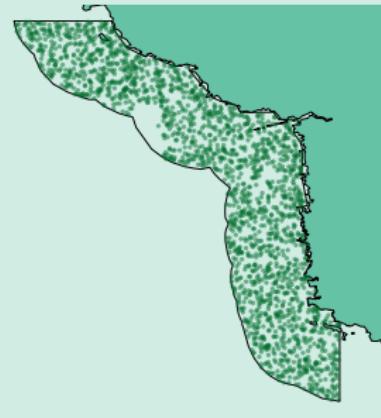
Pick a segment



Get seagrass coverage



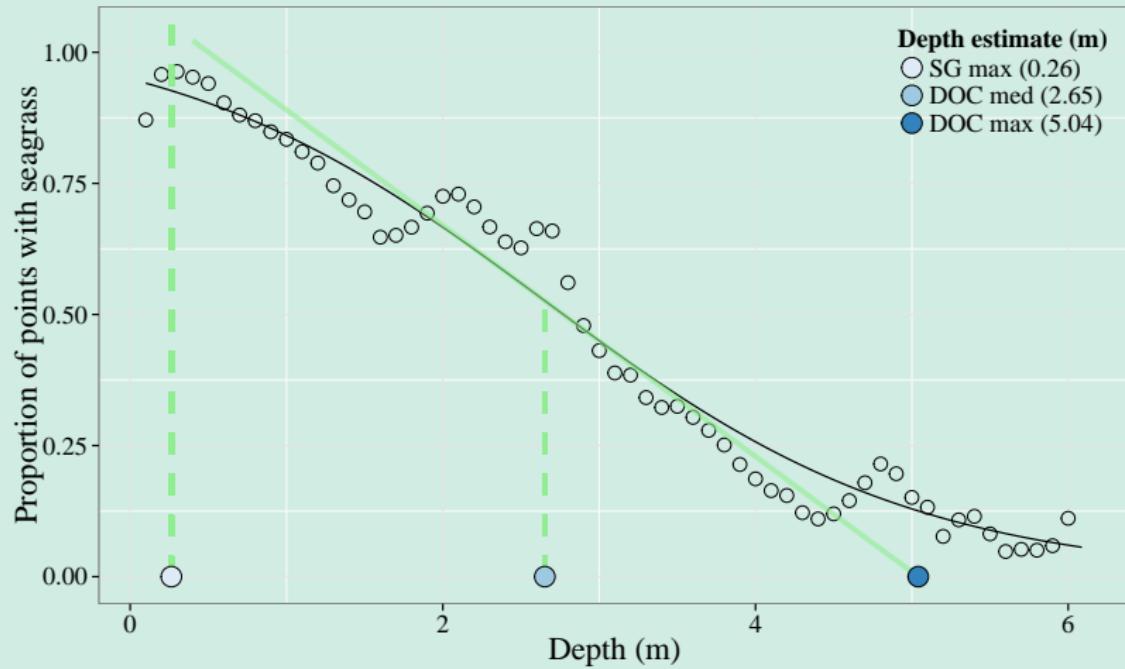
Get depth points



Seagrasses and water quality

Making the most of data

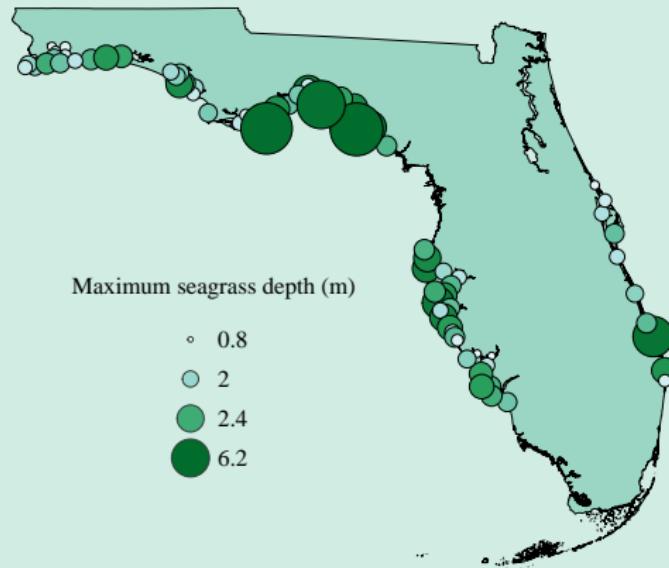
How can we estimate depth of colonization?



Seagrasses and water quality

Making the most of data

We can get an estimate of seagrass depth of colonization for each segment in Florida [Hagy, 2014]



Seagrasses and water quality

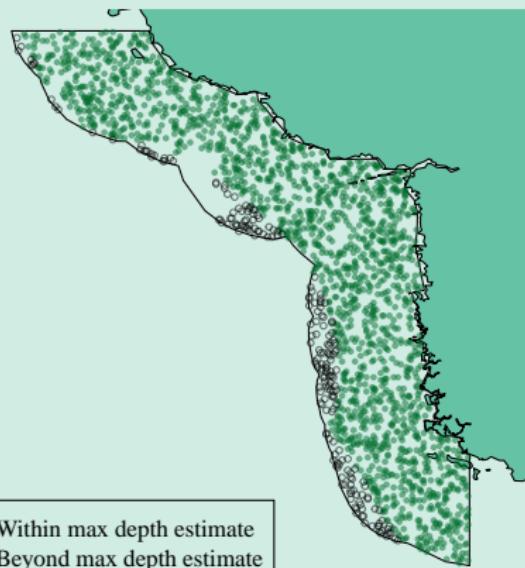
Making the most of data

This approach works if the segment is an appropriate spatial unit to characterize seagrass...

Seagrasses and water quality

Making the most of data

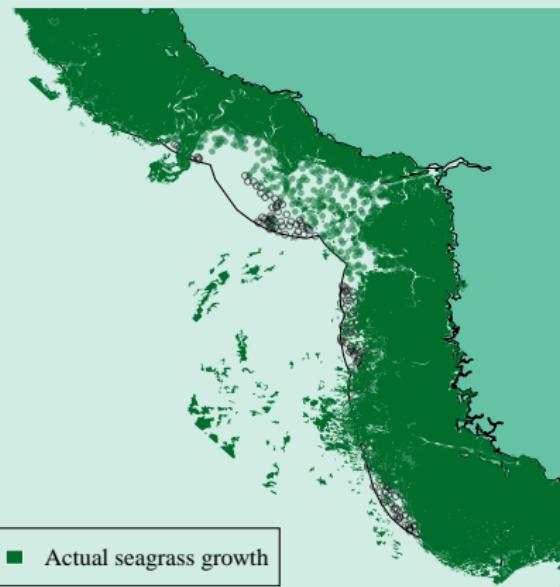
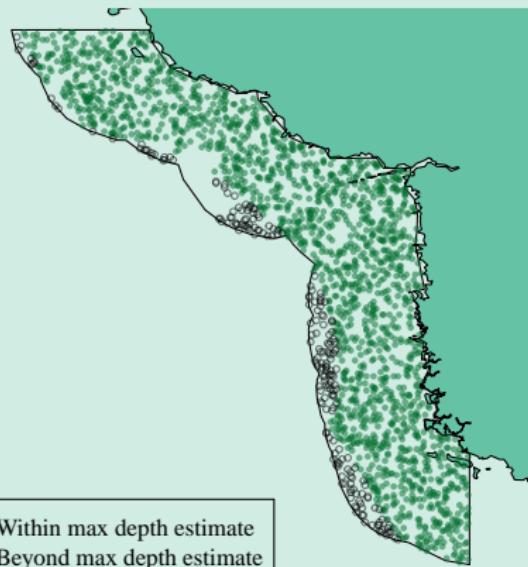
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Seagrasses and water quality

Making the most of data

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Seagrasses and water quality

Making the most of data

If segment is not appropriate, can we define a spatial boundary for estimating seagrass depth of colonization?

Seagrasses and water quality

Making the most of data

This can be repeated for a number of points until we get estimates that make sense

Seagrasses and water quality

Making the most of data

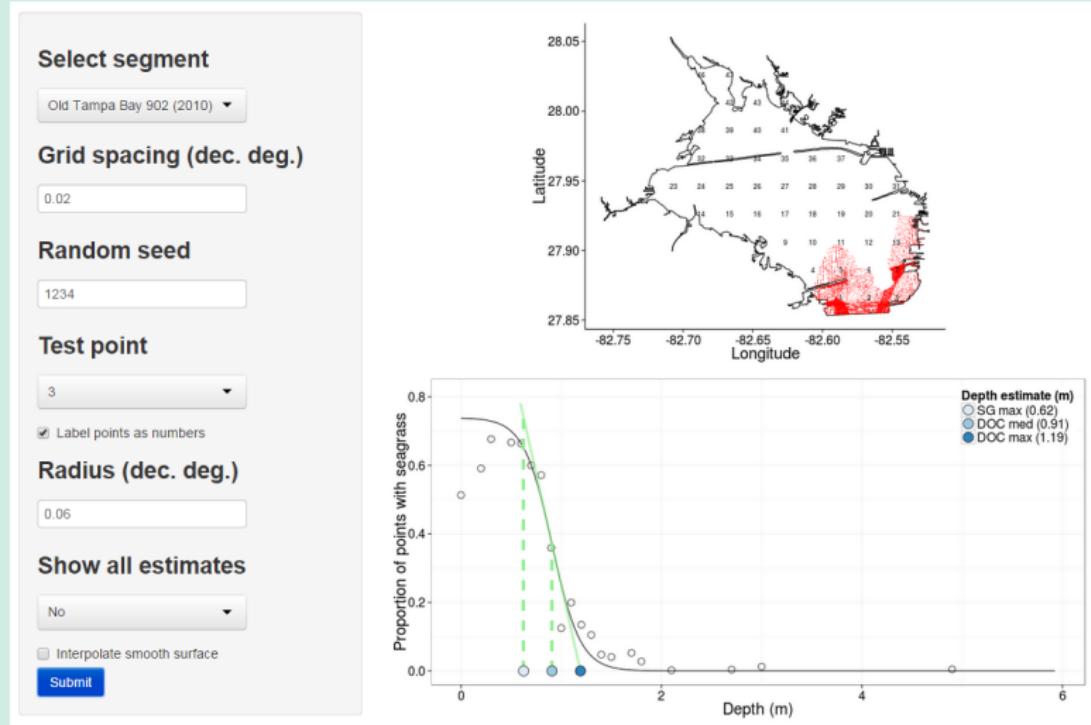
Benefits of the approach

- The spatial unit for any estimate of seagrass growth limit is problem-specific
- Allows for a ‘compliance-point’ approach (saves time/money)
- Increased understanding of seagrass growth patterns - natural and anthropogenic drivers
- Results are *communicable*...

Seagrasses and water quality

Making the most of data

https://beckmw.shinyapps.io/sg_depth/

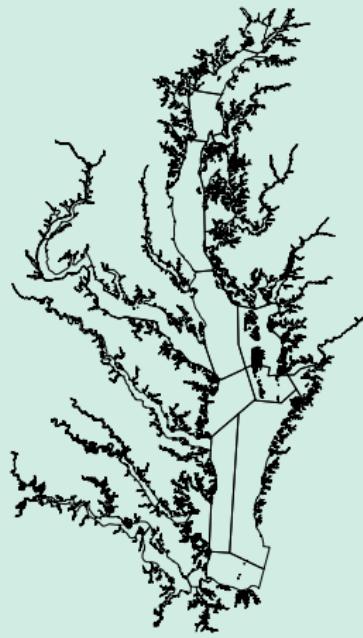


Seagrasses and water quality

Making the most of data

More importantly, the approach is *reproducible!*

Boundaries



Depth



Seagrass

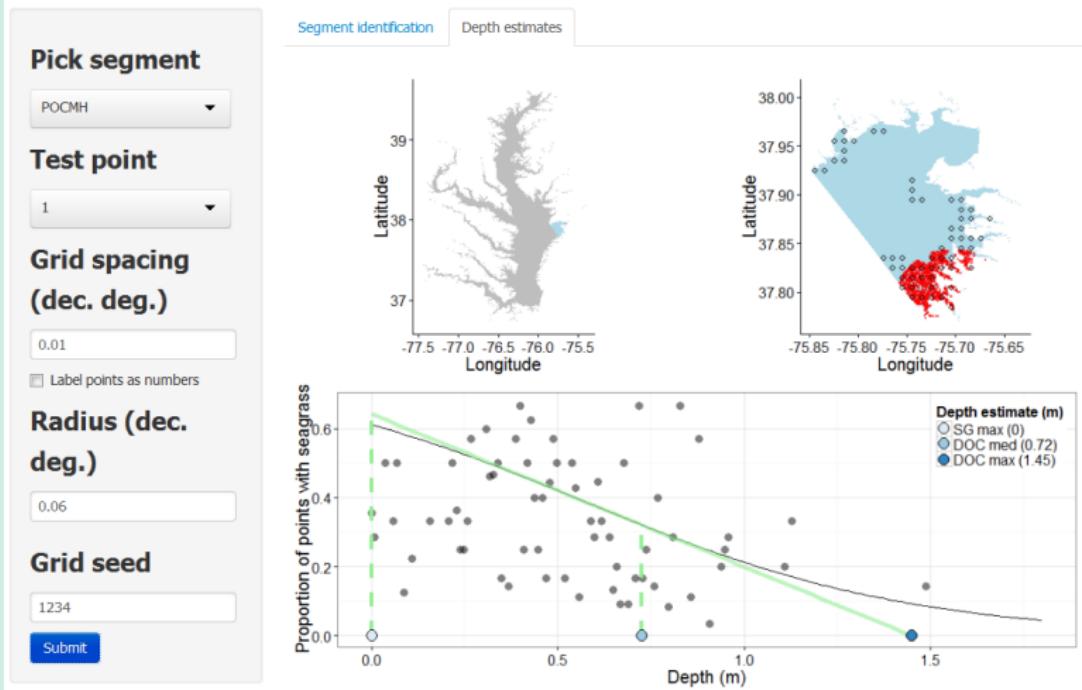


Seagrasses and water quality

Making the most of data

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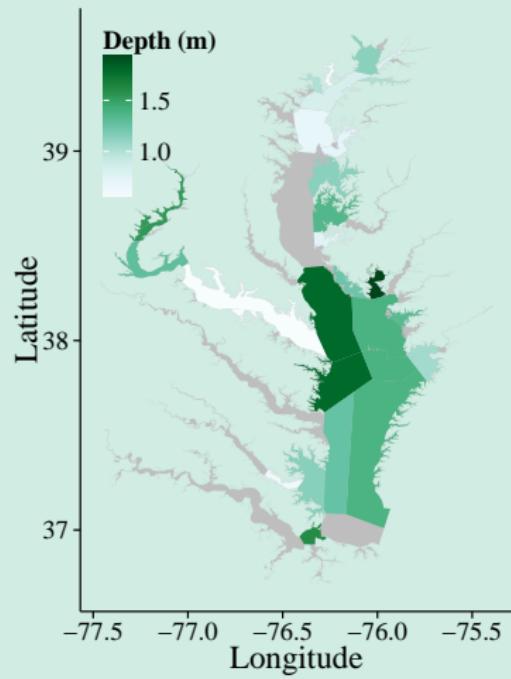
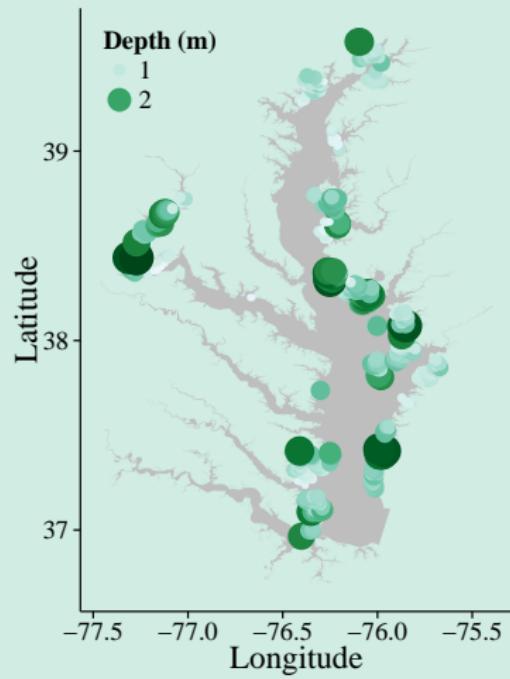
Chesapeake Bay 2012 seagrass depth limits



Seagrasses and water quality

Making the most of data

These are powerful tools...



Conclusions

Indicator development for goal assessment is problem-specific - tools will need to capitalize on available data to address questions of need

The seagrass example illustrates that *reproducible*, *transparent*, and *collaborative* methods can be developed

Results can also guide future decisions - management actions or additional data needs

Complexity is a challenge that can be mitigated through *open-science*



References

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