

# 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?*

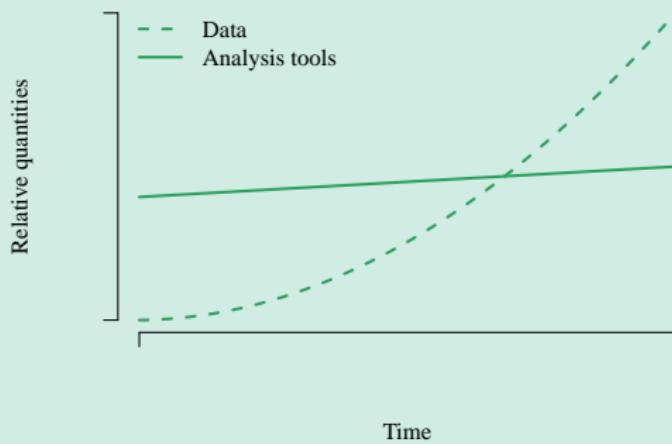
*What may have caused these changes?*

# 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!



# Managing coastal waters

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

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

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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

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

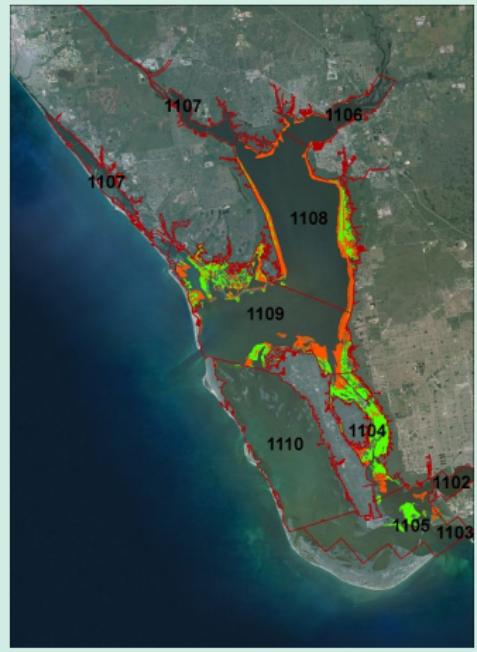
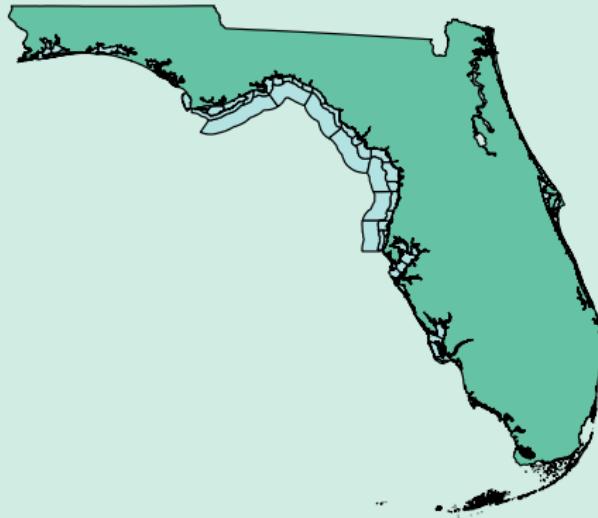
**Problem 2:** Plenty of data are available but standardized and flexible techniques have not been developed

# 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

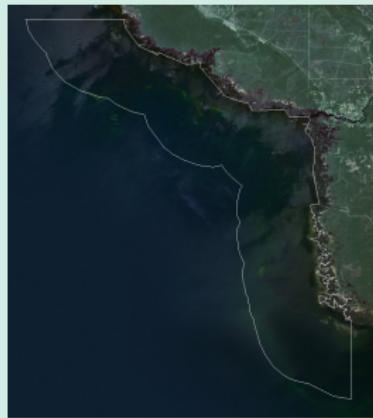
How can we estimate depth of colonization?

# Seagrasses and water quality

Making the most of data

How can we estimate depth of colonization?

Pick a segment

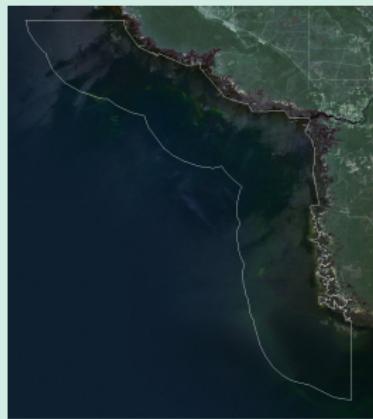


# Seagrasses and water quality

Making the most of data

How can we estimate depth of colonization?

Pick a segment



Get seagrass coverage

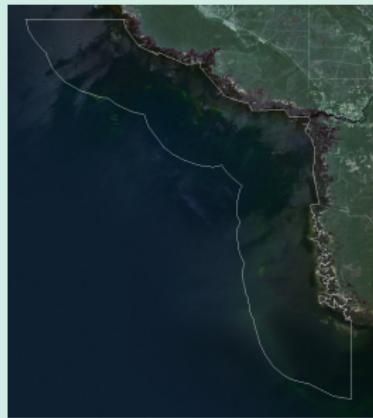


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How can we estimate depth of colonization?

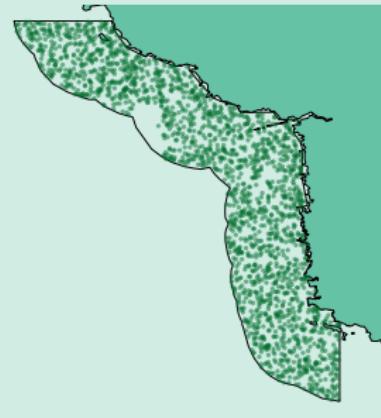
Pick a segment



Get seagrass coverage



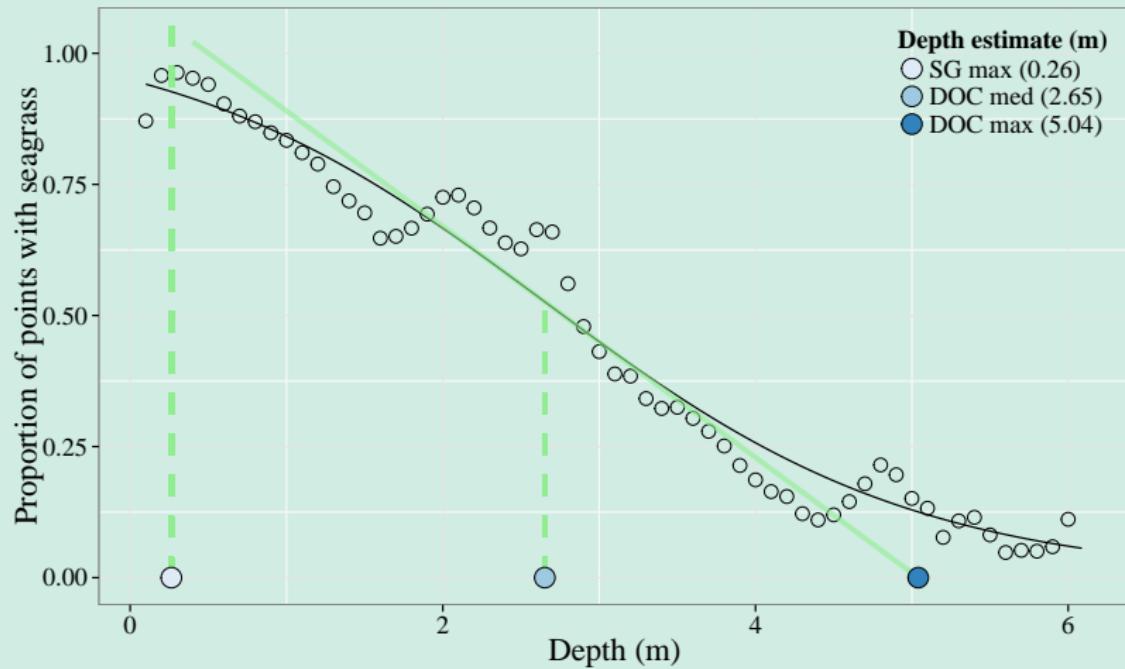
Get depth points



# Seagrasses and water quality

## Making the most of data

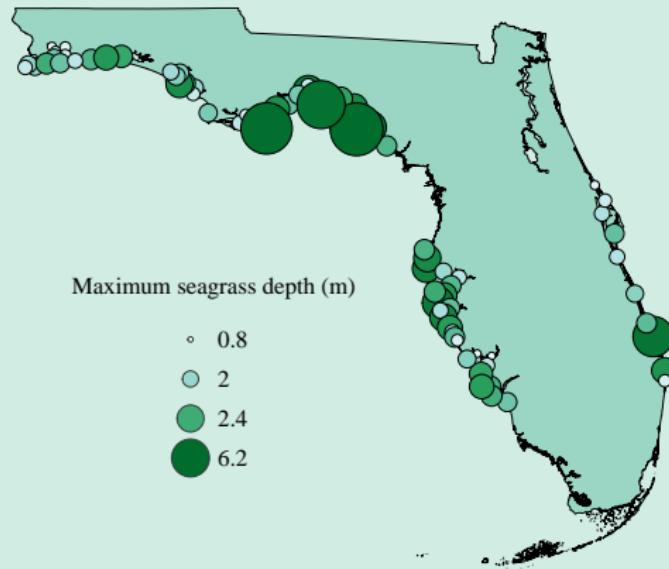
How can we estimate depth of colonization?



# 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

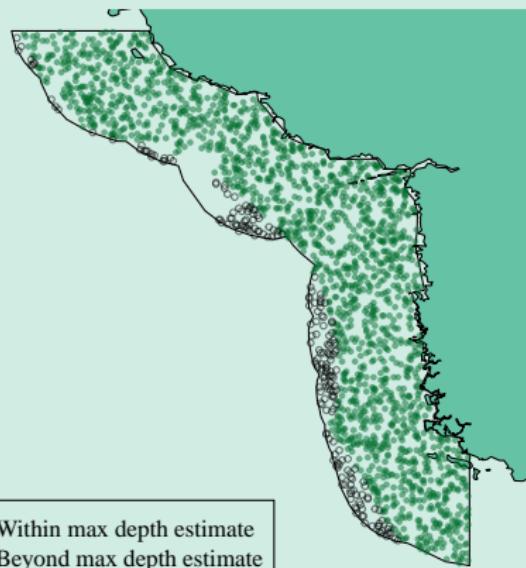
## Making the most of data

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

# Seagrasses and water quality

## Making the most of data

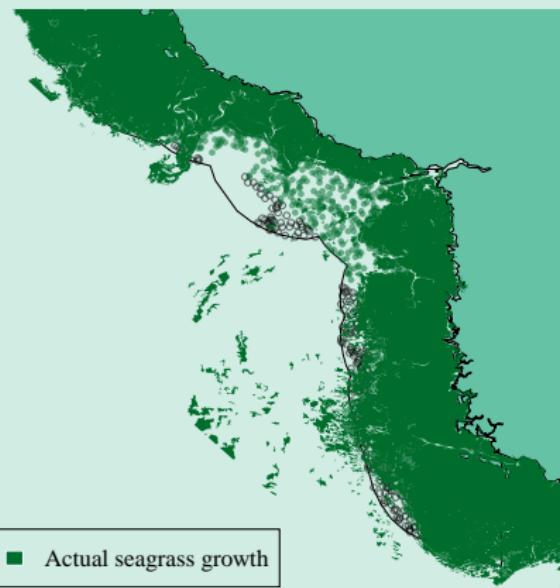
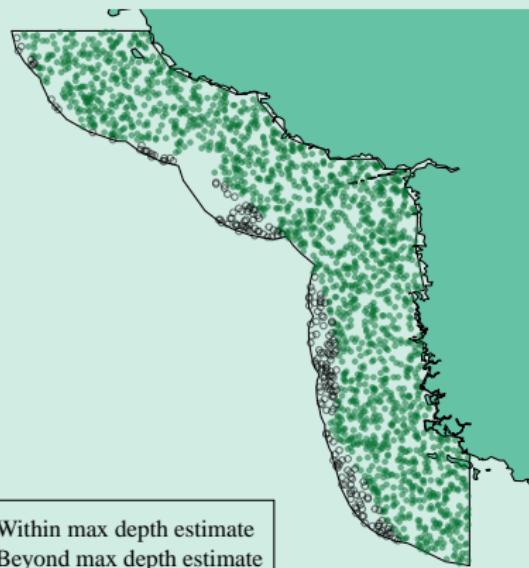
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# Seagrasses and water quality

## Making the most of data

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



# 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

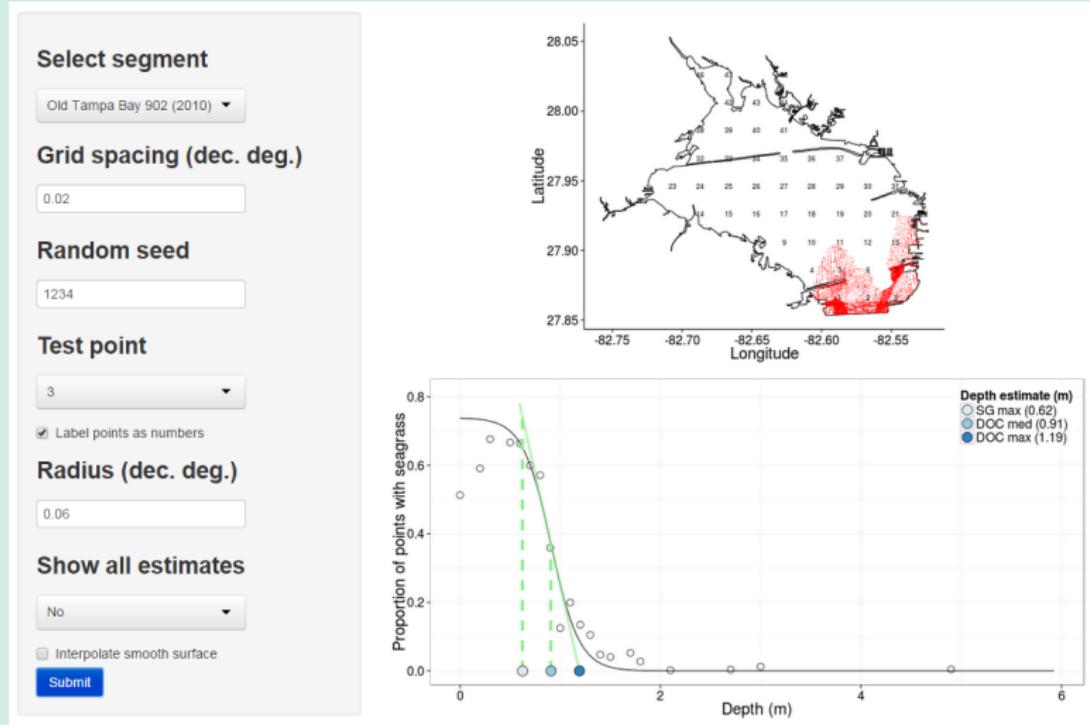
### Benefits of the approach

- 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/](https://beckmw.shinyapps.io/sg_depth/)

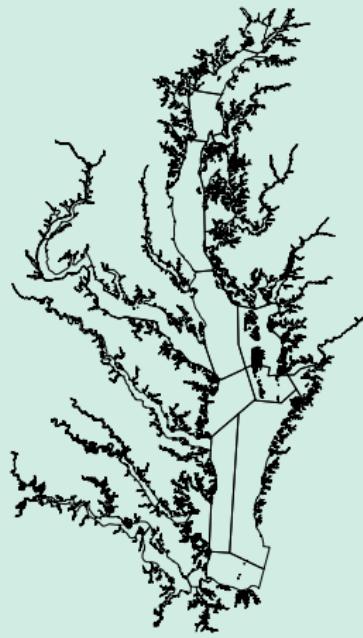


# Seagrasses and water quality

Making the most of data

More importantly, the approach is *reproducible!*

Boundaries



Depth



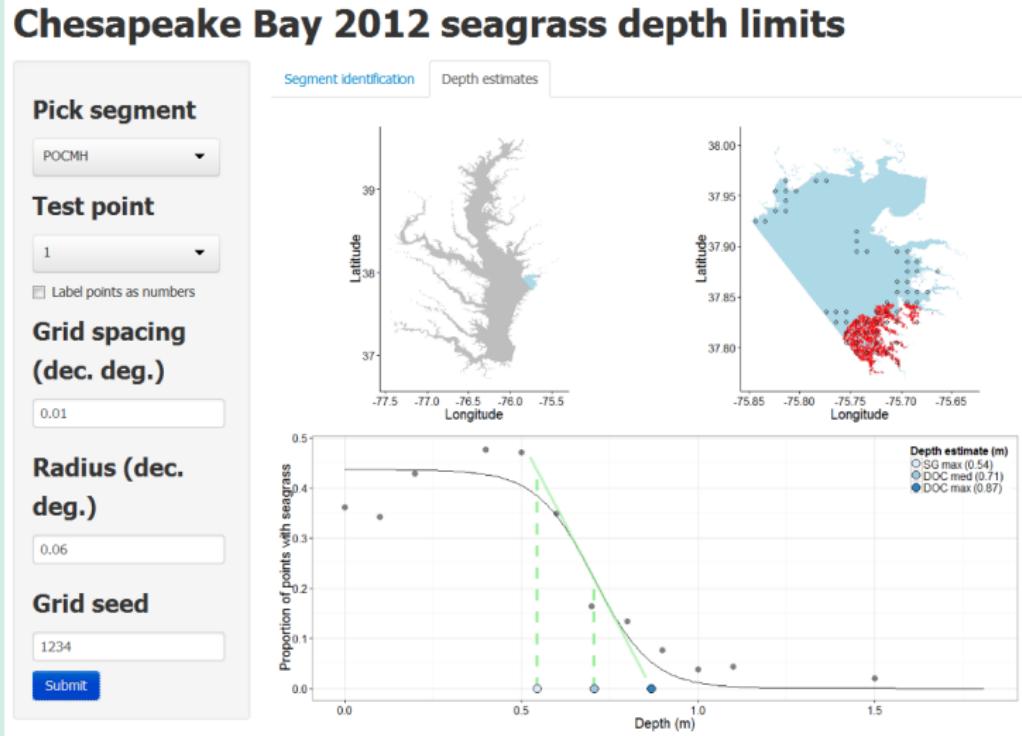
Seagrass



# Seagrasses and water quality

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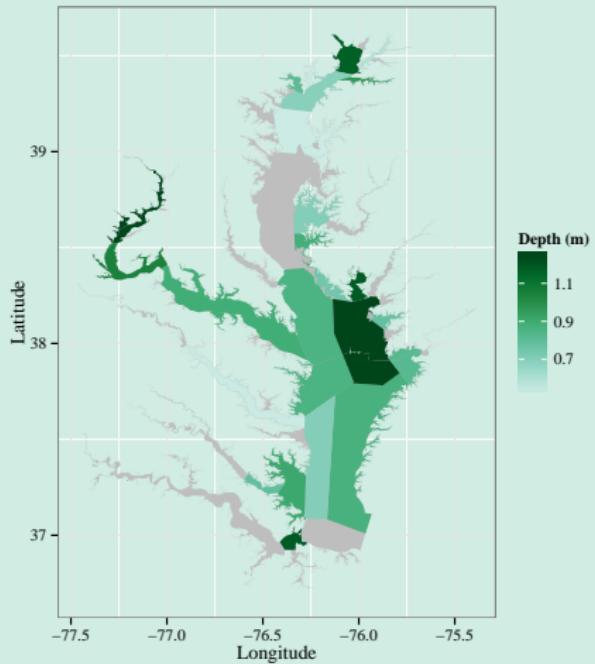
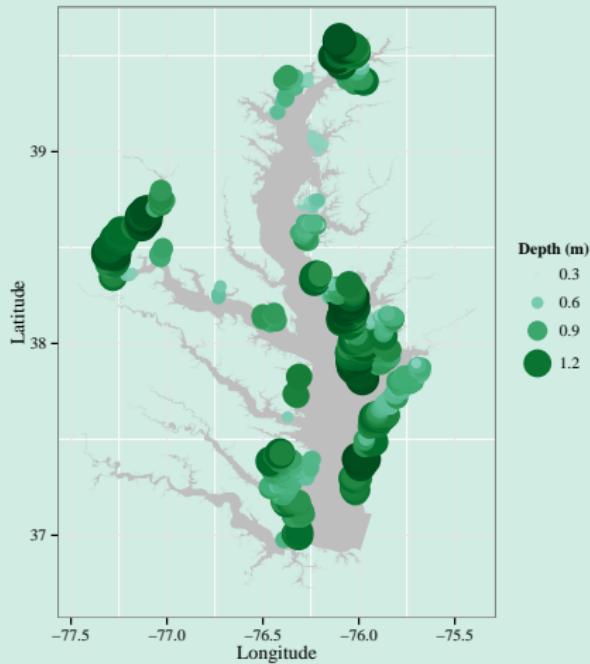
[https://beckmw.shinyapps.io/cb\\_seagrass/](https://beckmw.shinyapps.io/cb_seagrass/)



# 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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