

Comparison of WRTDS and GAMs for evaluating long-term trends in chlorophyll

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Today's call

- Motivation for the analysis
- Site selection
- Exploratory evaluation of trends
- Initial applications of WRTDS/GAMS
- Group discussion (and throughout)

Study motivation

- WRTDS recently used to evaluate water quality trends in tidal waters and GAMs approach under-development for use in Chesapeake Bay
- The relative values of each approach have not been evaluated - empirical description, desired products
- Comparisons could inform use of each model for management/restoration or for describing long-term changes

Goal: Provide a description of the relative abilities of GAMs and WRTDS to describe long-term changes in time series of response endpoints in tidal waters

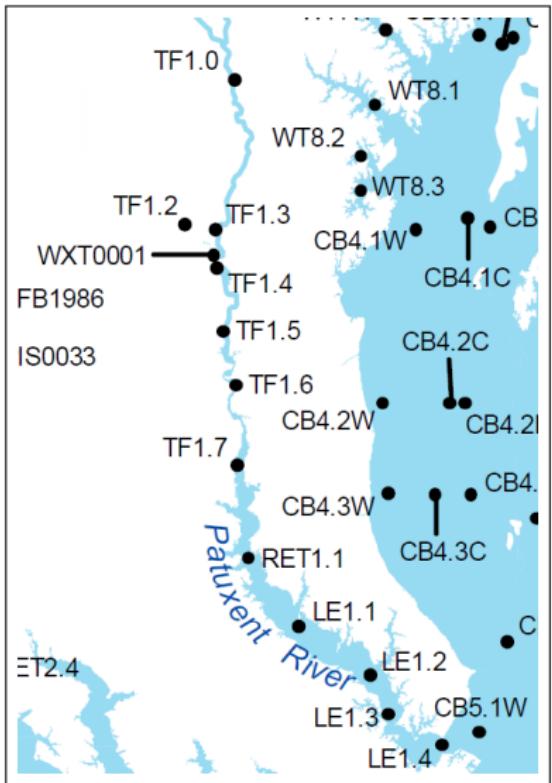
Objectives

- Provide a narrative comparison of the statistical foundation, both as a general description and as a means to evaluate water quality trends
- Use each technique to describe water quality changes in a common dataset with known historical changes in water quality drivers
- Compare each technique's ability to describe changes, as well as the differences in the information provided by each
- Apply to simulated data to evaluate the ability to reproduce flow-normalized trends

Site selection

Monitoring stations in the Patuxent River Estuary...

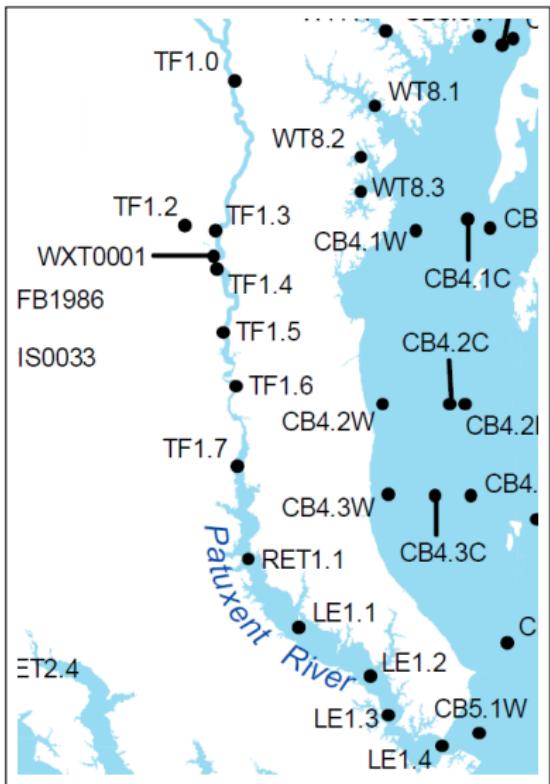
- longitudinal gradient from watershed to mainstem influences
- potential signals from hurricane impacts
- well-studied (Testa, Kemp, Hagy, etc.)



Site selection

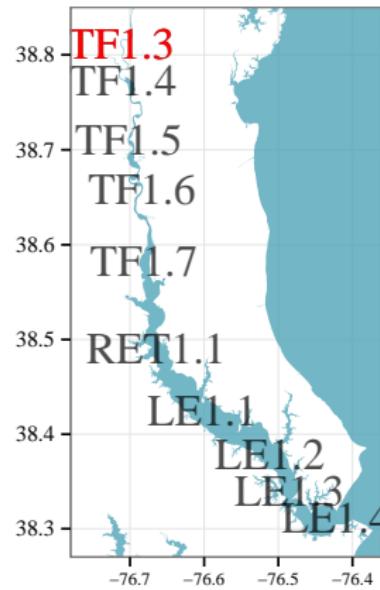
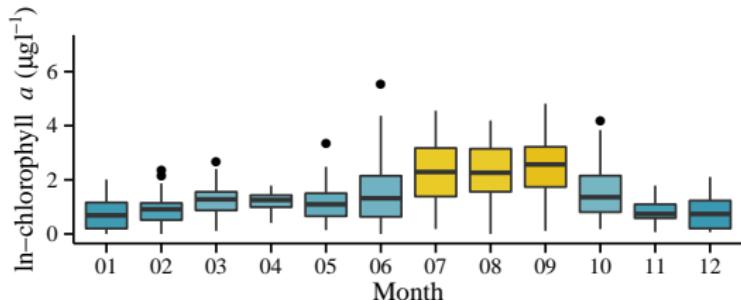
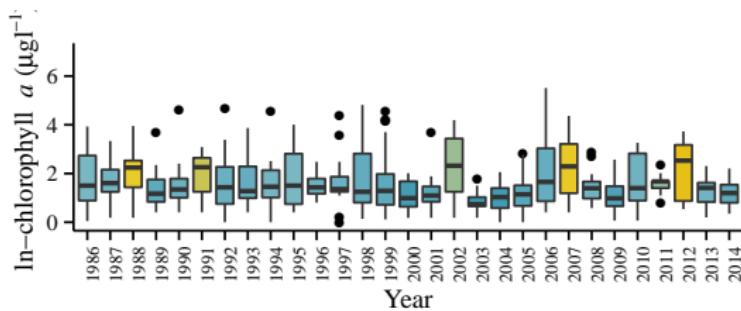
Monitoring stations in the Patuxent River Estuary...

- TF1.6, LE1.3 based on data distribution - monthly from 1986 – 2014
- surface chlorophyll
- vertically integrated salinity
- No detection limit issues



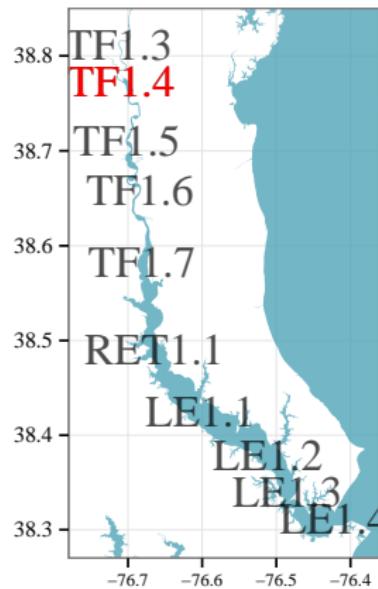
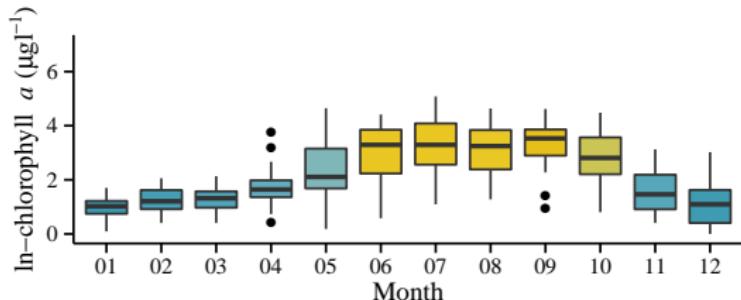
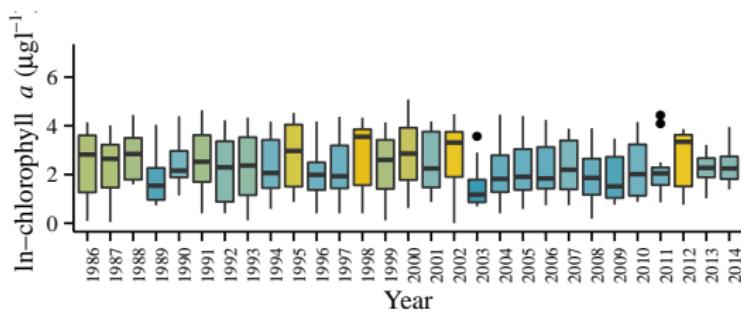
Some exploratory graphs

Summaries of annual and seasonal trends by station



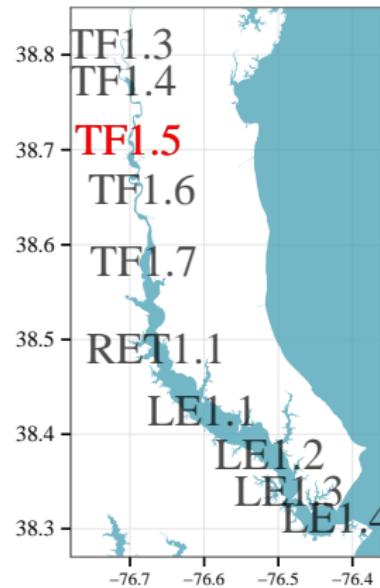
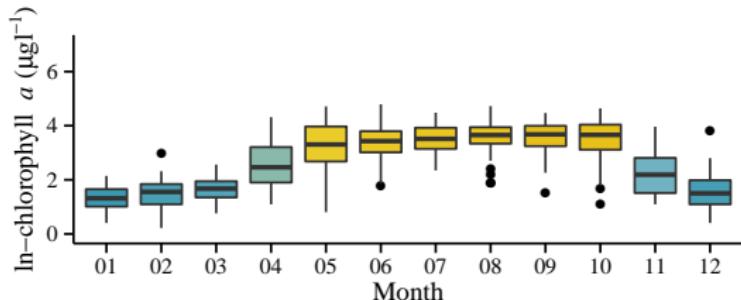
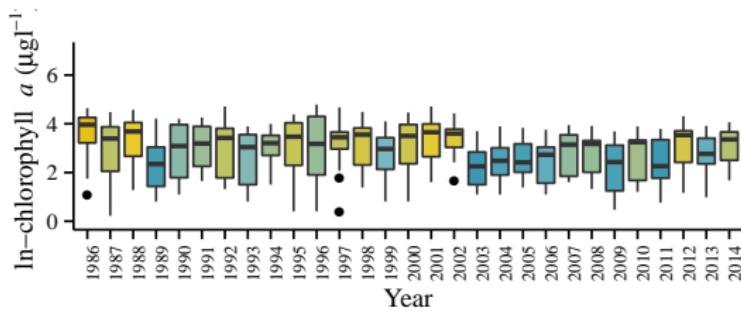
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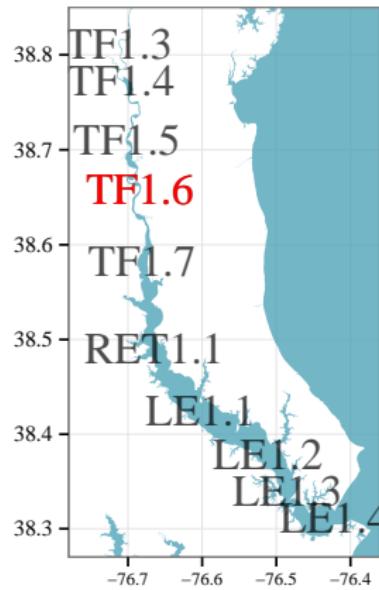
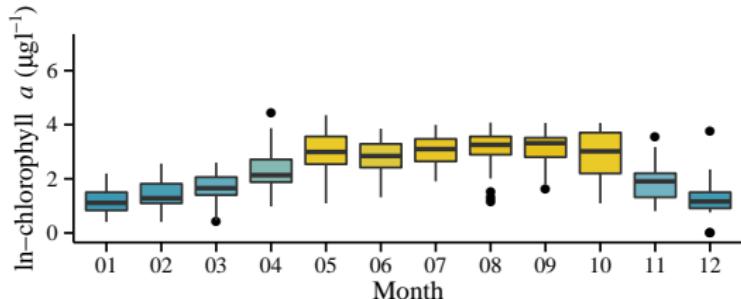
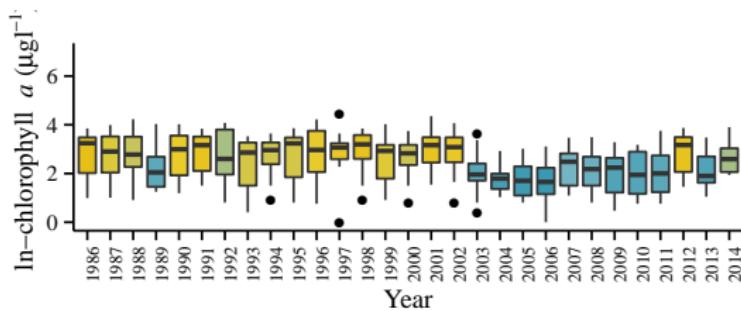
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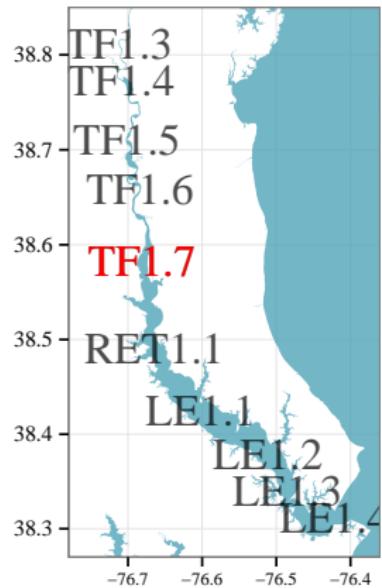
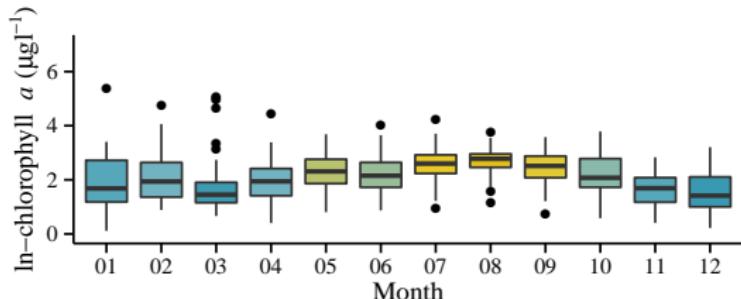
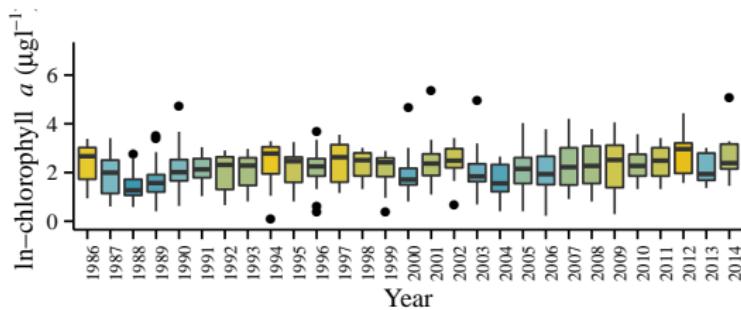
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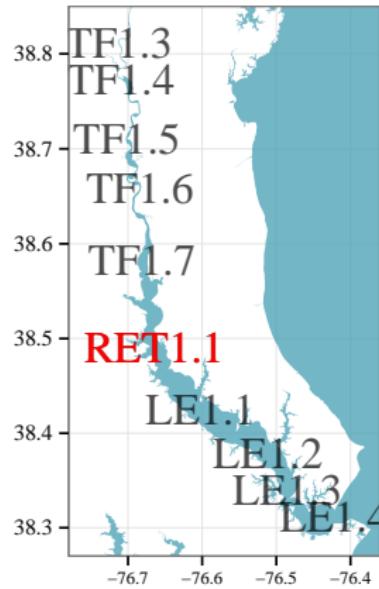
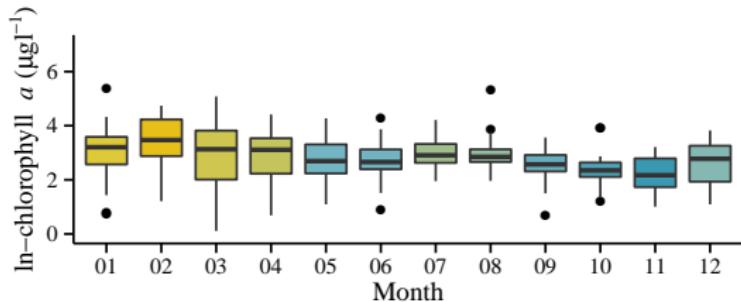
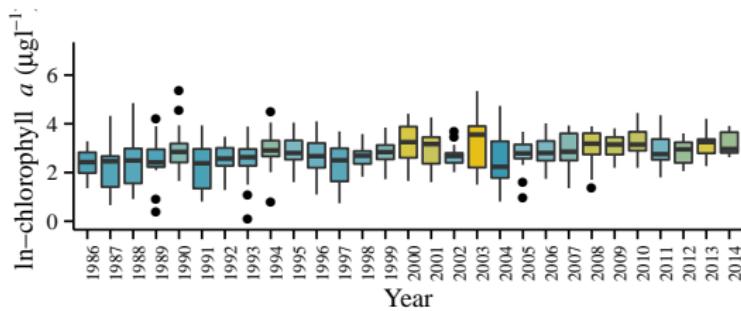
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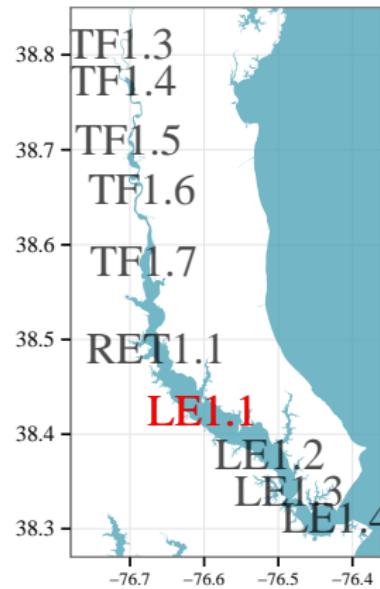
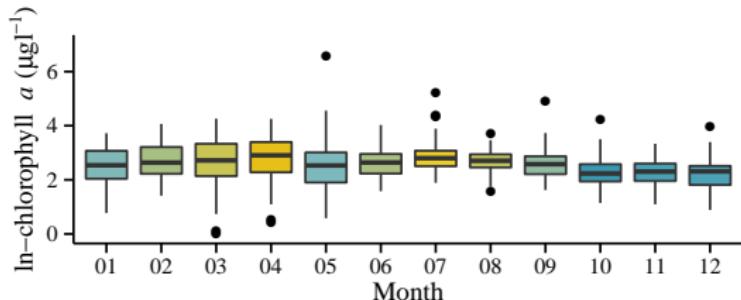
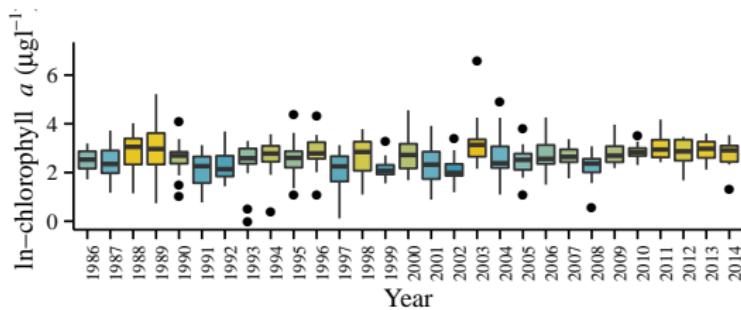
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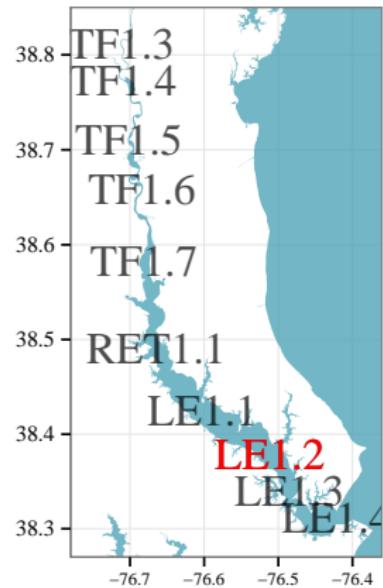
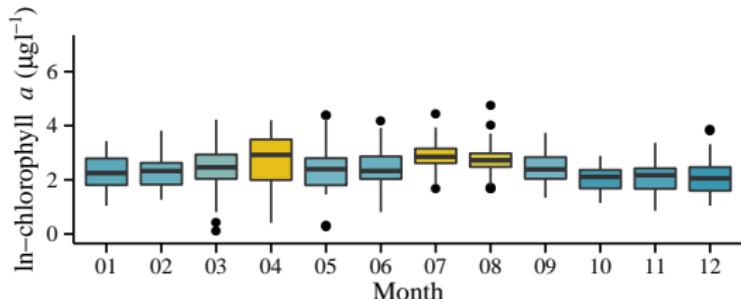
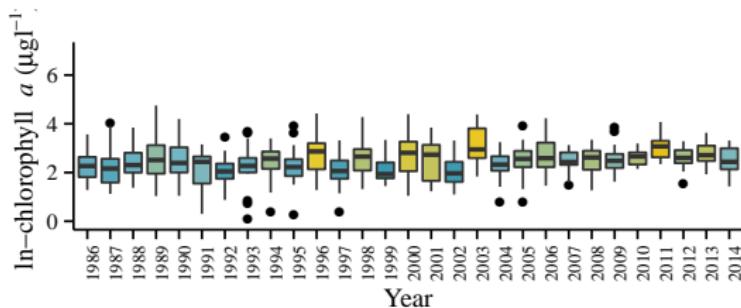
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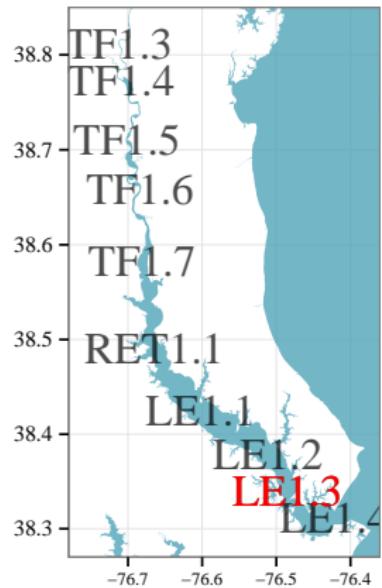
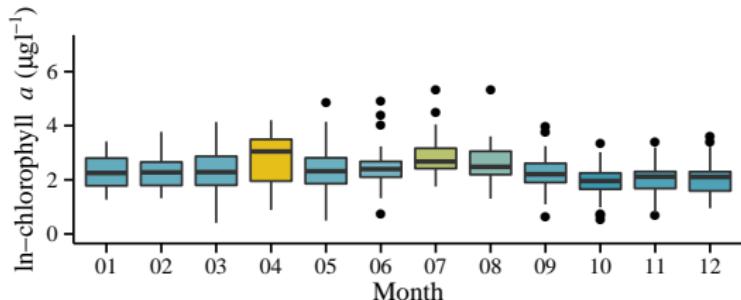
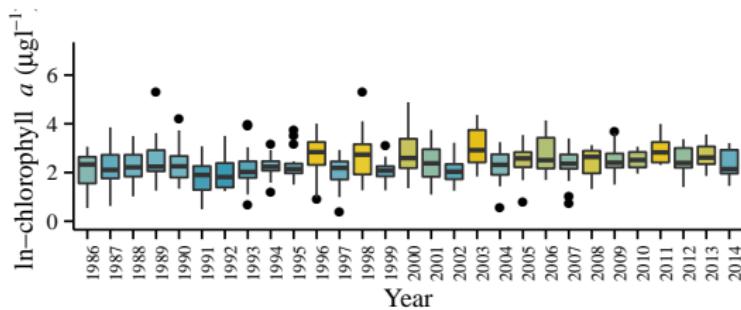
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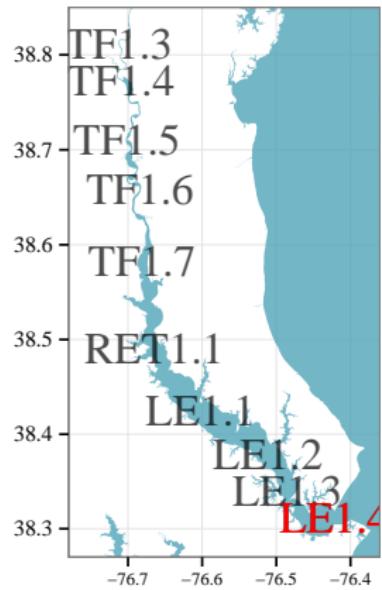
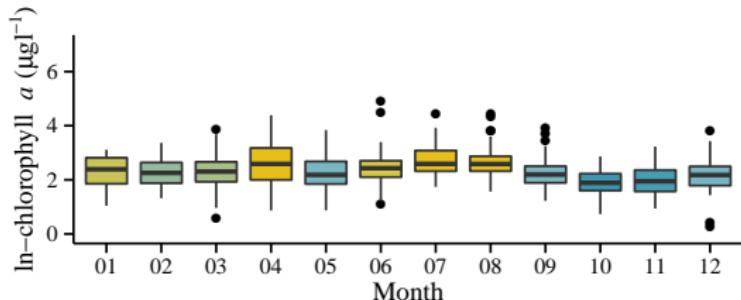
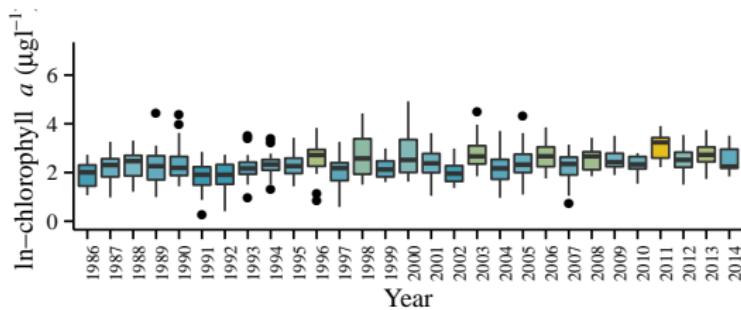
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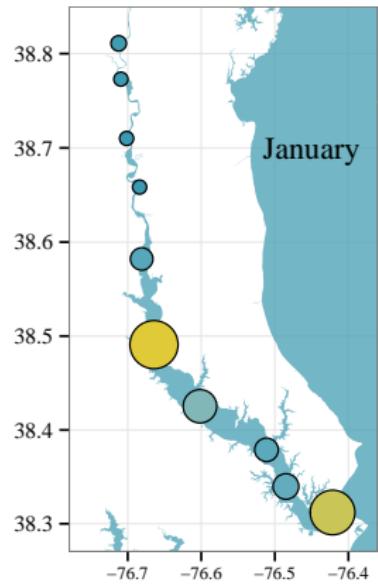
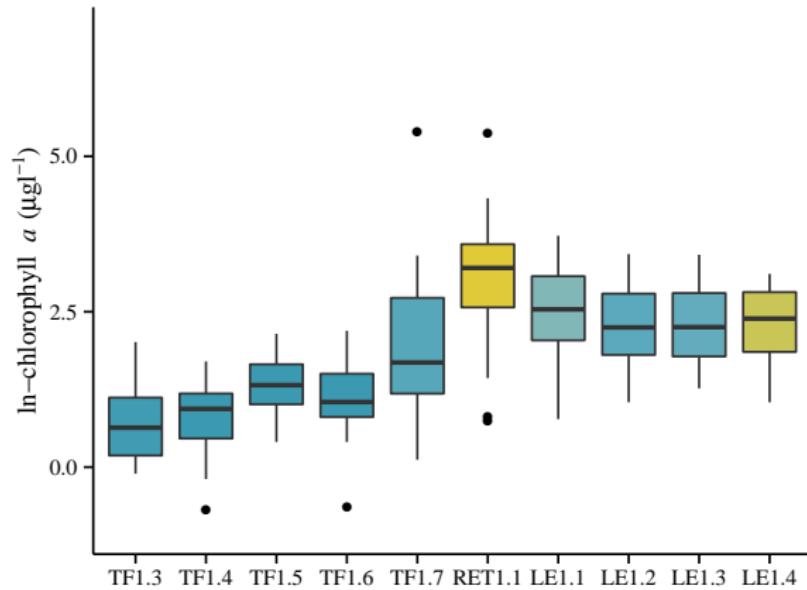
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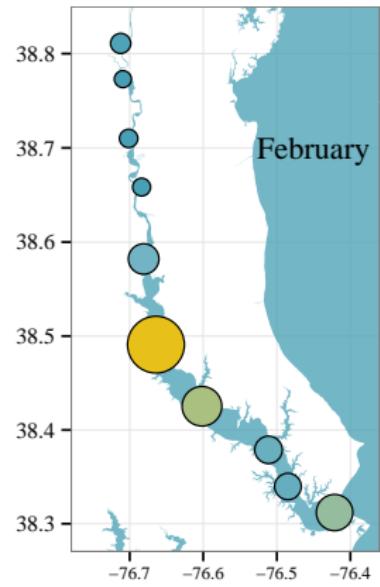
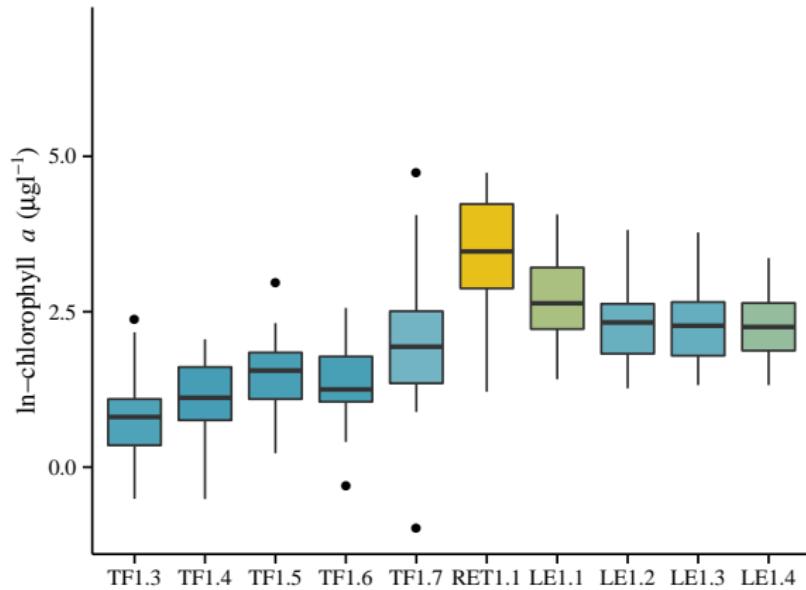
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Chlorophyll changes by month, annual aggregations



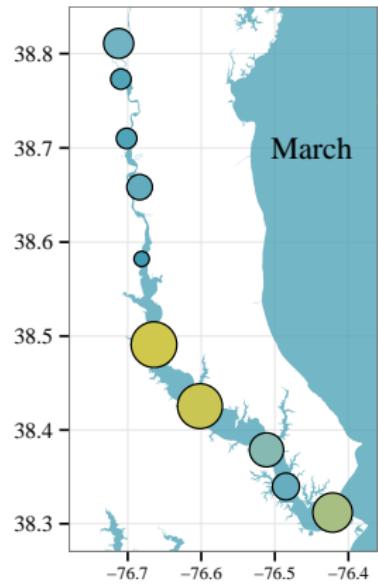
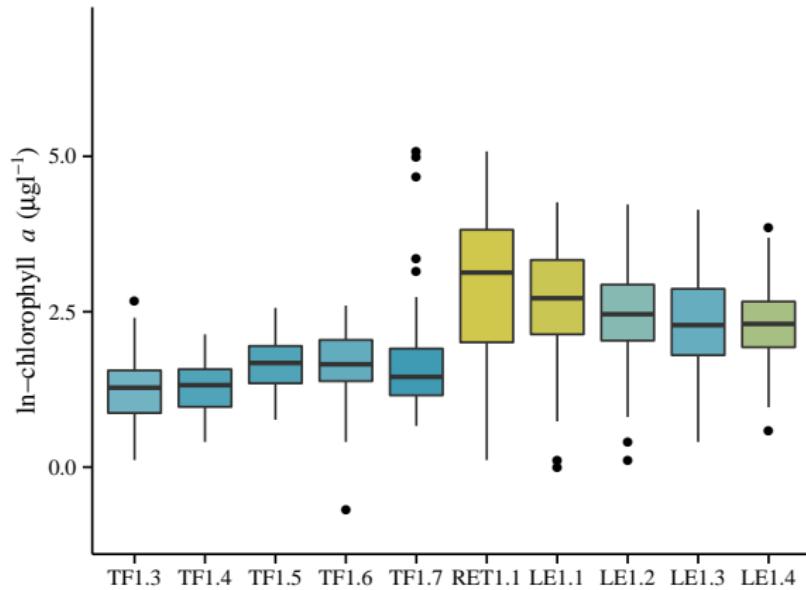
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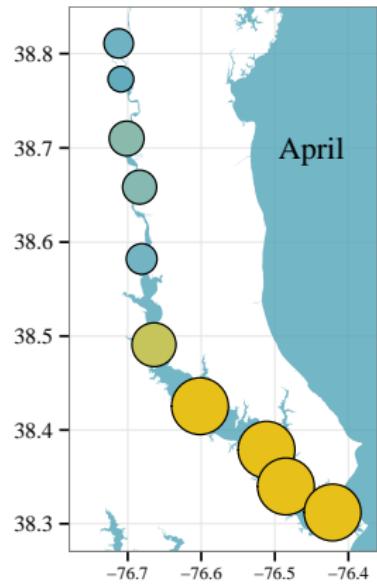
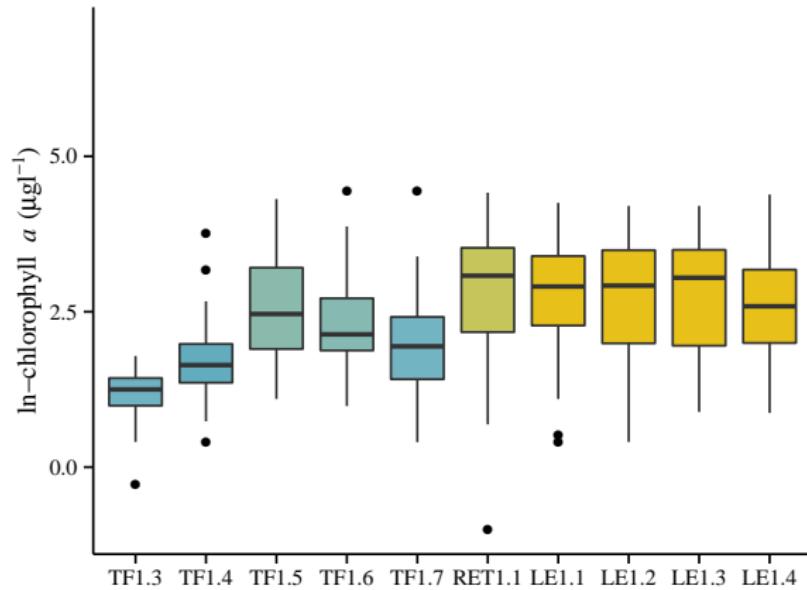
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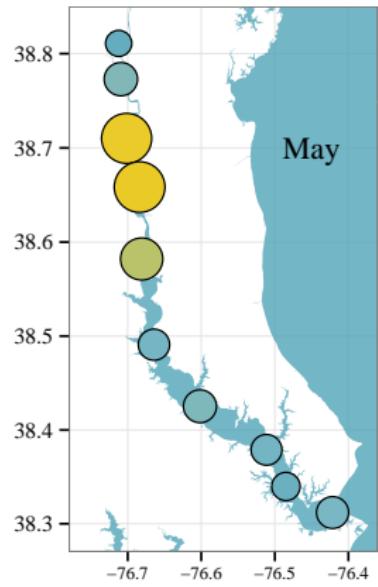
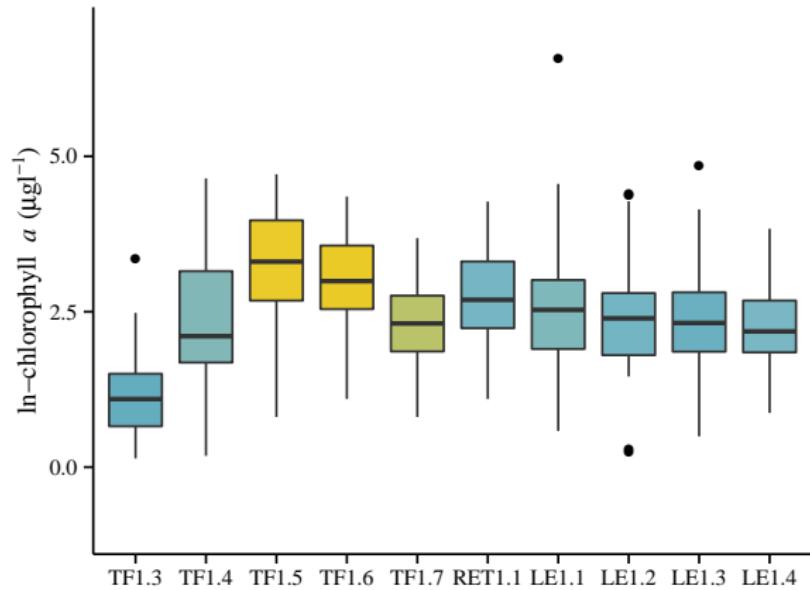
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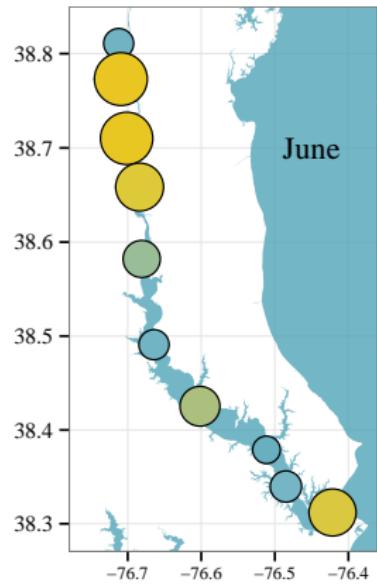
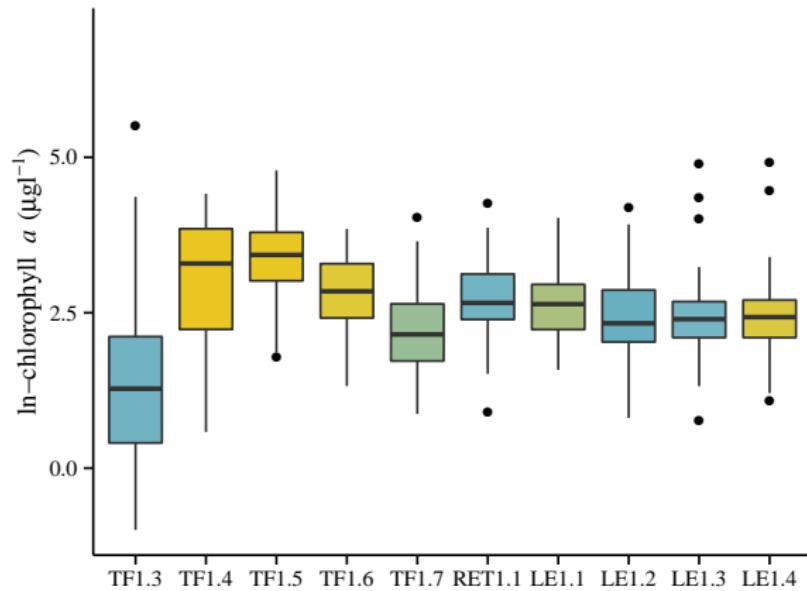
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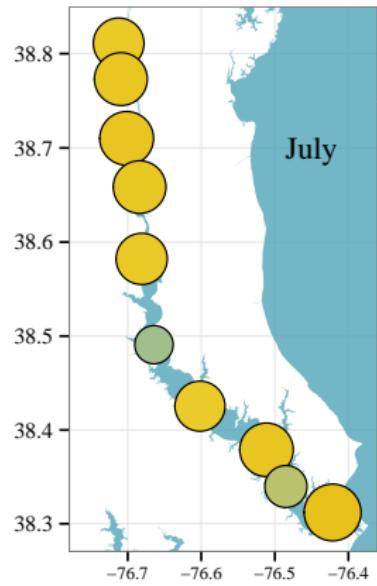
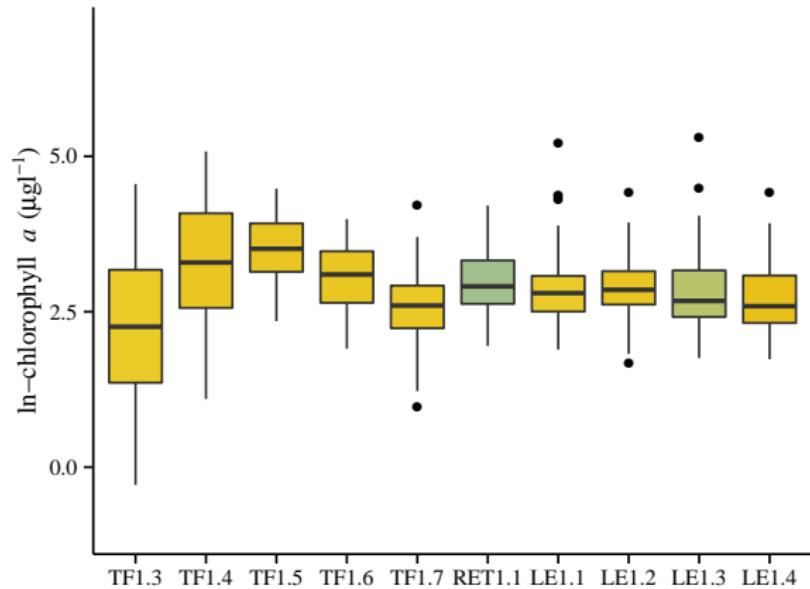
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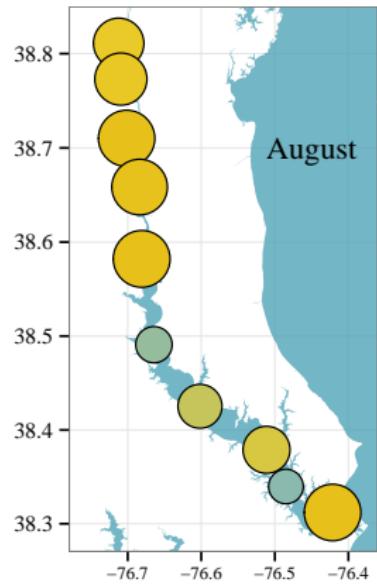
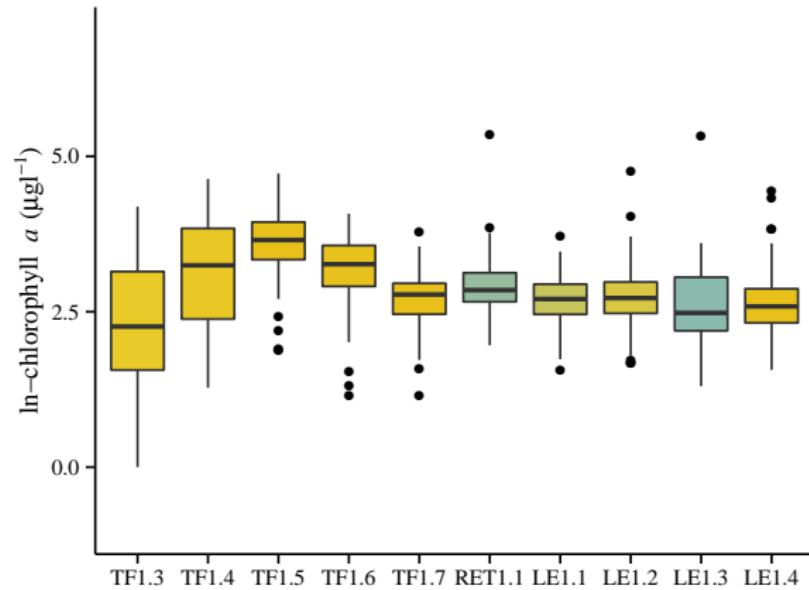
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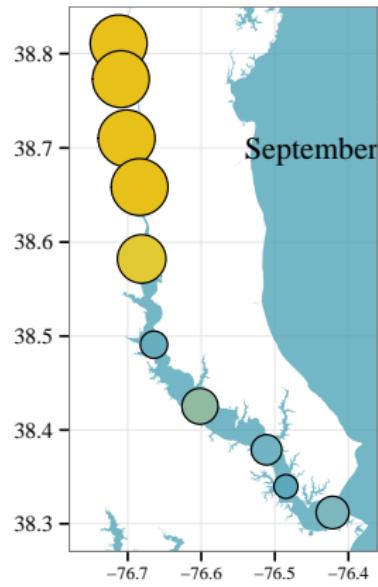
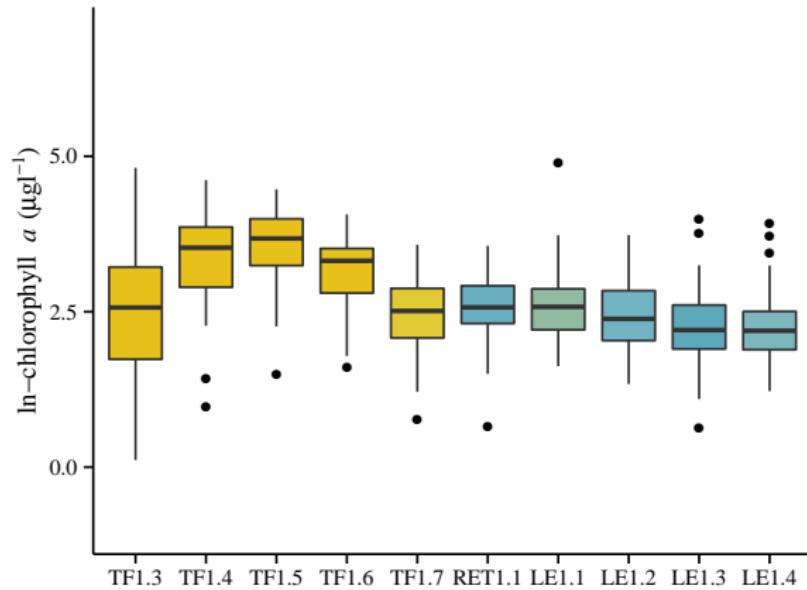
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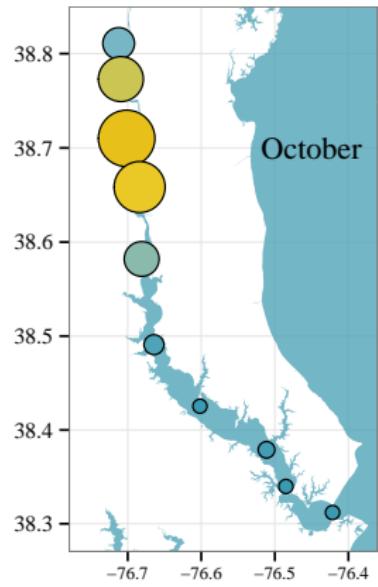
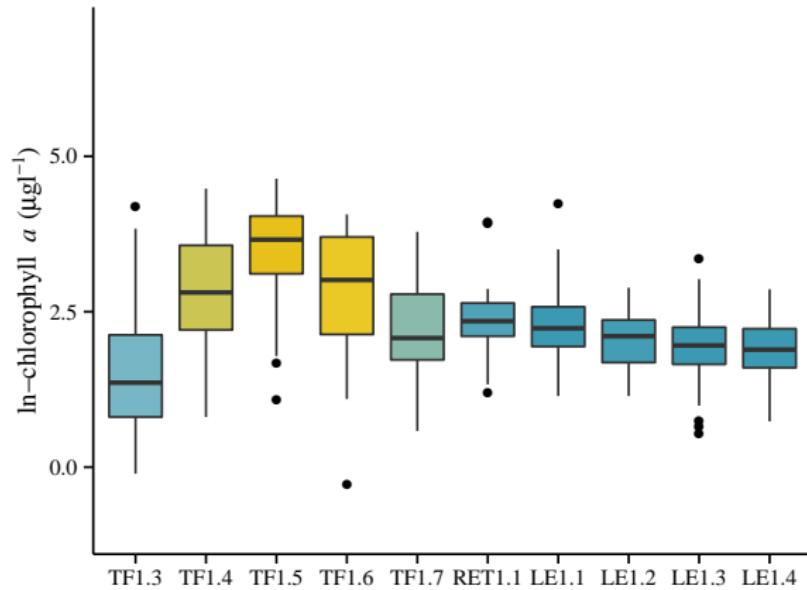
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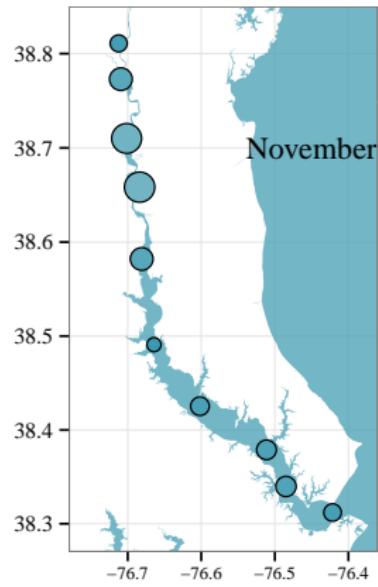
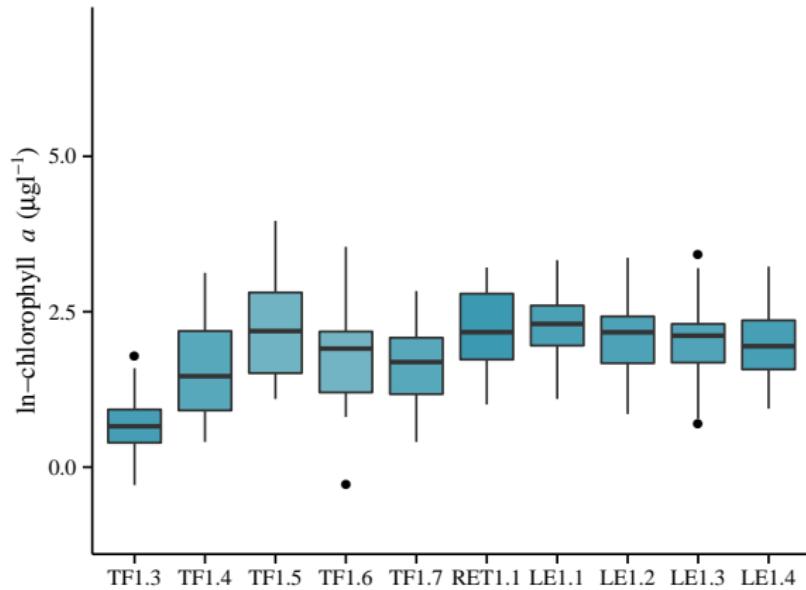
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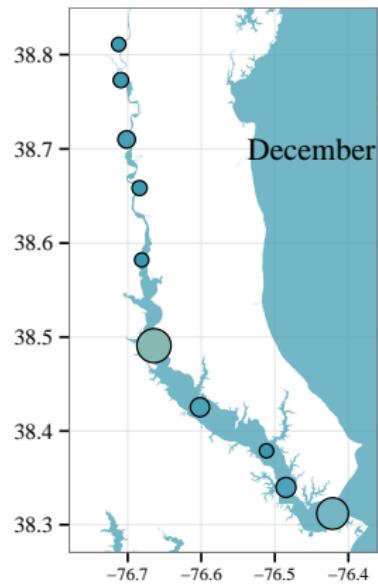
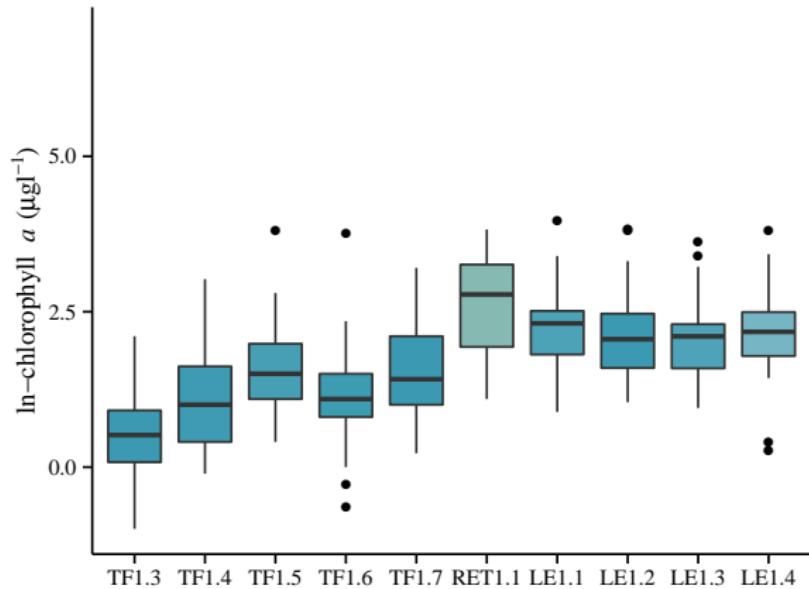
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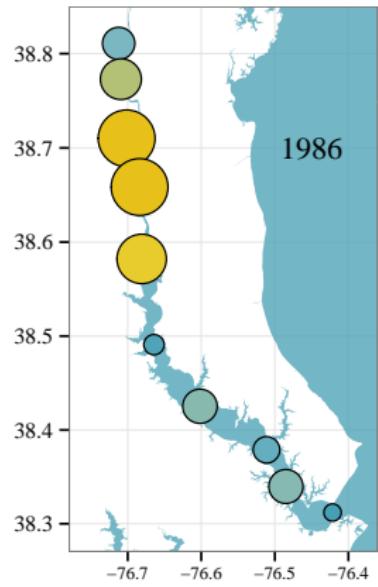
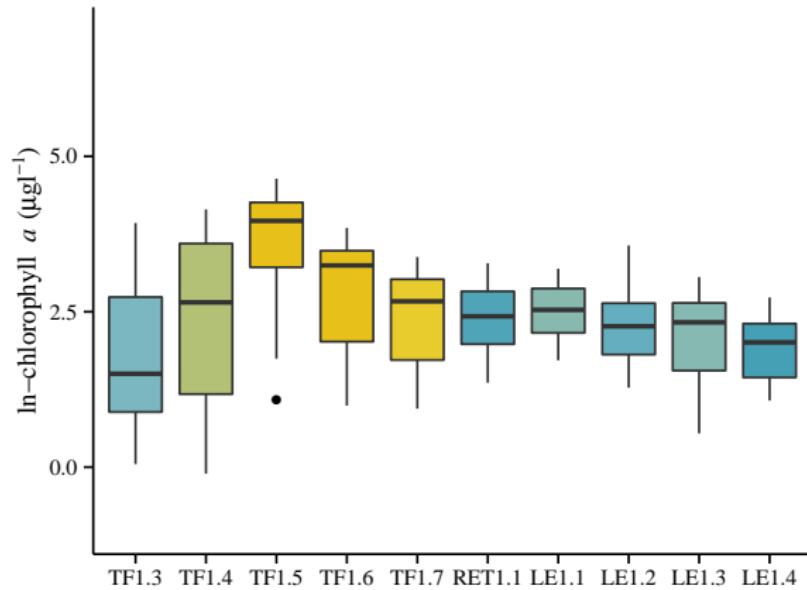
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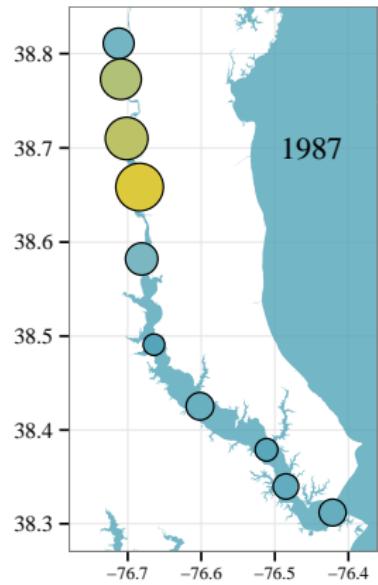
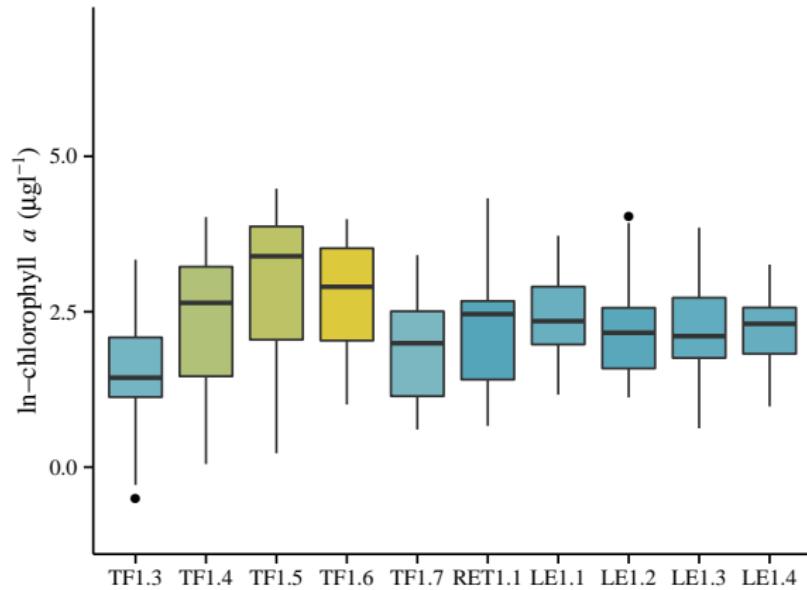
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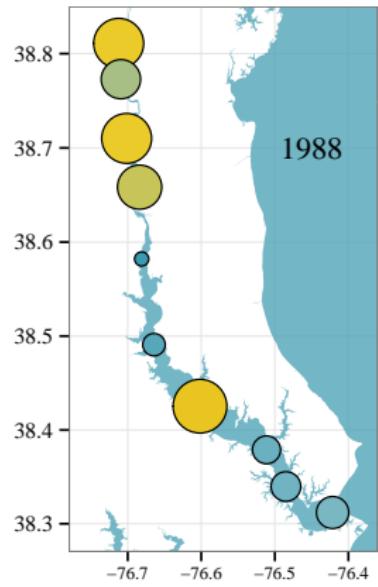
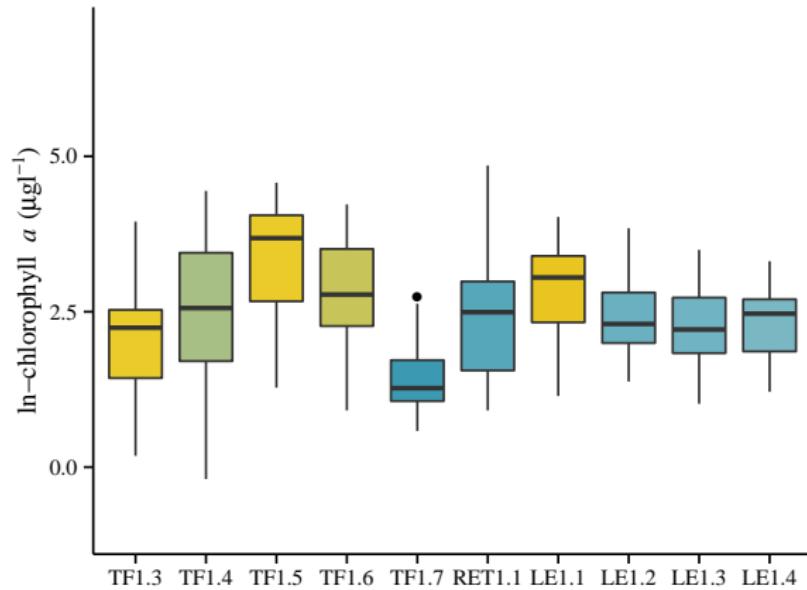
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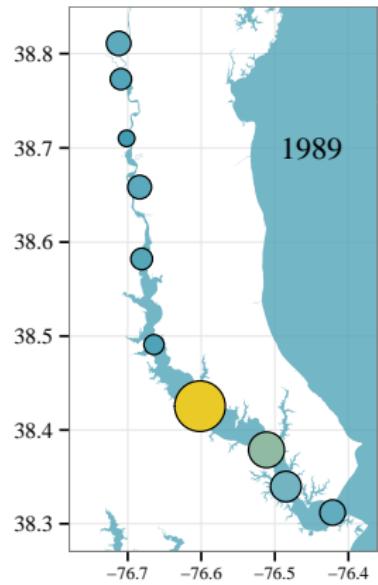
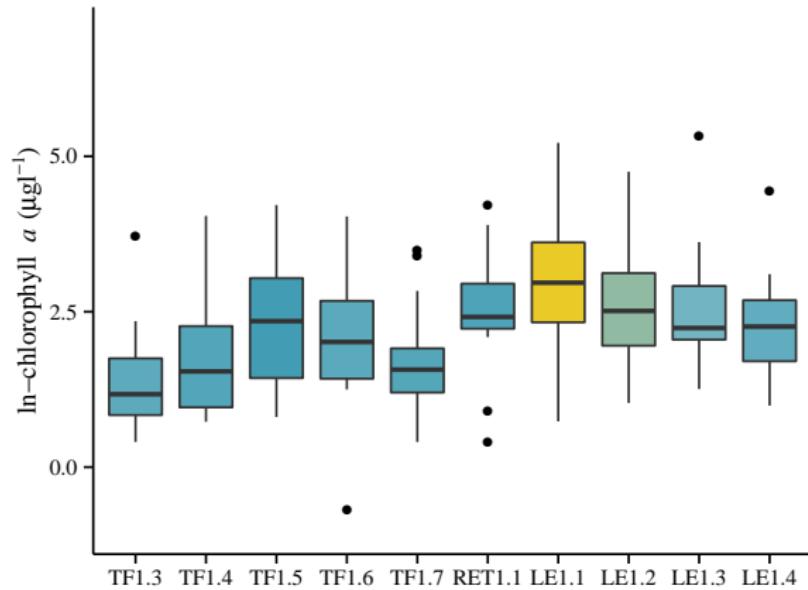
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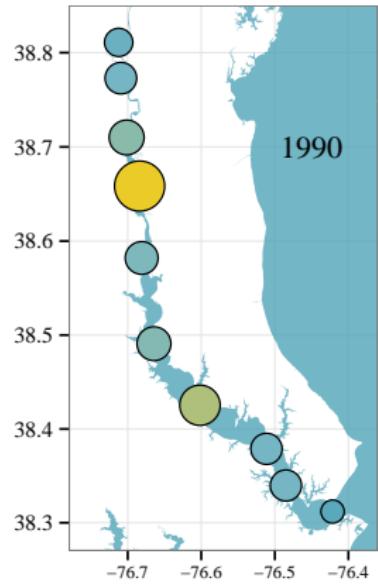
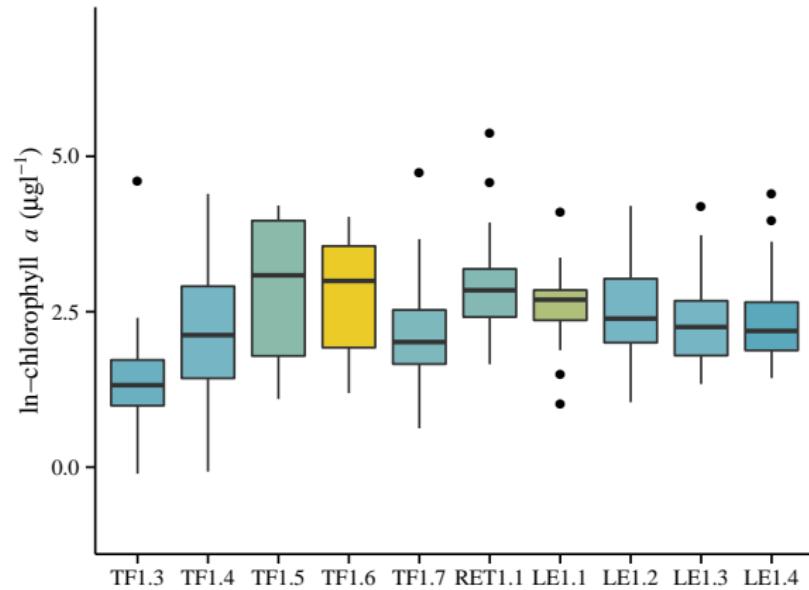
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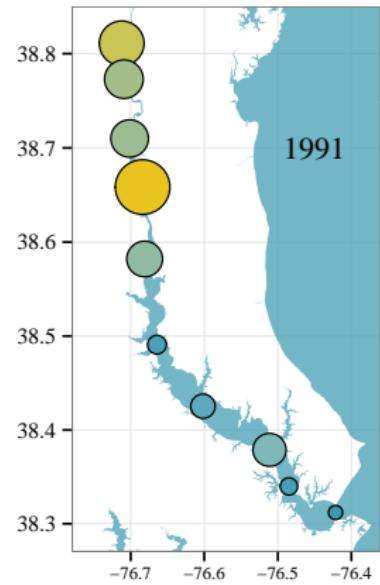
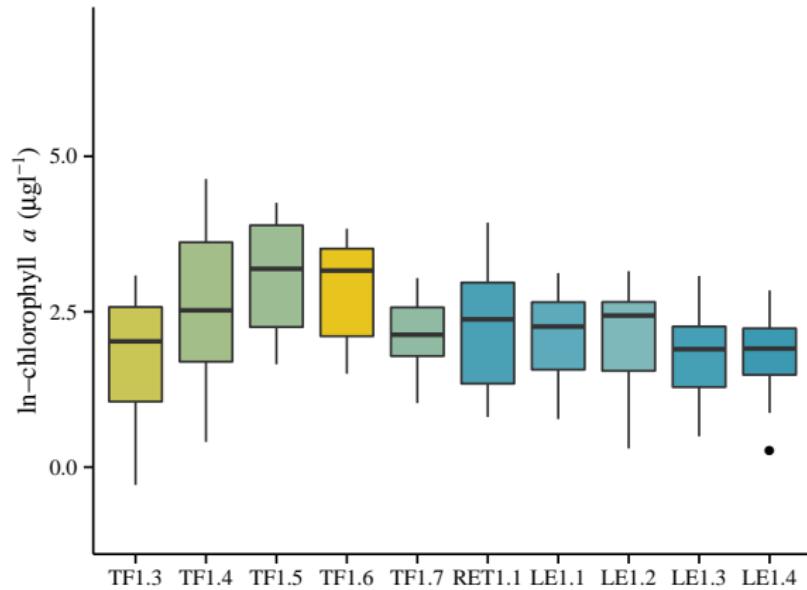
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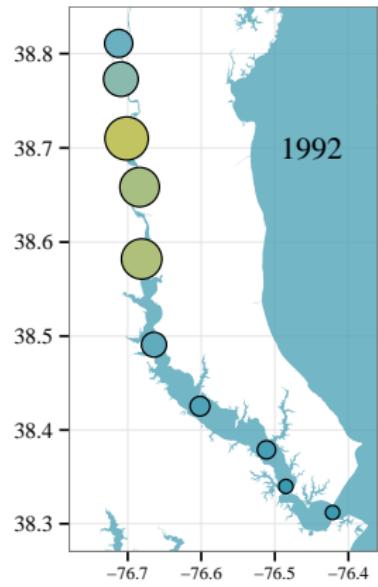
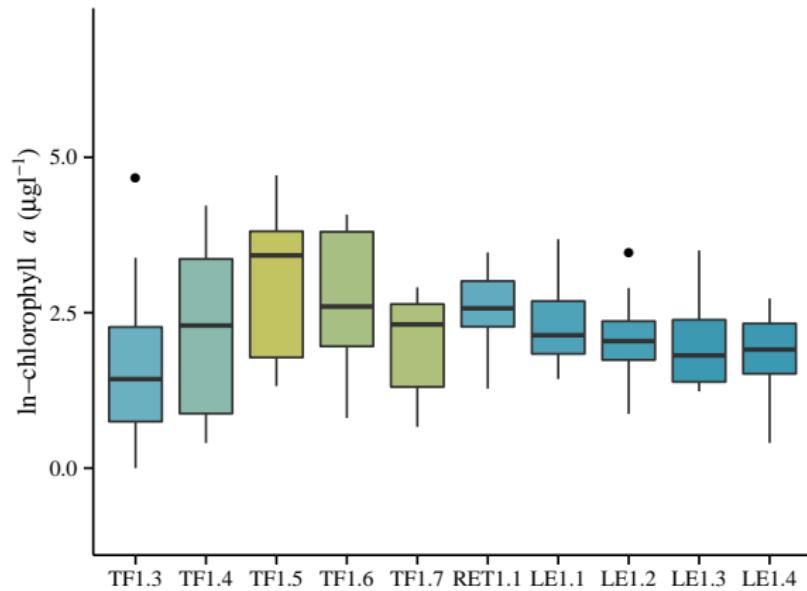
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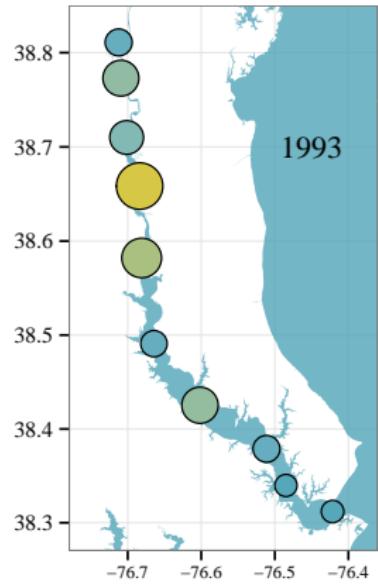
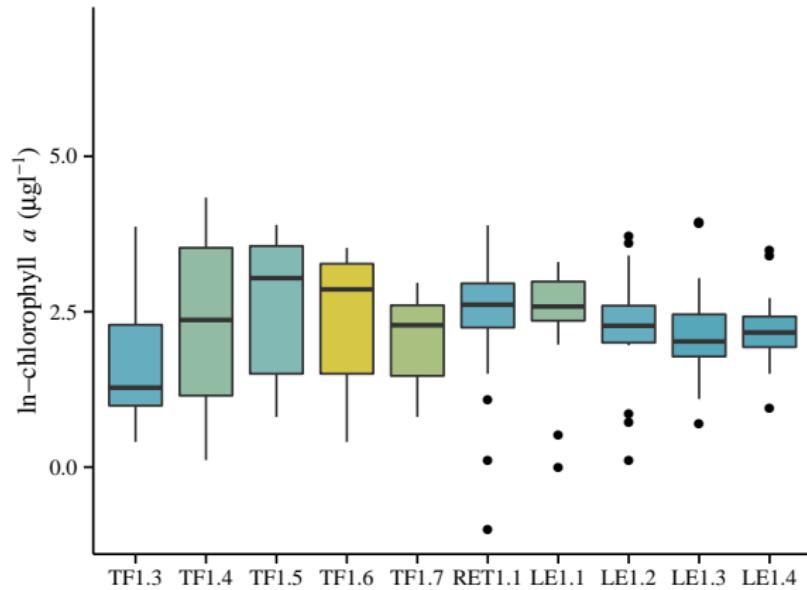
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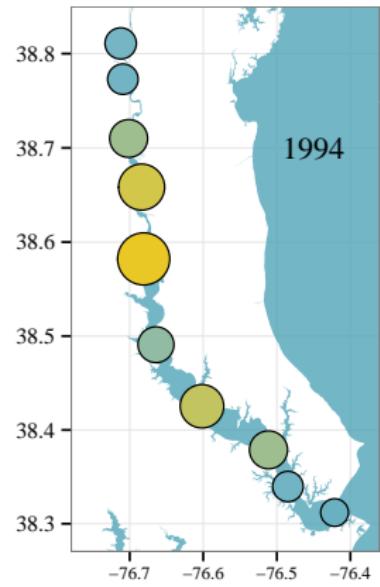
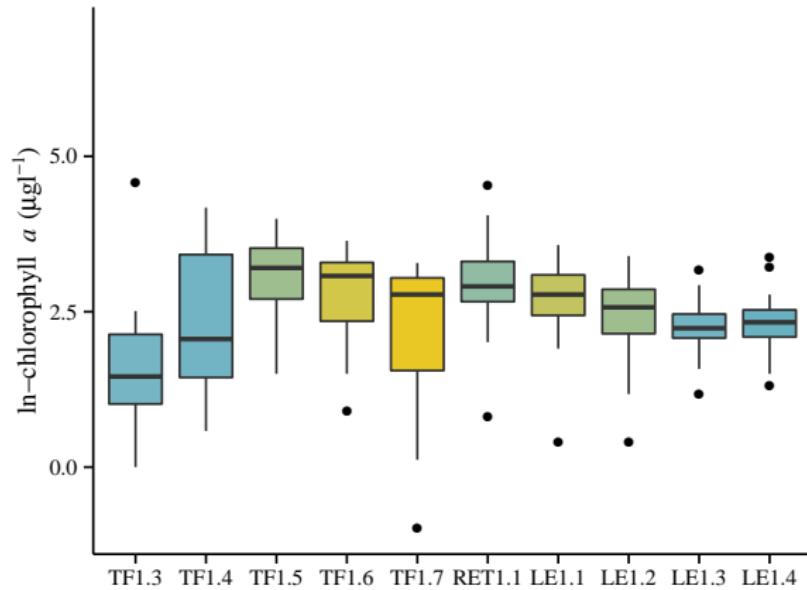
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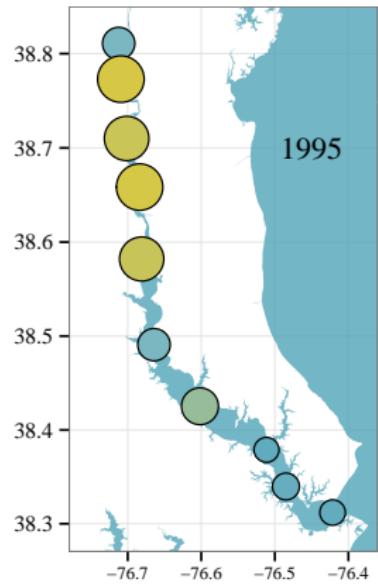
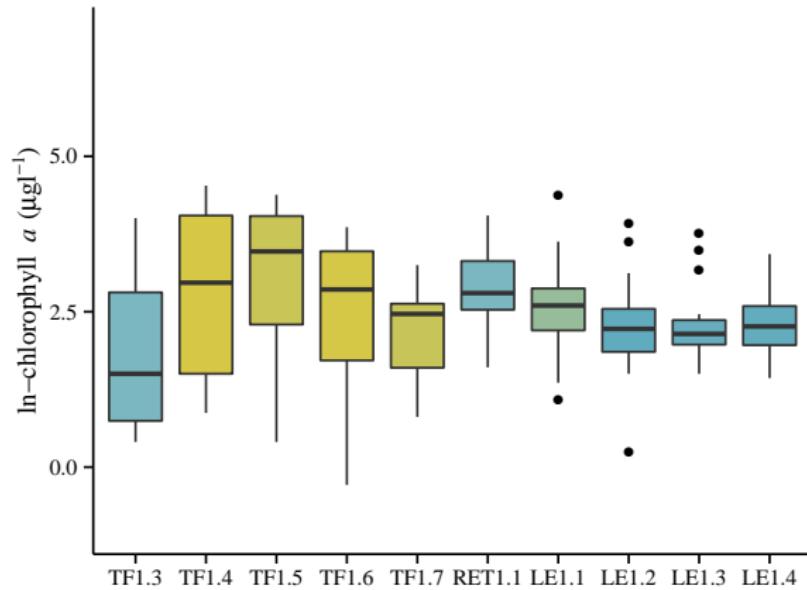
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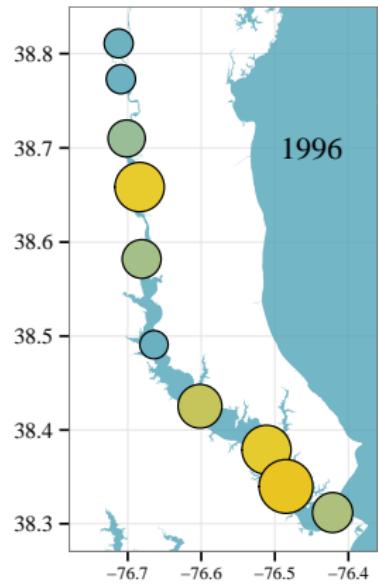
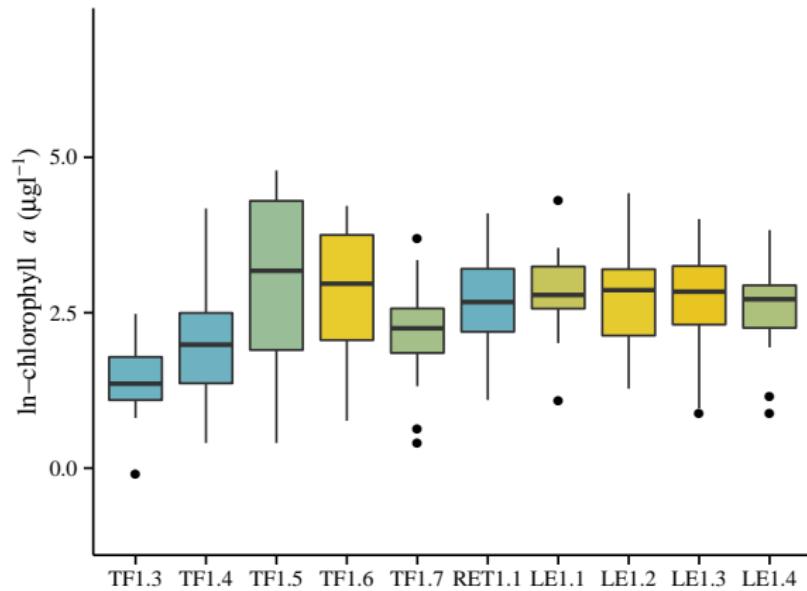
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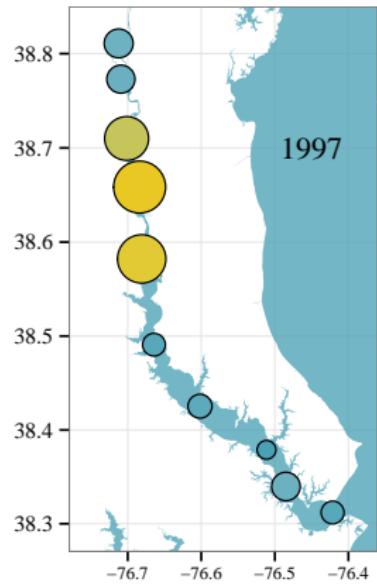
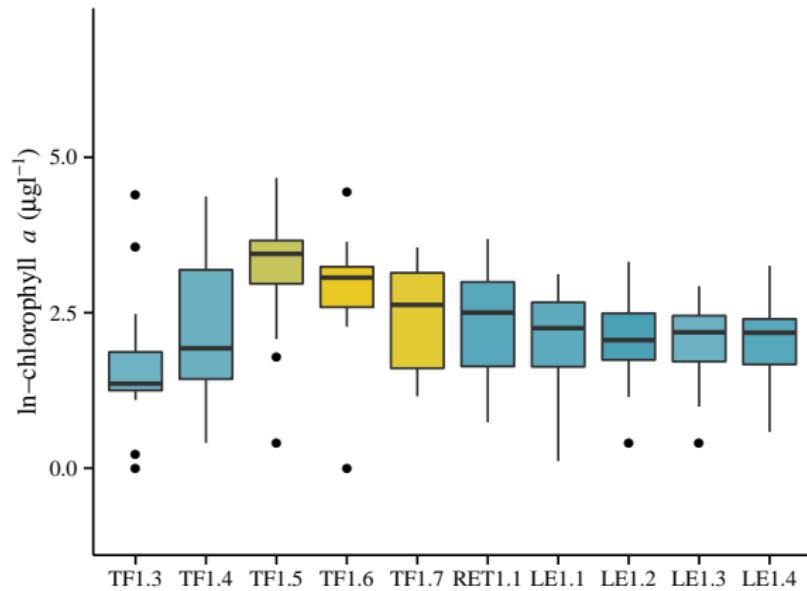
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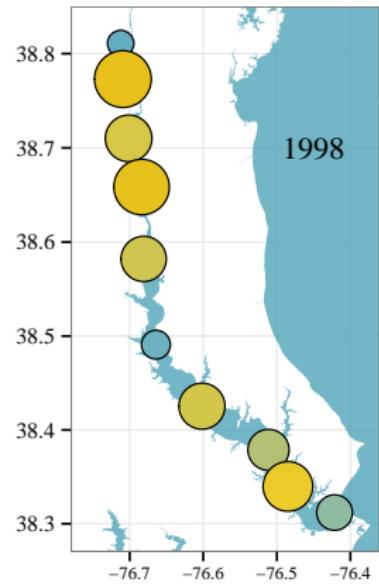
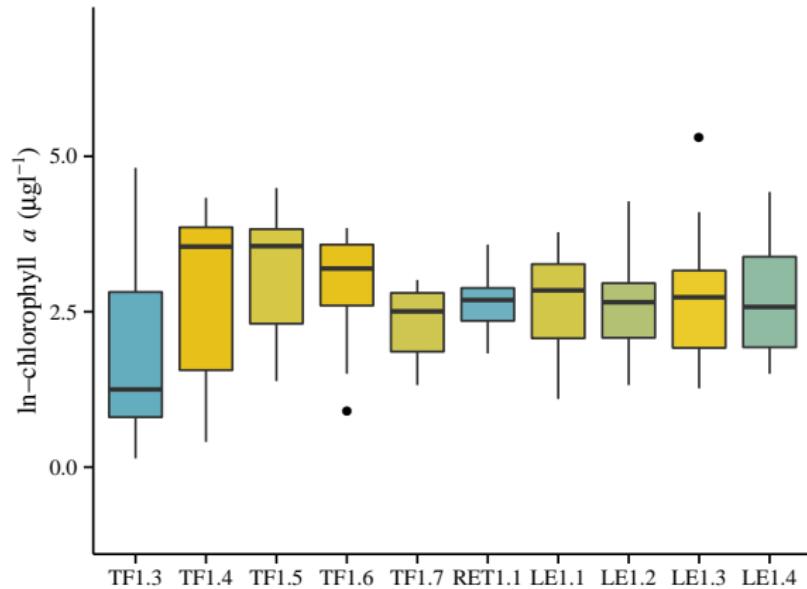
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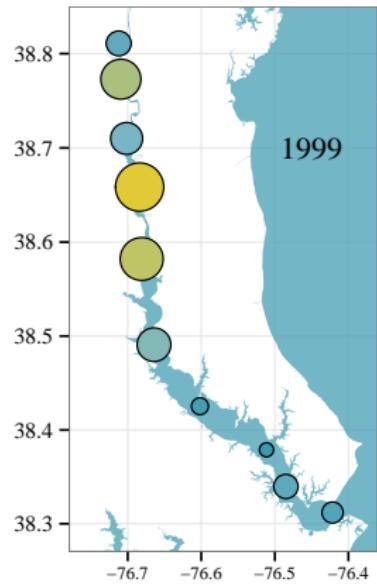
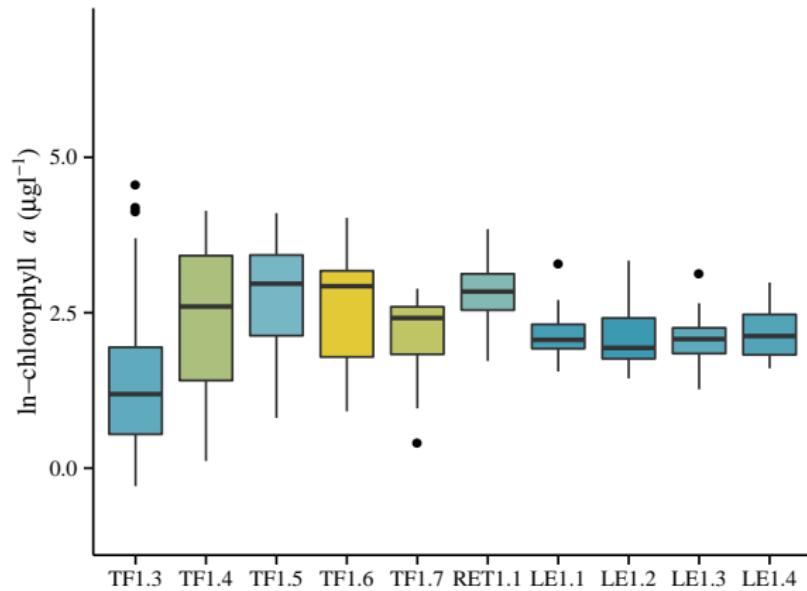
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Chlorophyll changes by year, monthly aggregations



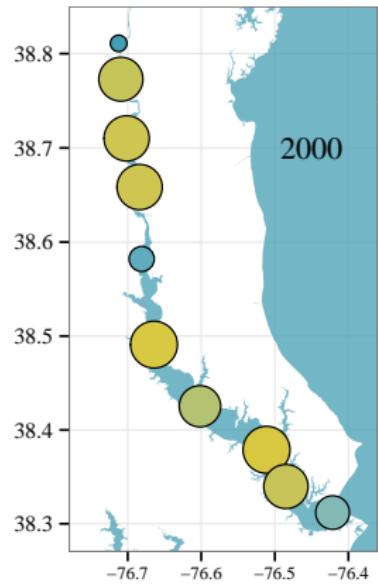
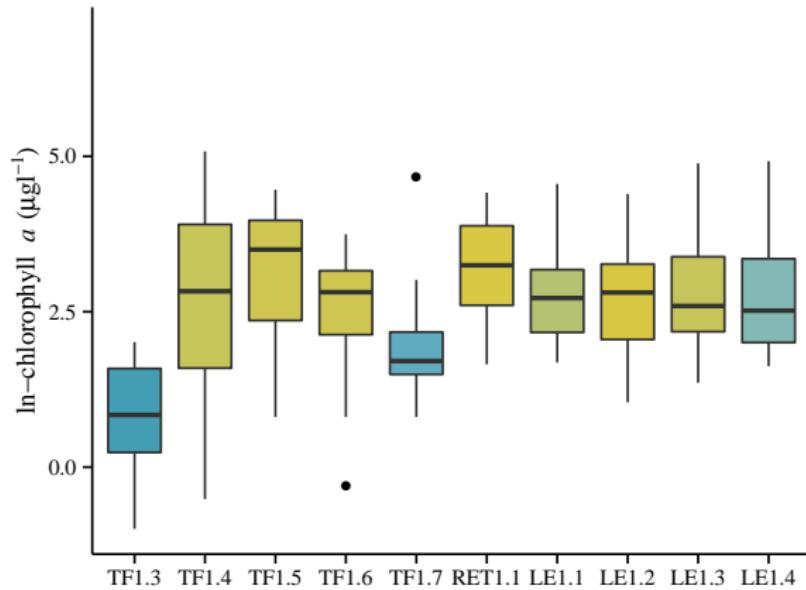
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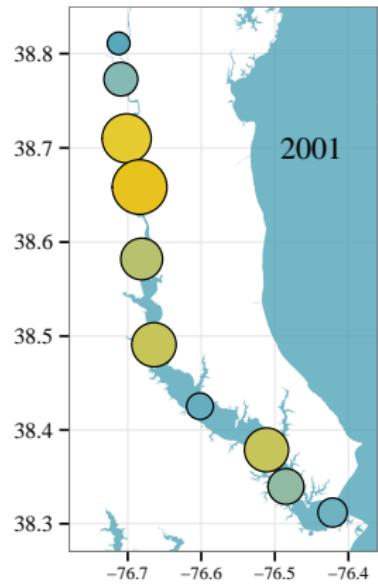
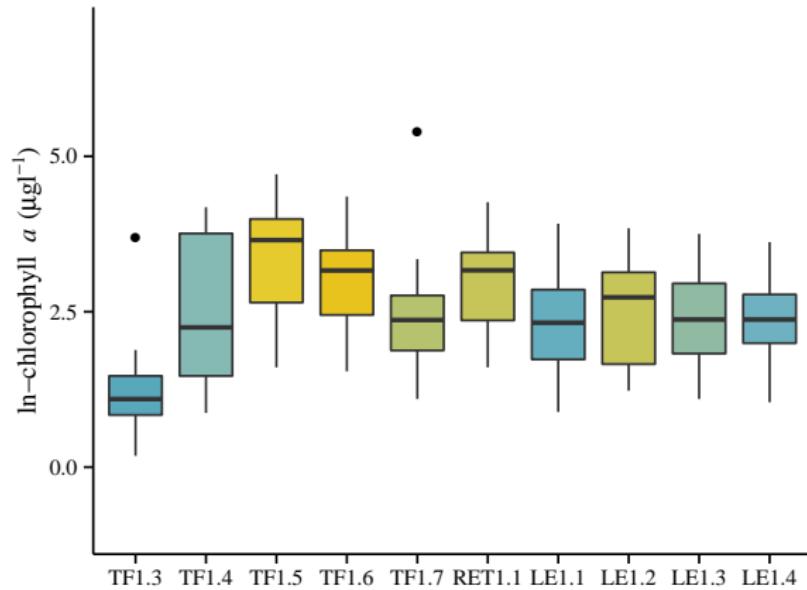
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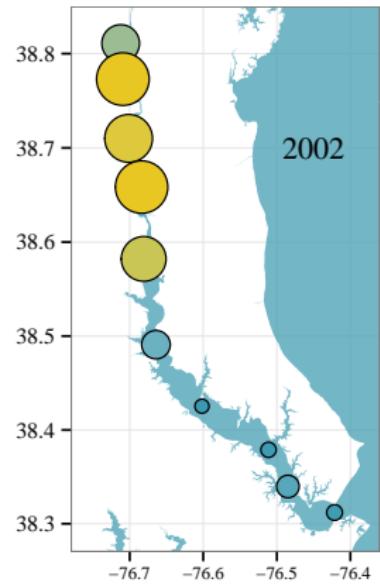
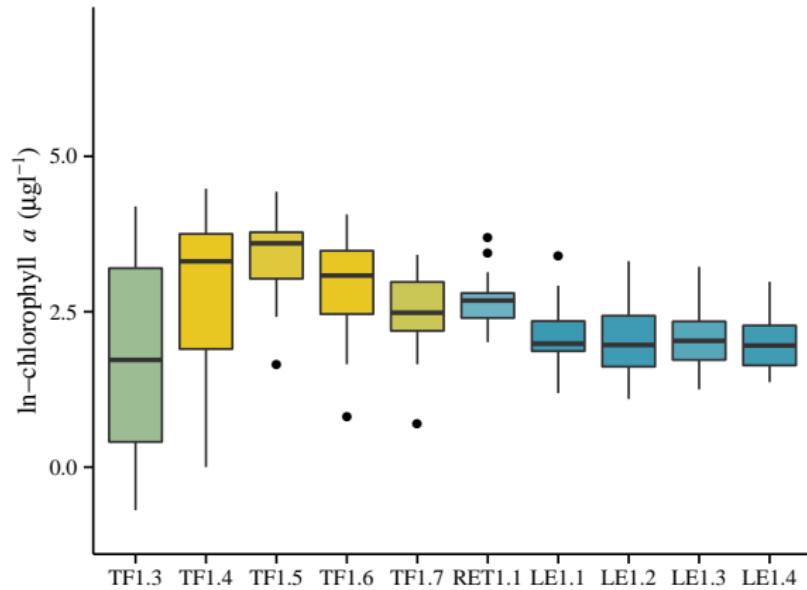
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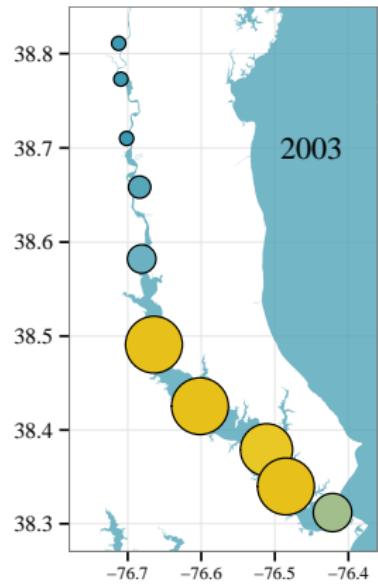
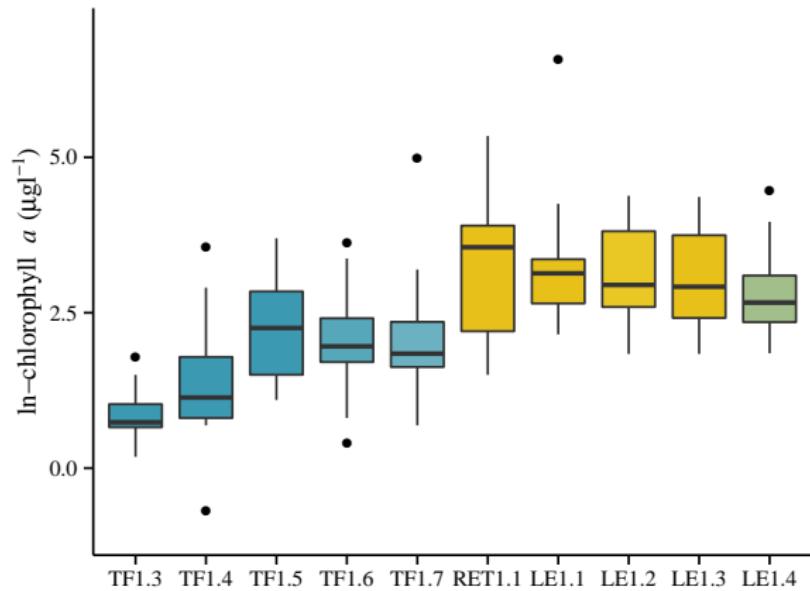
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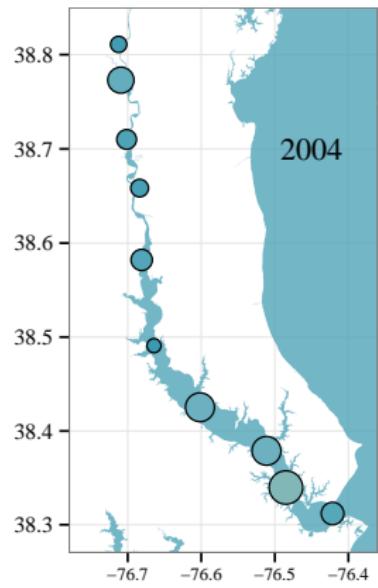
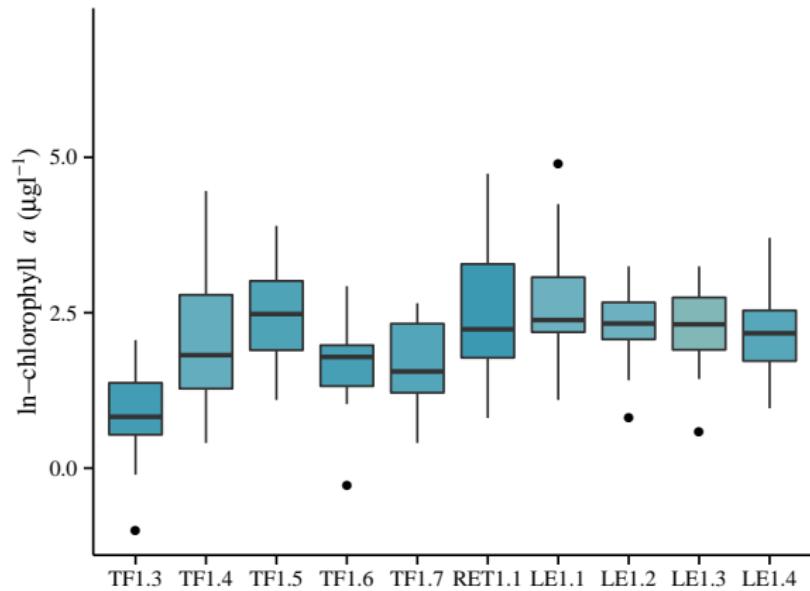
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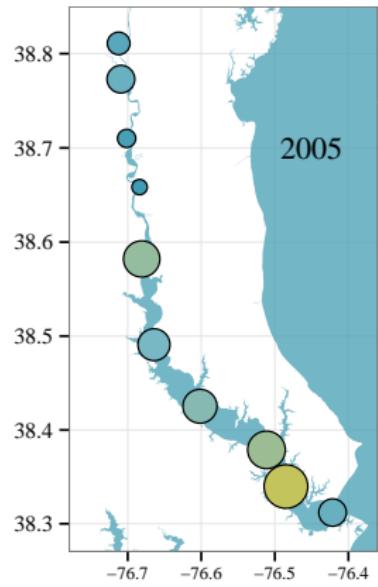
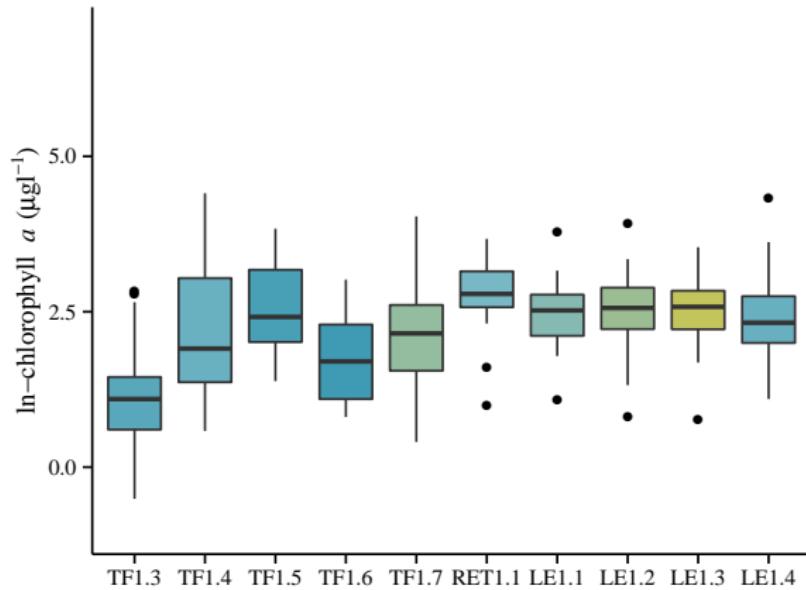
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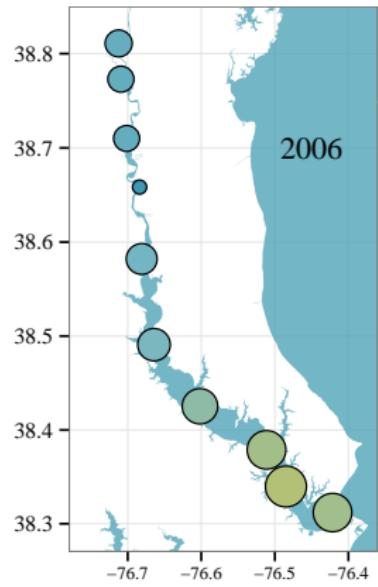
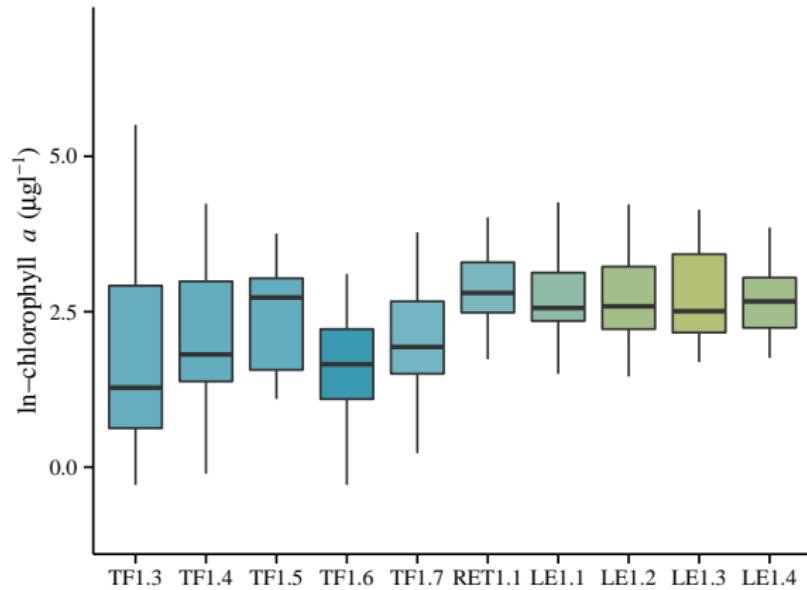
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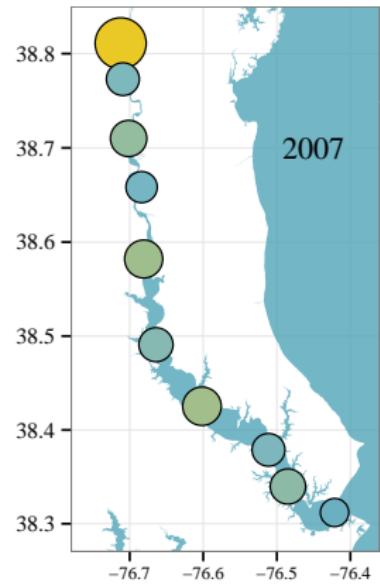
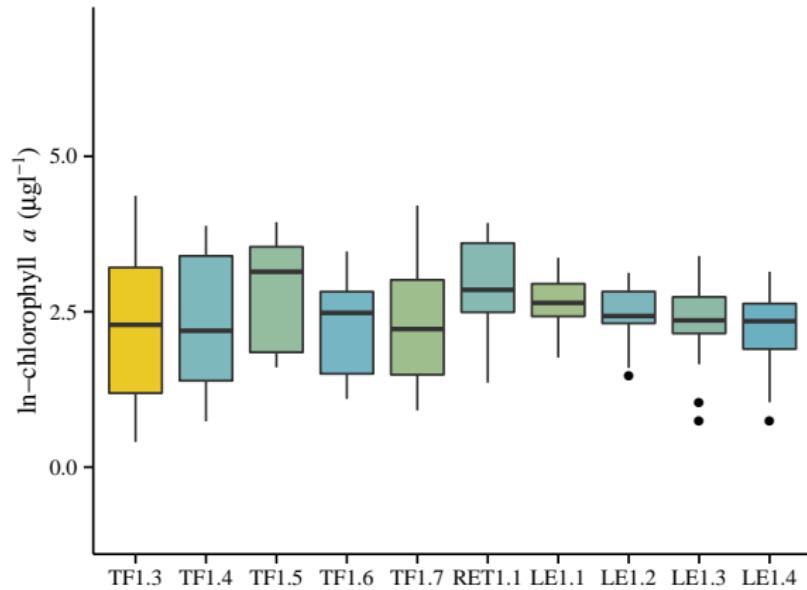
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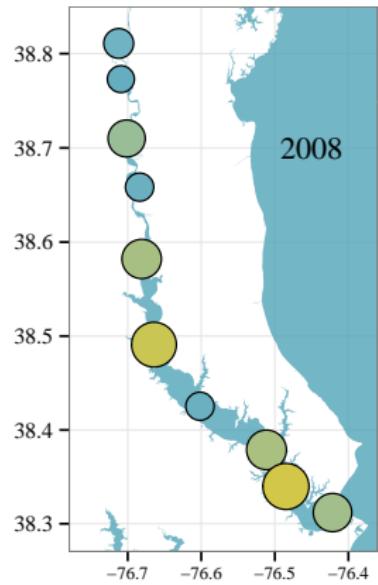
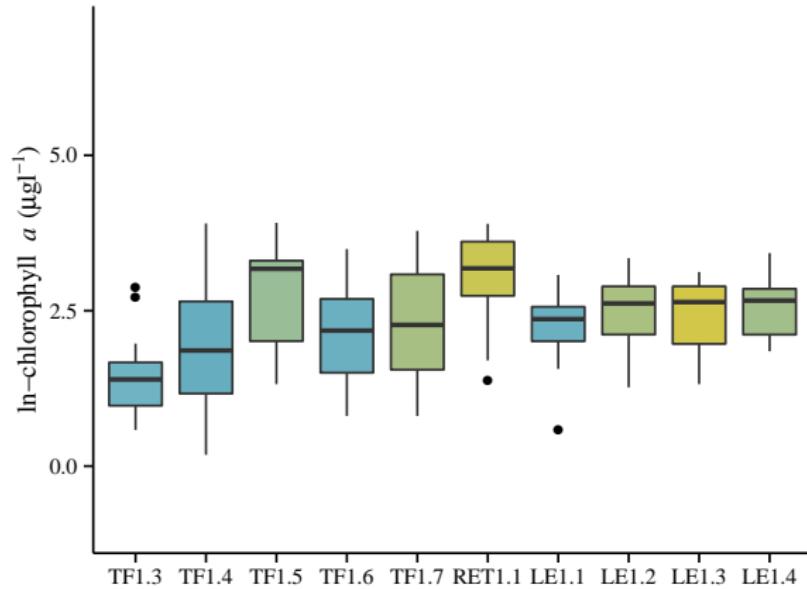
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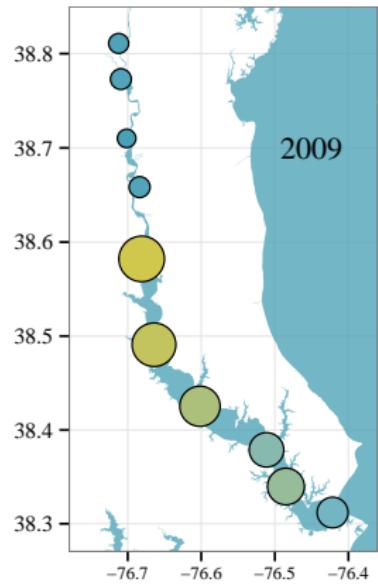
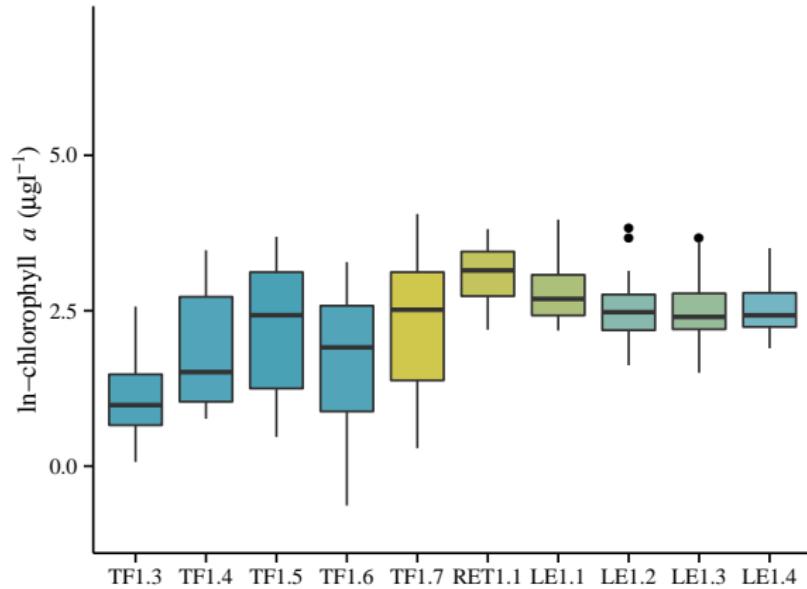
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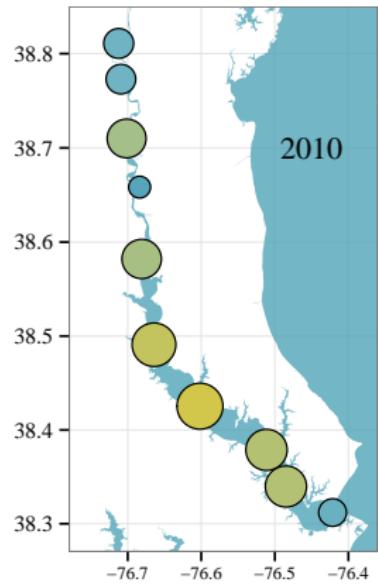
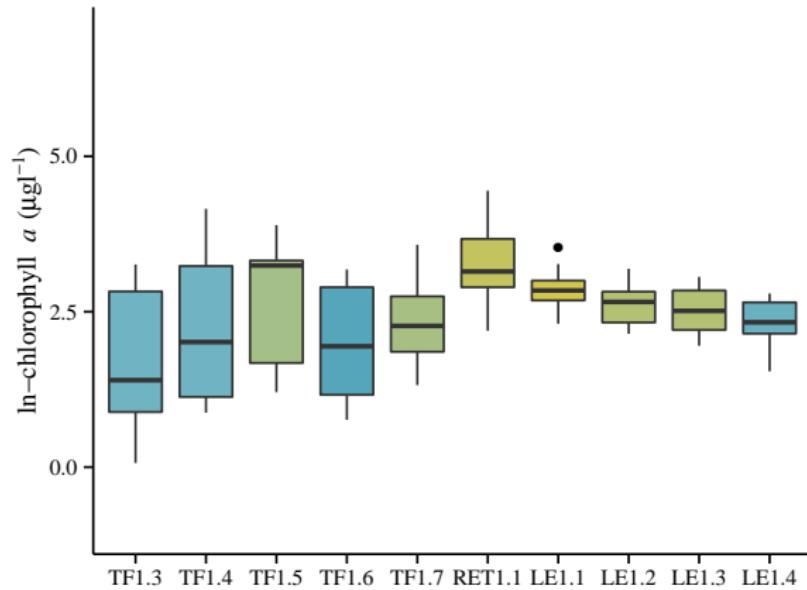
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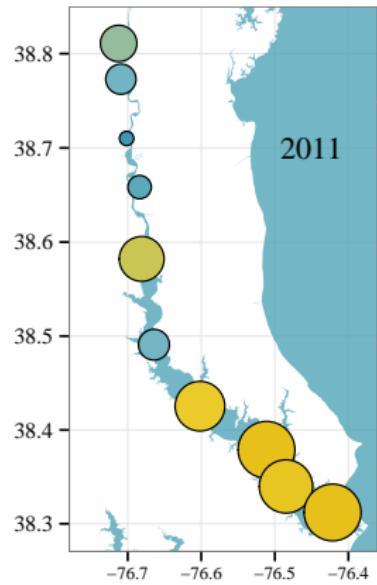
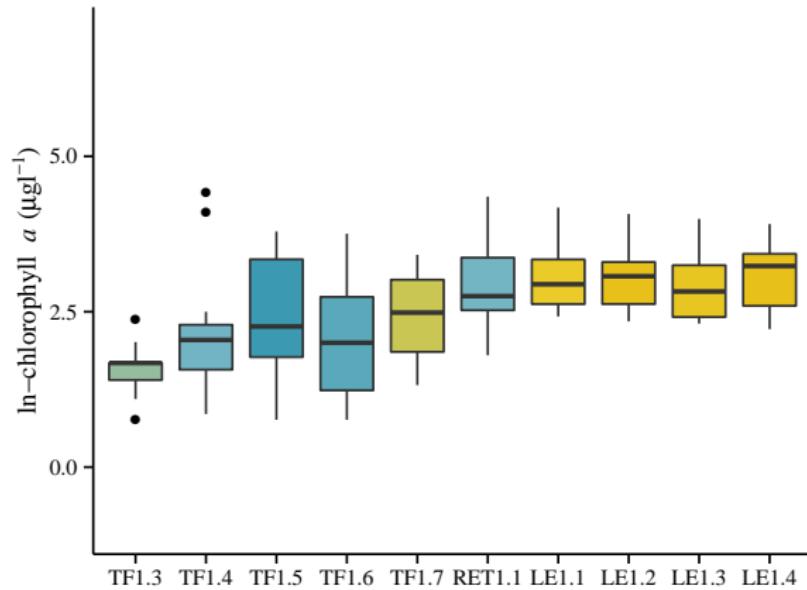
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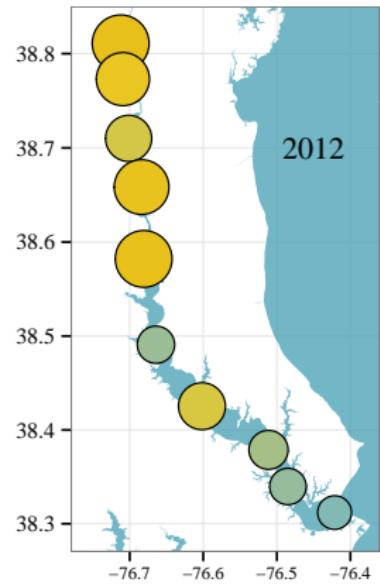
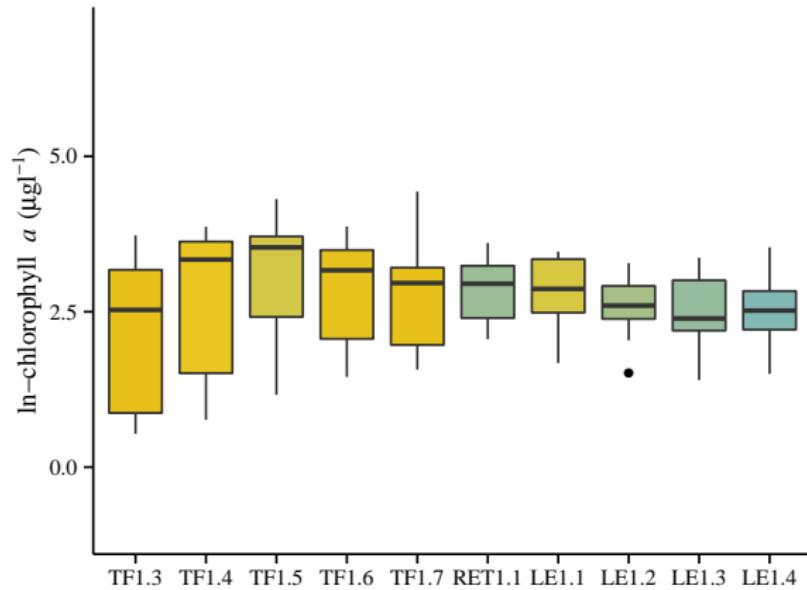
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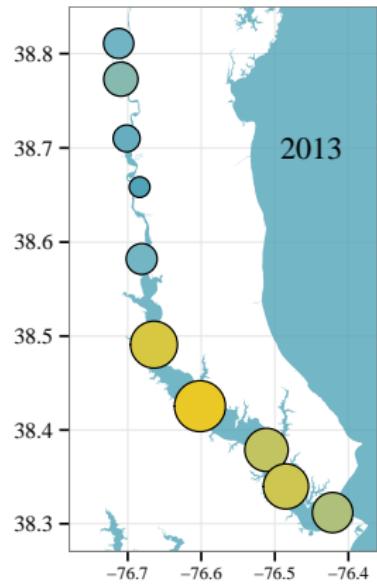
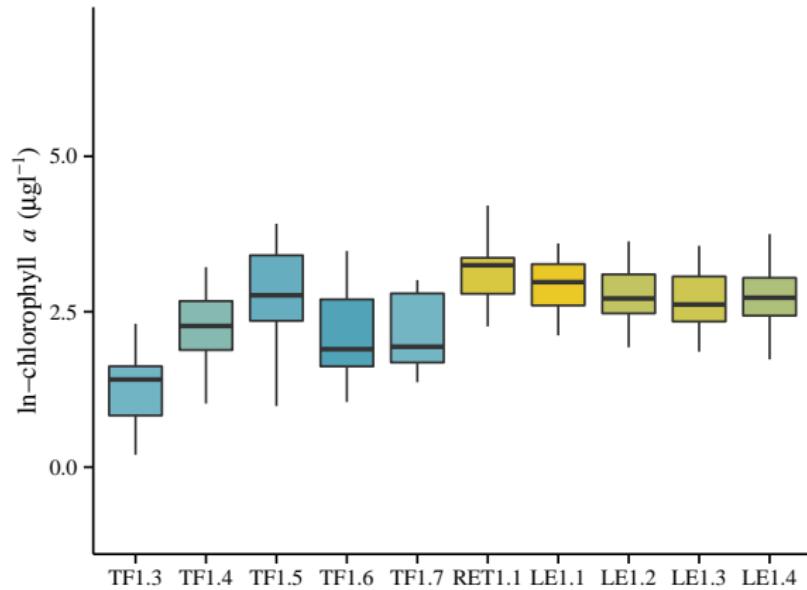
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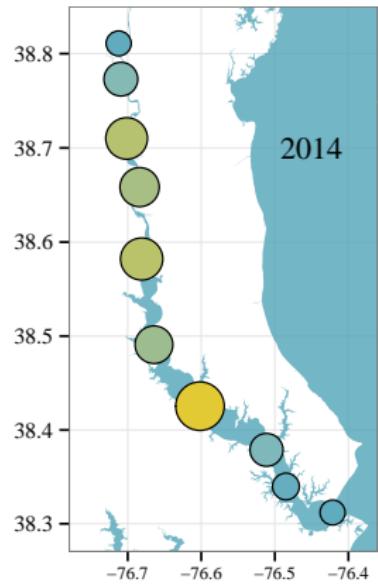
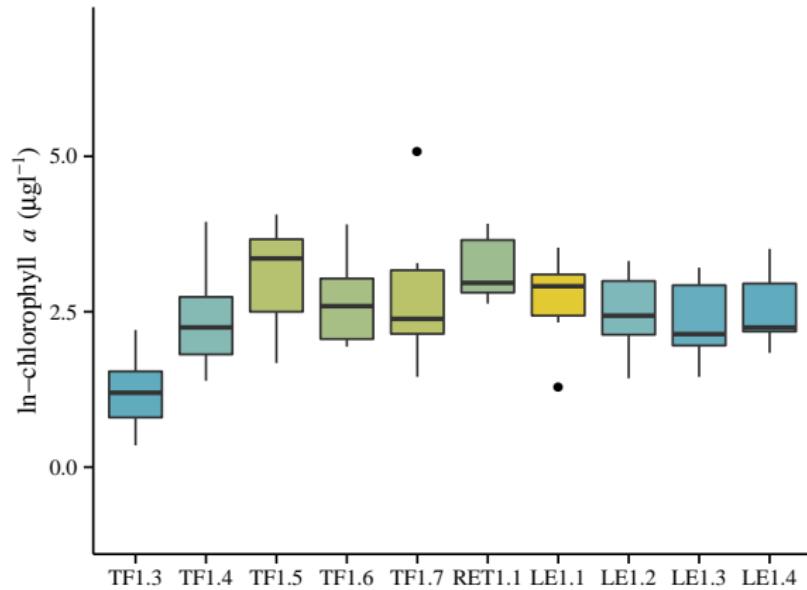
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Initial application of WRTDS/GAMs

Only preliminary evaluations so far...

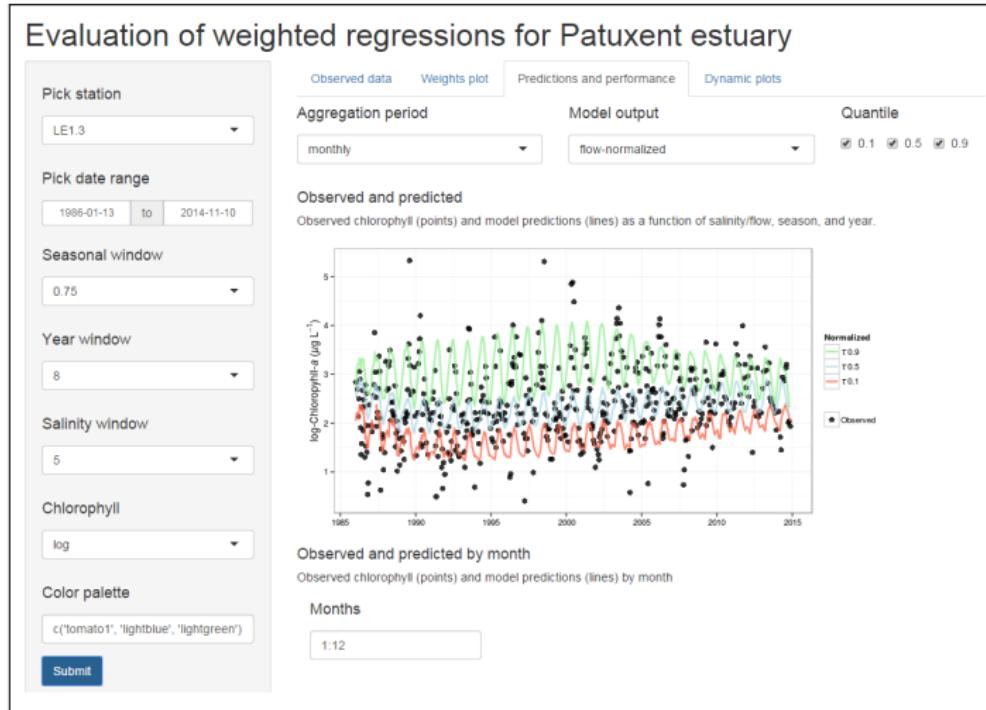
WRTDS and GAMs applied to TF1.6, LE1.3

General questions

- Do the models produce reasonable results for Patuxent?
- Are the results comparable?

Initial application of WRTDS/GAMs

Online [widget](#) to evaluate WRTDS results - uses [WRTDStidal](#) package



Initial application of WRTDS/GAMs

GAMs showing comparable results...

Discussion points

- General consensus that we are on the right track?
- Best ways to compare (accuracy/bias of predictions, scatter plots, comparison of flow-normalized patterns, etc.)
- Need for simulated data to evaluate flow-normalization
- Salinity vs flow for model development
- Mean vs quantile comparisons
- Effect of fitting process on results (window combos, no. of knots)

Discussion points

Contacts: beck.marcus@epa.gov, rmurphy@chesapeakebay.net

Widget: https://beckmw.shinyapps.io/patux_mods/

WRTDStidal: https://github.com/fawda123/wtreg_for_estuaries

This presentation:

https://github.com/fawda123/tidal_comp/raw/master/text/summary.pdf