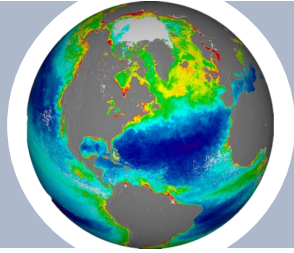


^{14}C -uptake:

What have we learned?

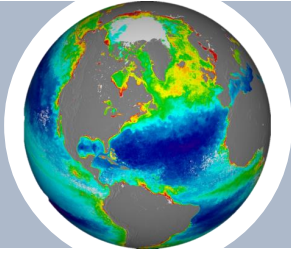
Where can we go from here?

Kimberly Halsey, Associate Professor
Dept. of Microbiology
Oregon State University

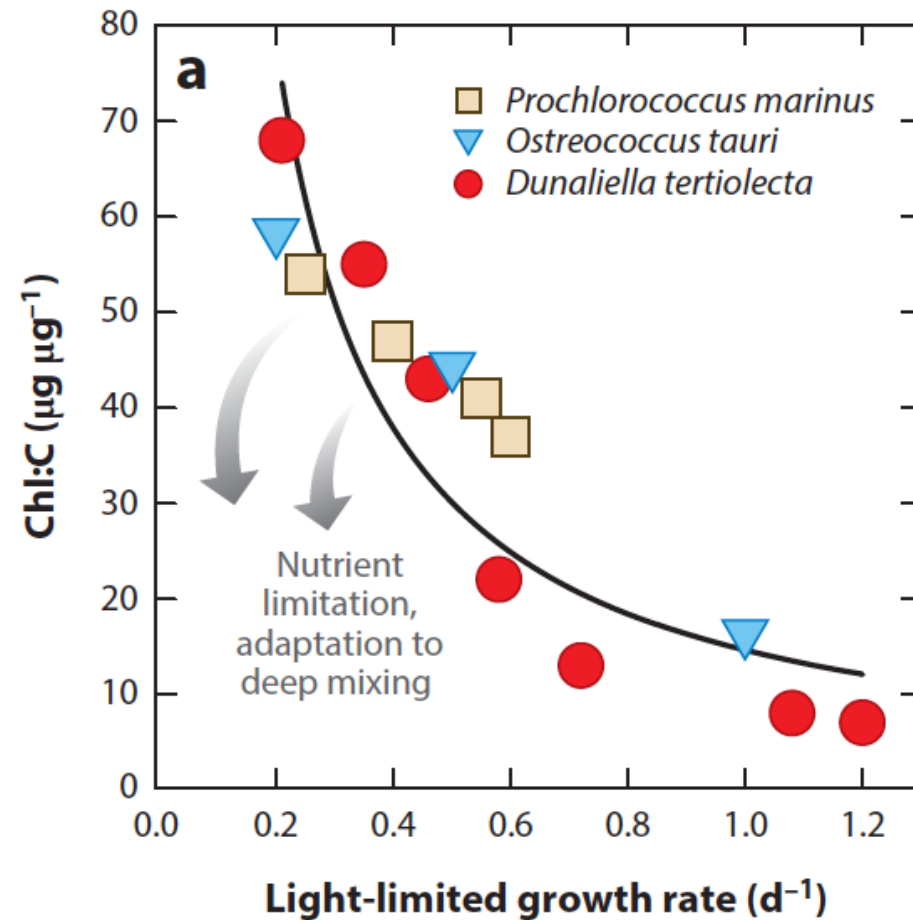


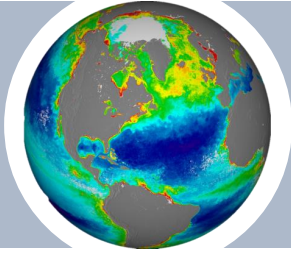
Initial points. . .

- Net primary production (NPP) is a *rate*
- Properties retrieved by satellite are generally standing stocks
 - Chlorophyll
 - Carbon
- To convert a *stock* to a *rate* we rely on the assimilation efficiency = ^{14}C uptake rate per unit Chlorophyll
- Most of the error in Chlorophyll-derived NPP is associated with the light-saturated carbon assimilation rate



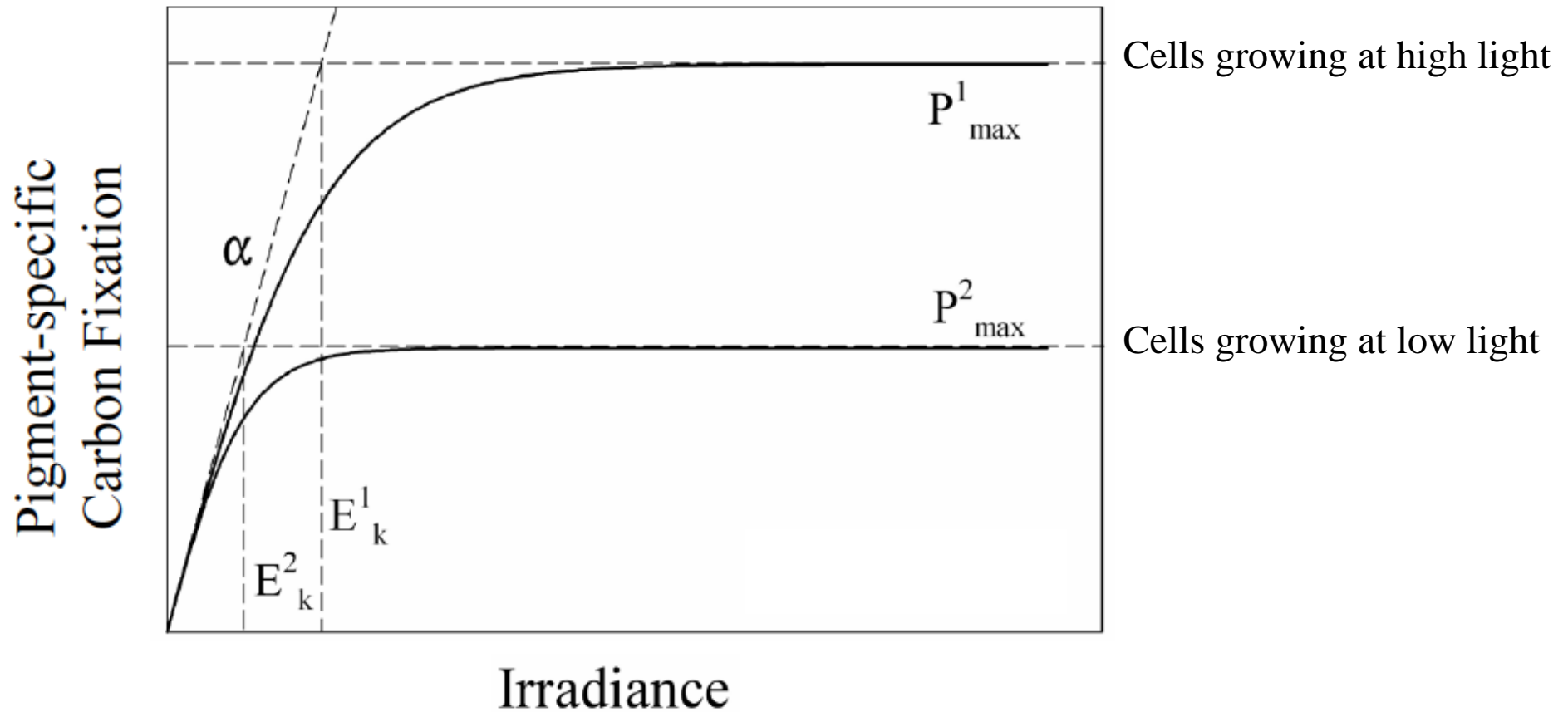
Chlorophyll content varies with environment

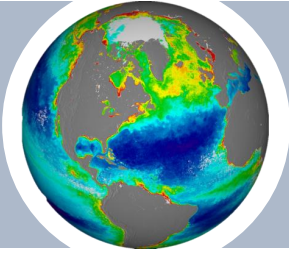




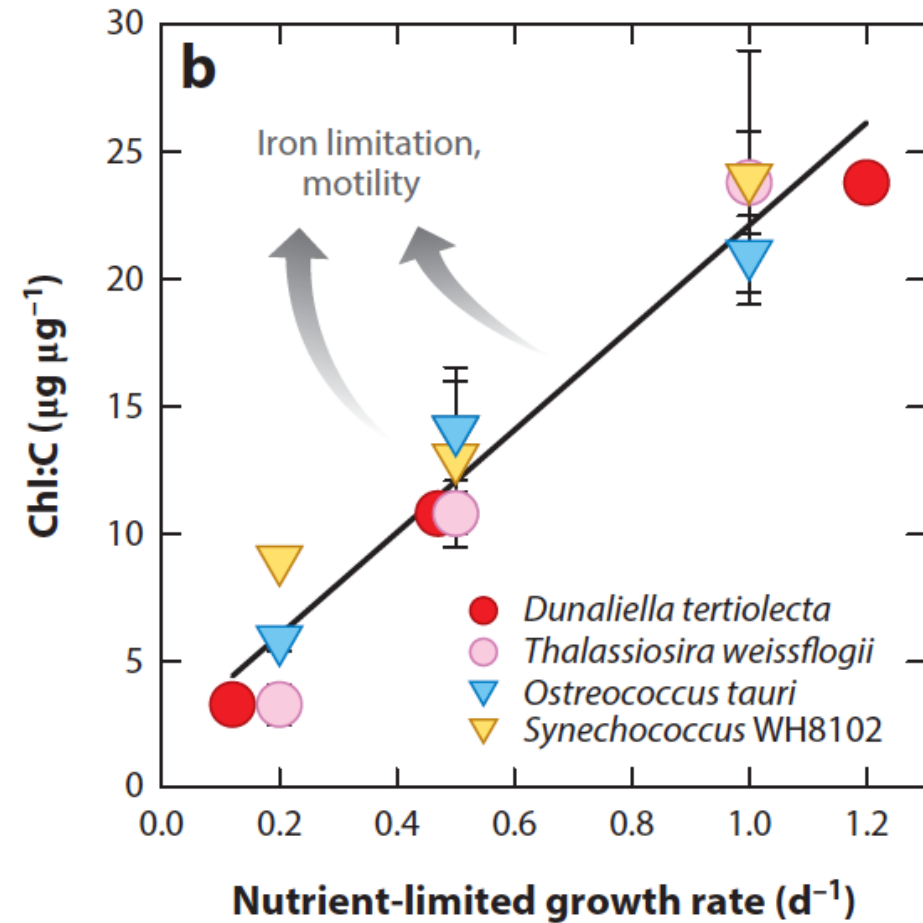
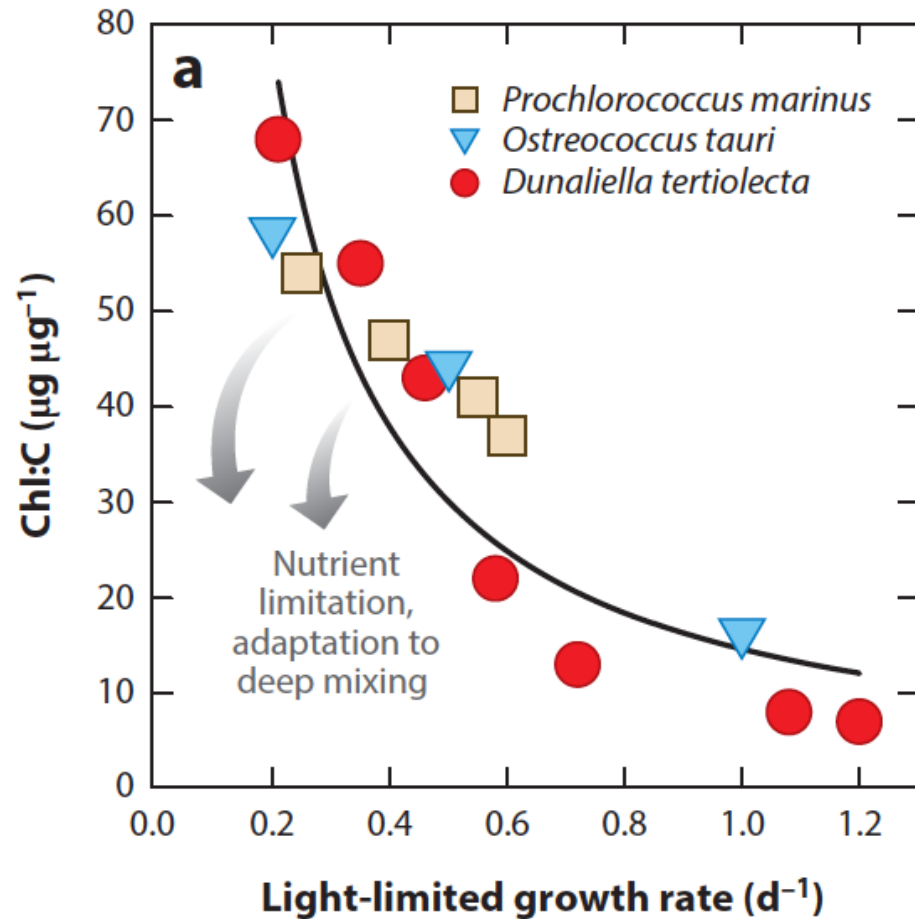
Photosynthesis – irradiance relationship

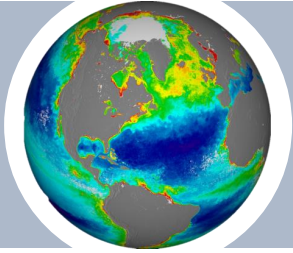
Light-driven photoacclimation



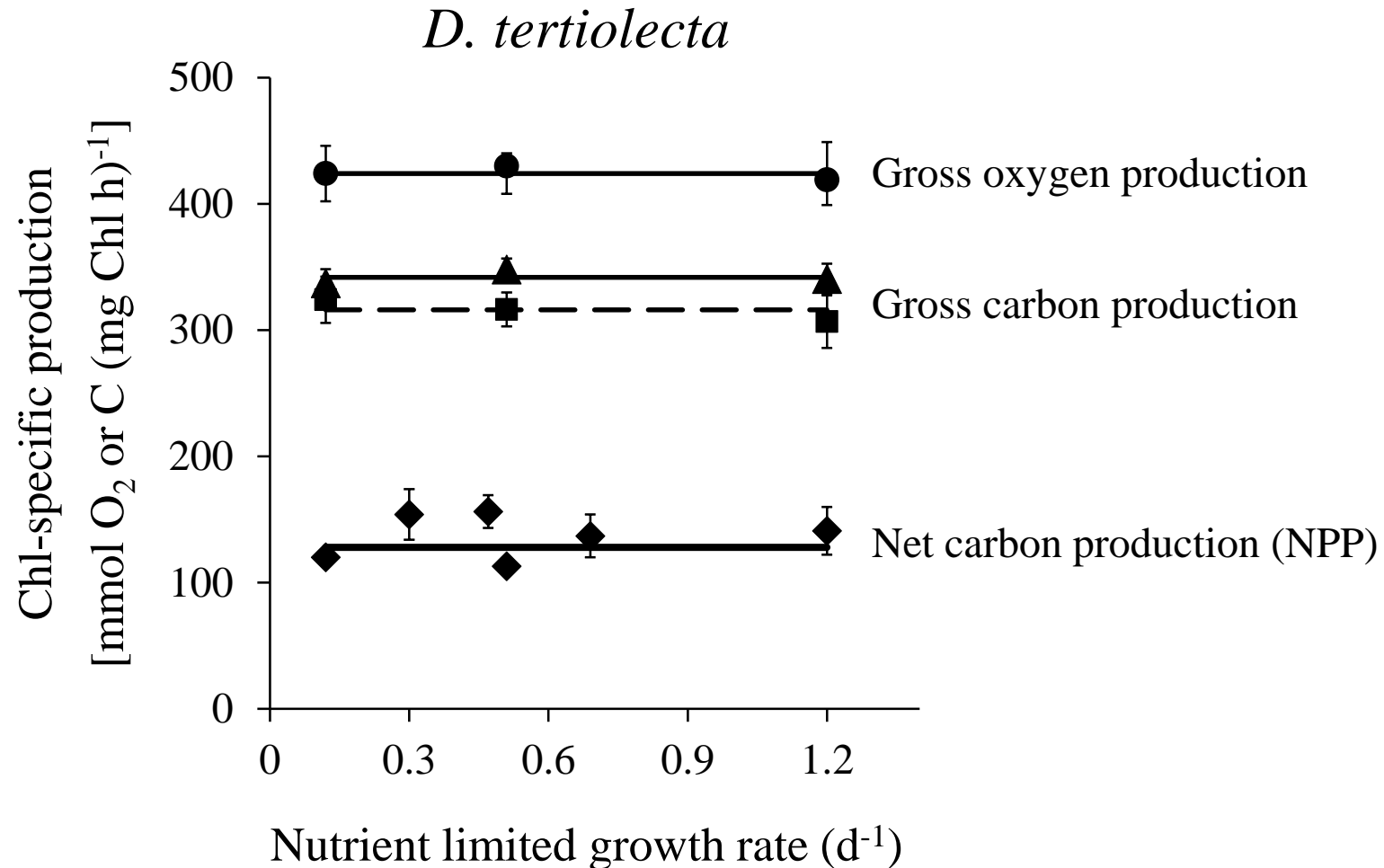


Chlorophyll content varies with environment

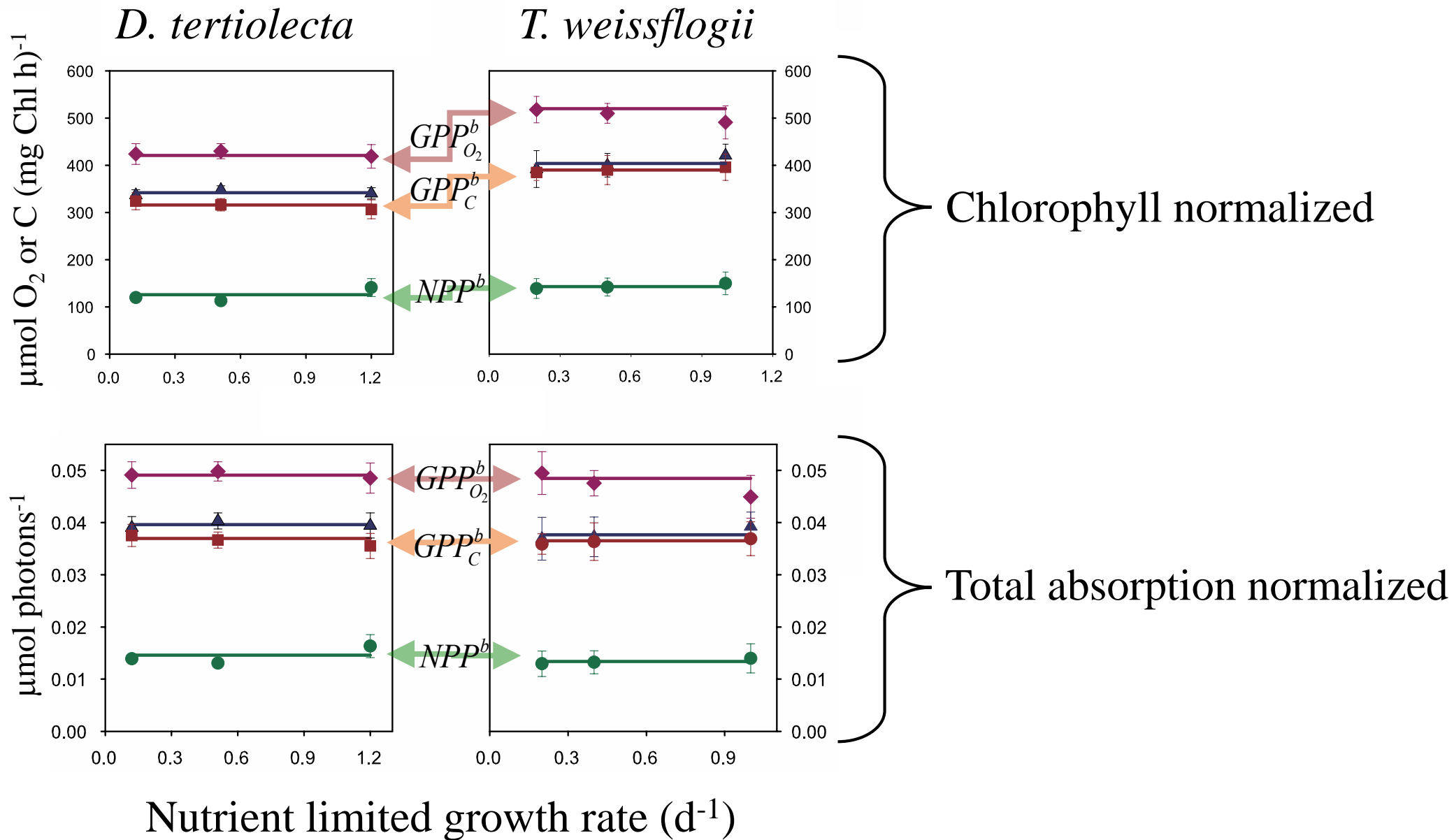


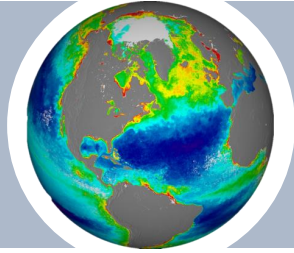


Chl-specific production is independent of nutrient limitation



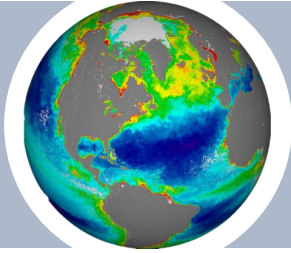
Production





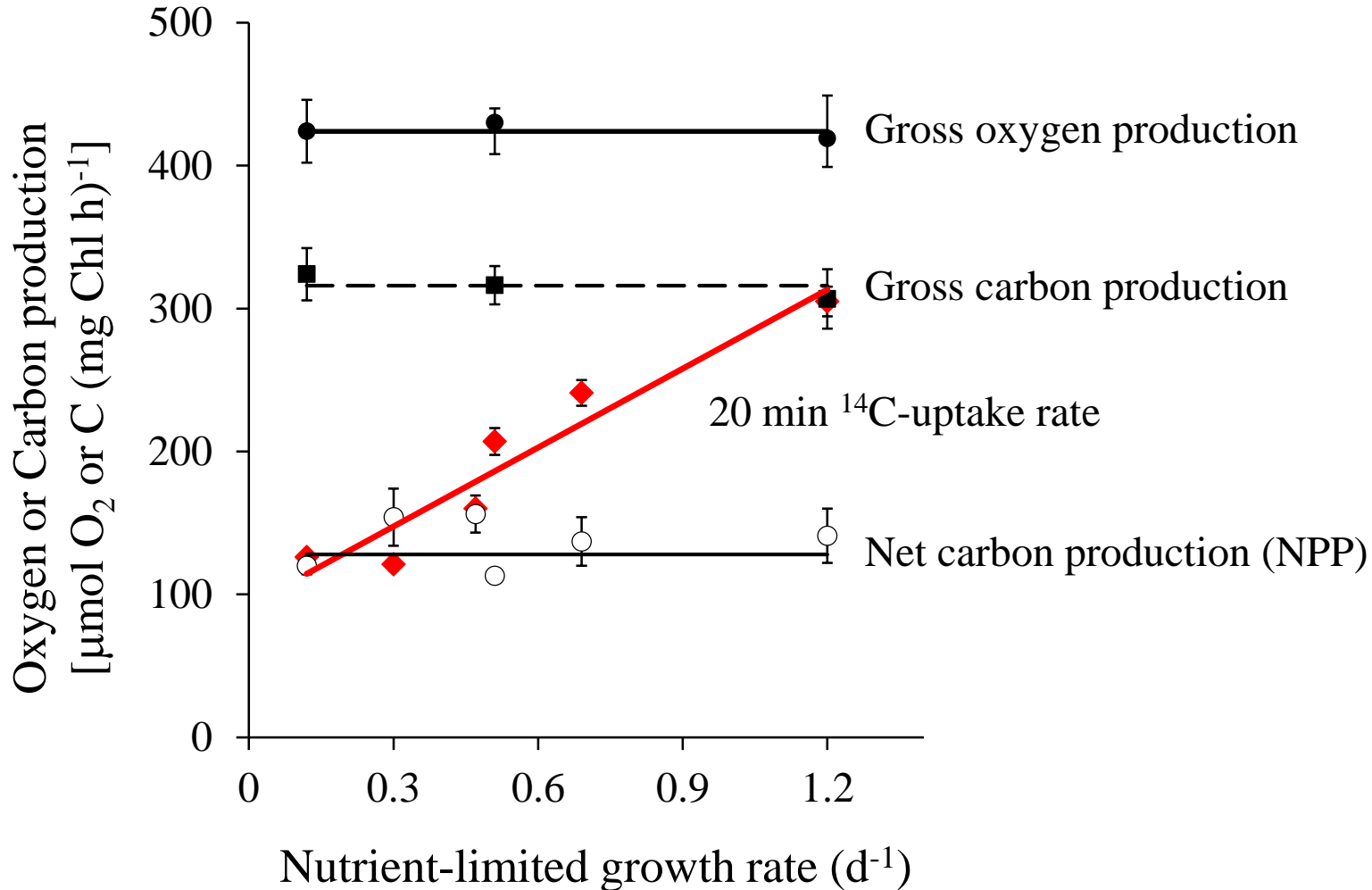
Key points for using ^{14}C -uptake

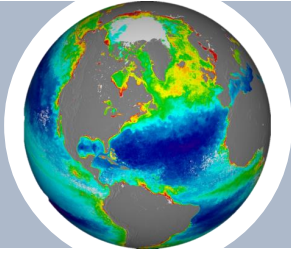
- Chlorophyll conversions to NPP need to account for light-driven photoacclimation
- Dependence of production on total absorption not just chlorophyll
- *Exceptions to these behaviors:*
 - *Micromonas* sp. does not tune chlorophyll to nutrient status
 - Iron stress
 - Bottle effects, labeling, start-stop times (dawn-to-dawn), time-of-day
- What other information can we glean from ^{14}C -uptake besides focusing on assimilation efficiencies?
 - $\text{NPP} = \text{C} \cdot \mu$



Short-term ^{14}C uptake is sensitive to growth rate

Can we use time-dependency of carbon metabolism to estimate growth rate?

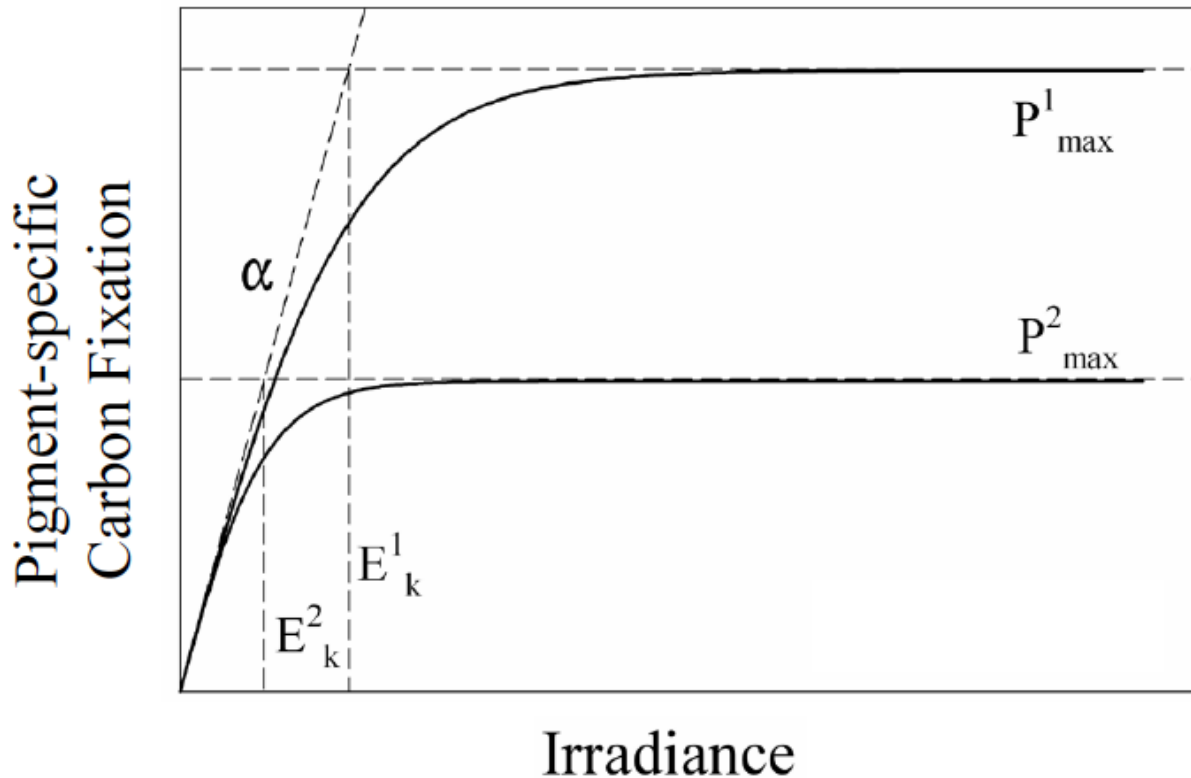




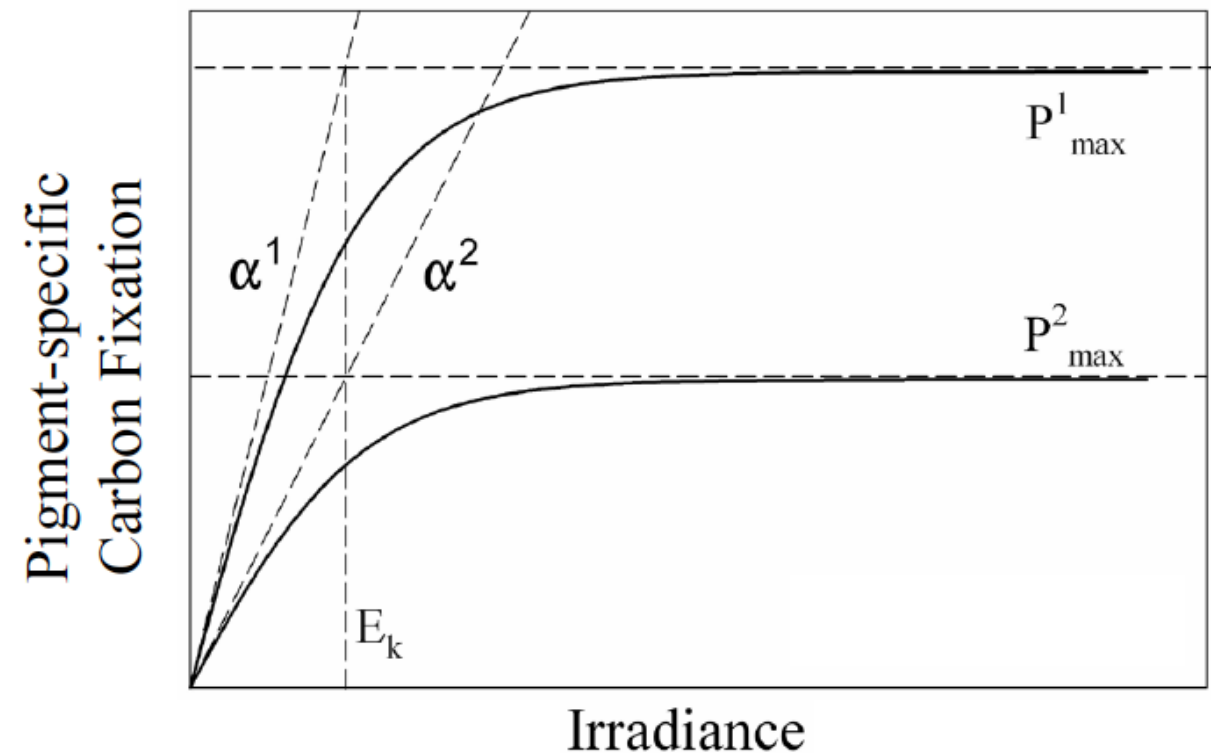
Photosynthesis – irradiance relationships

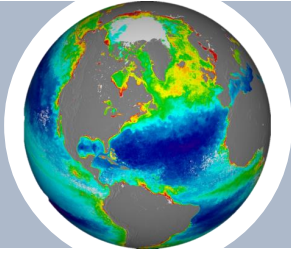
Can we use E_k independent variability to estimate growth rate?

E_k -independent variability
Light-driven photoacclimation

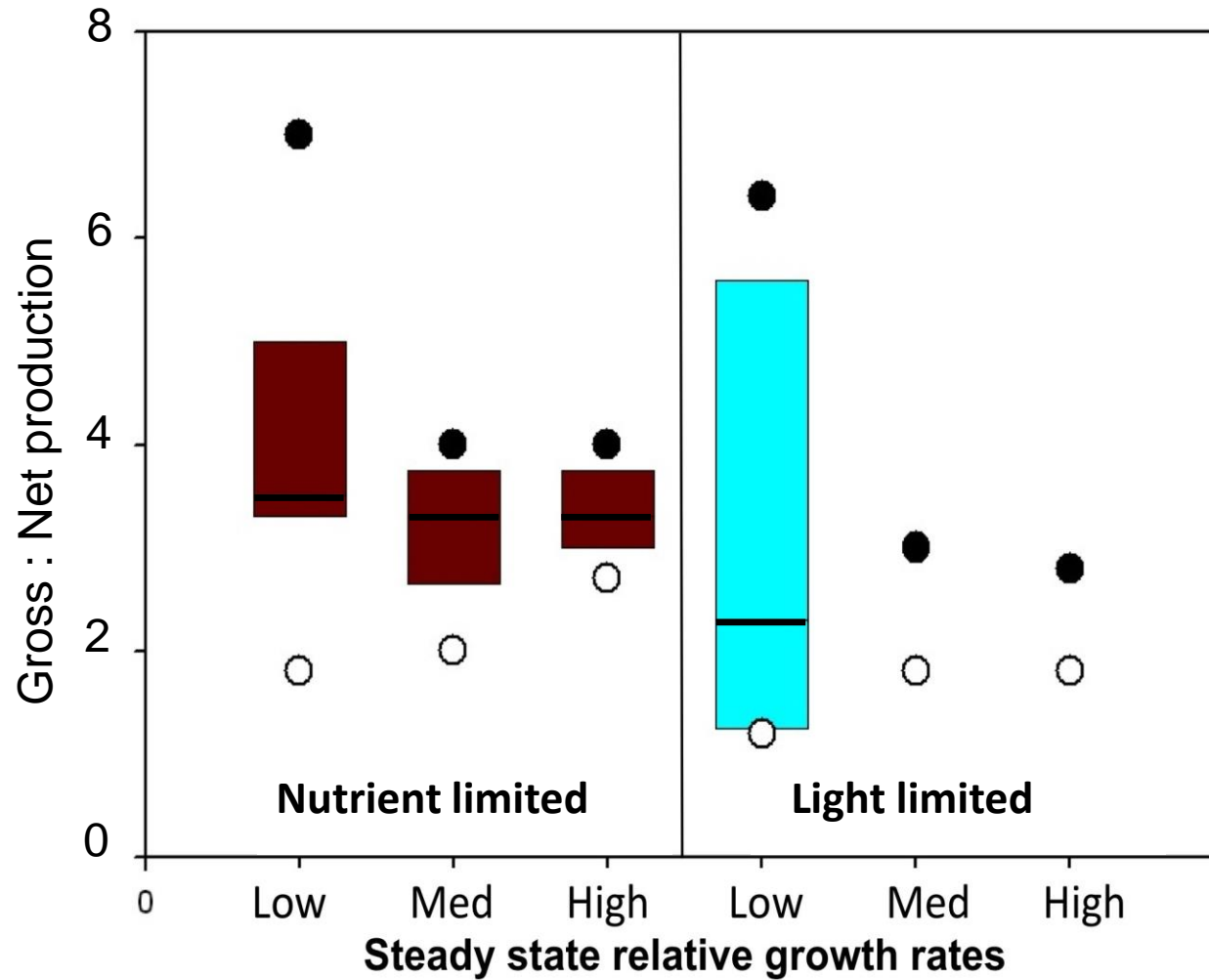


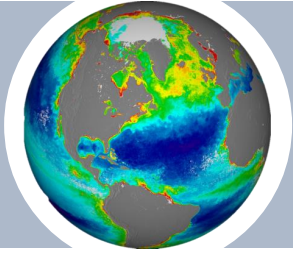
E_k -independent variability
Growth rate-driven metabolism





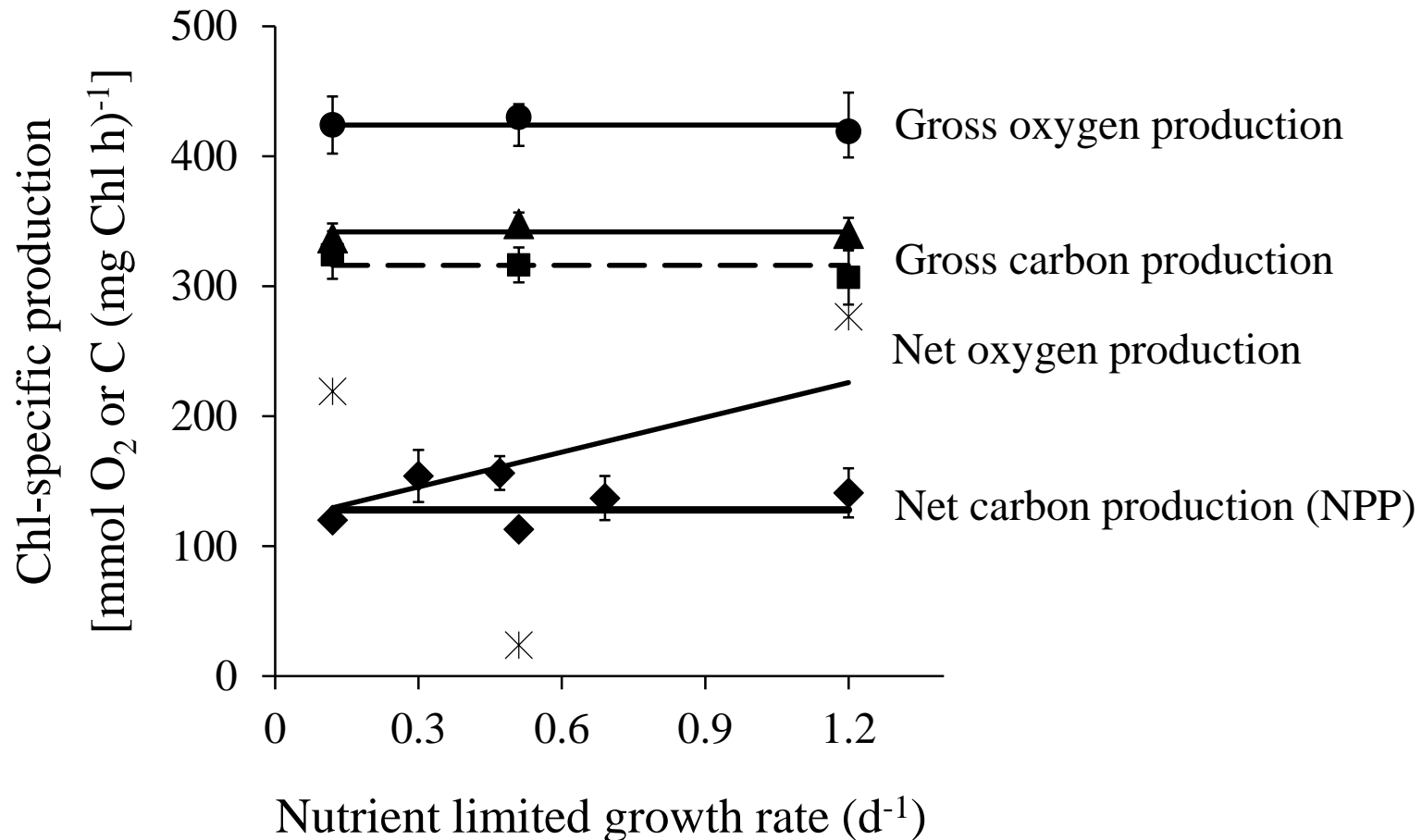
Scaling from gross to net production



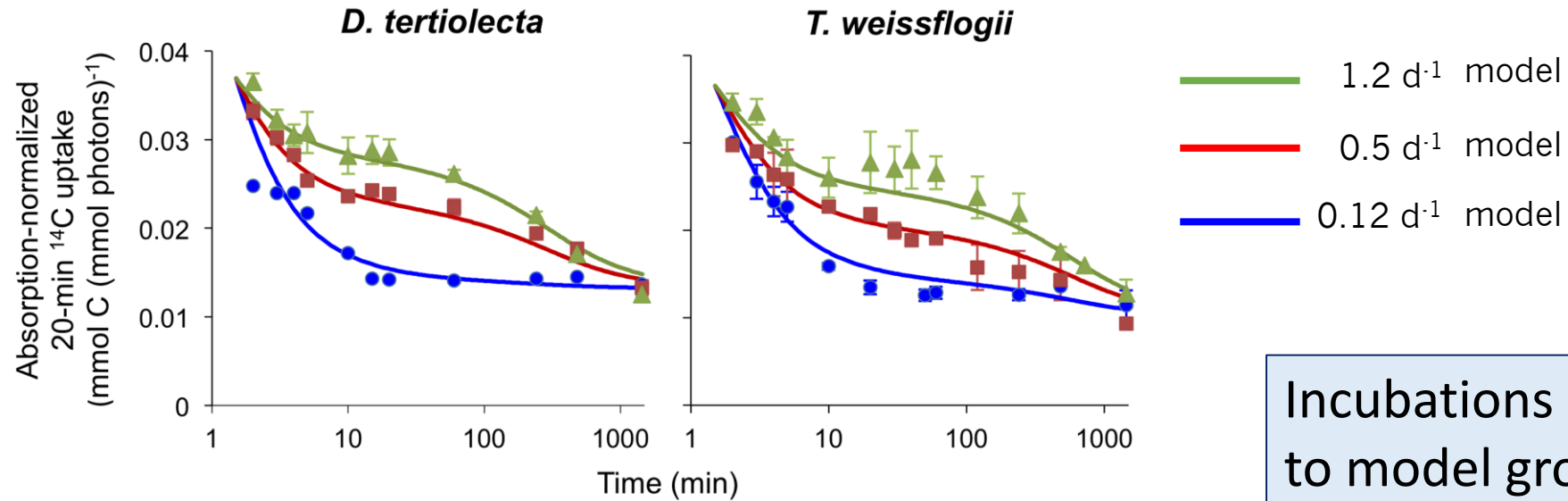


Chl-specific production is independent of nutrient limitation

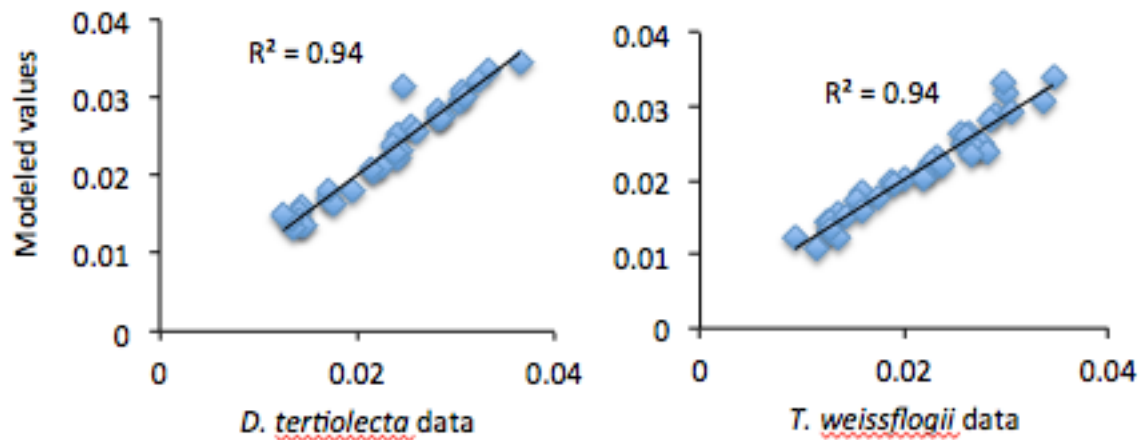
D. tertiolecta



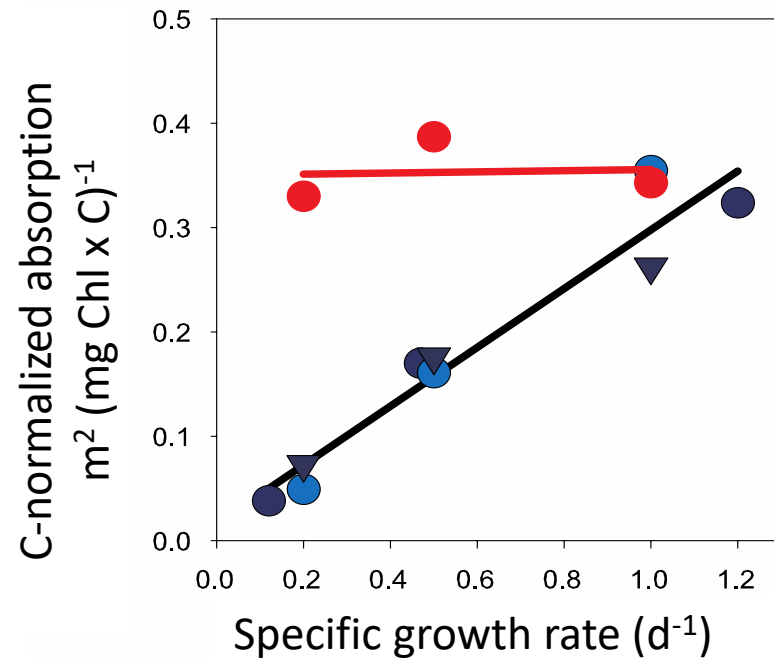
Leverage growth rate-dependency in ^{14}C -uptake to measure growth rate in the field??



Incubations of varying duration to model growth rate



Retention of chlorophyll by some phytoplankton groups causes deviations from expected behaviors



Micromonas sp. (pico-flagellate) does not alter chlorophyll content during N-limited growth

....and neither do cyanobacteria under iron limitation

What about nitrogen fixation or mixotrophy?
How do other metabolisms and environments influence assimilation efficiencies?

Chl-specific ^{14}C -uptake is highly sensitive to light availability and metabolism

Is there opportunity to use time-dependency of Chl-specific ^{14}C -uptake to evaluate growth rate?

Use ^{14}C -uptake in combination with other measurements to better constrain production

Use ^{14}C -uptake in combination with other measurements to understand underlying metabolism