Laboratory results on marine phytoplankton growth rates, temperatures, and isolation locations collected at Michigan State University in 2012

Website: https://www.bco-dmo.org/dataset/544814
Version: 2014-12-22

Project
» Phytoplankton Traits, Functional Groups and Community Organization: A Synthesis (Phytoplankton Traits)

Contributors	Affiliation	Role
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Dataset Description

This dataset gives marine phytoplankton growth rates, isolation locations and temperature, and the literature sources for the studies. The data are a compilation of measurements made in laboratories around the world.

Methods & Sampling

Text here is modified from the supplementary information of Thomas et al. (2012):

We assembled a data set containing growth rate measurements of marine and estuarine phytoplankton at different temperatures that have been published over the past century. Where data were available only in the form of graphs, they were digitized using the program g3data.

Several criteria were used to determine the inclusion of species/strain data in our dataset.

1) To facilitate comparisons across studies we only included data for growth rates measured in units that could be converted to specific growth rate.

2) Because we were primarily concerned with estimating the temperature at which strains/species achieve their maximum growth rates, we rejected data from thermal reaction norms where the largest measured growth rate occurred at the lowest or highest temperature considered.

3) Published reaction norms with fewer than four measured growth rates were excluded, as were curves showing strong bimodality, which we attributed to imprecise experimental measurements.

4) Where multiple published reaction norms on the same isolate existed and were measured under different experimental conditions (salinity, nutrient limitation, light levels, day length), we preferentially selected ones meeting the following conditions:

a. Salinity between 30 and 40 parts per thousand.

b. Light levels greater than or equal to 100 microeinsteins.$m^{-2}.s^{-1}$.

c. Not experimentally limited by nutrients

d. Day lengths of greater than or equal to 10 hours.

When no reaction norms for a particular isolate satisfied these experimental constraints, we settled for using data from the curve(s) that were closest to the desired light and salinity levels.

5) We considered only marine and estuarine strains not isolated from inland waters.

After applying these criteria, we had data for a total of 194 isolates/strains belonging to approximately 130 species, from 111 unique isolation locations ranging in latitude from 76°N to 75°S.

Related Reference:

Thomas, M. K., Kremer, C. T., Klausmeier, C. A., & Litchman, E. (2012). A global pattern of thermal adaptation in marine phytoplankton. Science, 338(6110), 1085-1088. DOI: 10.1126/science.1224836.

Supplemental materials: http://www.sciencemag.org/content/suppl/2012/10/25/science.1224836.DC1/Thomas.SM.pdf

Data Processing Description

1) Measurements have been converted to units of specific growth rate (day-1) where they were presented in other units.

2) Where the highest or lowest pair of measurements were zero or negative, the more extreme value was excluded (e.g. where the lowest 2 measurements were at 5 and 10 degrees and were both zero, the 5 degree measurement is excluded). This is because measurements of negative growth rates are experimentally challenging and frequently unreliable; including these poor estimates tends to skew the shape of fitted thermal reaction norms.

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Data Files

File
growth_rates.csv (Comma Separated Values (.csv), 130.53 KB) MD5:af3c3b6bef8561a7a46914f29198036e Primary data file for dataset ID 544814

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Parameters

Parameter	Description	Units
strain	Index number for each strain in the dataset.	unitless
lat	Latitude at which the strain was originally isolated; north is positive	decimal degrees
lon	Longitude at which the strain was originally isolated; east is positive	decimal degrees
temp	Temperature at which the growth rate was measured	degrees Celsius
growth_rate	Measured specific growth rates	units/day
taxon	Species name, including strain/clone name where available. In some cases, taxa were not identified to a species level; in this case the available identifying information was provided.	unitless
study	Reference to the published paper from which the data were collected. The complete reference may be found in the supplementary information of Thomas et al. (2012). Thomas, M. K., Kremer, C. T., Klausmeier, C. A., & Litchman, E. (2012). A global pattern of thermal adaptation in marine phytoplankton. Science, 338(6110), 1085-1088. Specifically, pages 27-36 at http://www.sciencemag.org/content/suppl/2012/10/25/science.1224836.DC1/Thomas.SM.pdf	unitless

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Deployments

Litchman_2012

Website	https://www.bco-dmo.org/deployment/544811
Platform	lab Litchman
Start Date	2009-09-01
End Date	2015-08-31
Description	Phytoplankton growth and temperature optima from literature search.

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Project Information

Phytoplankton Traits, Functional Groups and Community Organization: A Synthesis (Phytoplankton Traits)

Description from NSF award abstract:
Phytoplankton account for half of global primary productivity and their biomass and community composition significantly impact global carbon and other biogeochemical cycles and ecosystem functioning. Explaining patterns of global distributions of phytoplankton groups and predicting how phytoplankton communities will re-organize under anthropogenic environmental change requires knowledge of diverse eco-physiological traits defining ecological niches of phytoplankton species. In this project, the investigators will assemble a query-based database of diverse phytoplankton traits such as cell/colony size, growth rates, resource acquisition and predator avoidance traits, among others. Data for all available species and strains will be included. They will use the database to answer fundamental questions in phytoplankton ecology such as:
1) what traits exhibit trade-offs (pairwise and beyond) and what shapes are they?
2) What traits scale allometrically with cell/body size? Can scaling exponents from first principles be predicted? What are potential limits to allometric scaling as a way of simplifying the complex trait space that characterizes real organisms?
3) What are trait differences among major functional/taxonomic groups of phytoplankton and how much does taxonomy/phylogeny constrain particular functional traits?
4) Are there differences in trait distributions between marine and freshwater groups?

The investigators will also use the database to parameterize novel models of phytoplankton community organization and evolution based on adaptive dynamics approaches. They will use the models to explore how community structure emerges under different environmental scenarios, given physiological constraints and ecological interactions. Changes in elemental stoichiometry, size structure and functional group distributions at different spatial and temporal scales will also be examined.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0928819

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