Metadata template[[1]](#footnote-1) for datasets of *L&O-Letters* articles

**Table 1.** Description of the fields needed to describe the creation of your dataset.

|  |  |
| --- | --- |
| **Title of dataset** | Data from: Divergent physiological and molecular responses of light- and iron-limited Southern Ocean phytoplankton. |
| **URL of dataset** | Data is forthcoming upon decision at the first review stage |
| **Abstract** | It has recently been shown that Southern Ocean phytoplankton species have evolved to optimise their light-harvesting potential without increasing the high iron-requiring proteins used for photosynthesis. We measured molecular and physiological responses of phytoplankton cultures under a combination of iron and light conditions. While iron-replete cultures mostly increased biovolume, photochemical efficiency (Fv/Fm) and the relative abundance of PSII and Cytochrome *b6f* protein compared to iron-limited cultures, light also regulated cellular chlorophyll *a* content and played a role in controlling PSII protein abundance. Investment of protein resources into the carbon fixing enzyme Ribulose 1, 5 bisphosphate carboxylase oxygenase (Rubisco) was species-specific, but increased growth rates correlated with increased investment into Rubisco for all species. Our results suggest that *Proboscia inermis* uses a divergent molecular strategy to compete for nutrients, light and CO2 in the Southern Ocean.  This data submission contains photophysiology data, Rubisco and cell size data. |
| **Keywords** | Rubisco, iron, light, photosystem II, ATP, cytochrome *b6f*, diatom |
| **Lead author for the dataset** | Sarah Andrew |
| **Title and position of lead author** | PhD Candidate |
| **Organization and address of lead author** | Research School of Earth Sciences, Australian National University, Canberra, ACT, Australia.  Current address: Department of Earth, Marine, and Environmental Sciences, University of North Carolina at Chapel Hill, NC, USA |
| **Email address of lead author** | smandrew@email.unc.edu |
| **Additional authors or contributors to the dataset** | Robert F. Strzepek, Spencer Whitney, Wah Soon Chow, Michael J. Ellwood |
| **Organization associated with the data** | Australian National University |
| **Funding** |  |
| **License** | [CCO](https://creativecommons.org/publicdomain/zero/1.0/) – most accommodating of data reuse, |
| **Geographic location – verbal description** | NA |
| **Geographic coverage bounding coordinates** | NA |
| **Time frame - Begin date** | NA |
| **Time frame - End date** | NA |
| **General study design** | Laboratory experiment determining the protein responses of 3 Southern Ocean phytoplankton *(Phaeocystis antarctica, Proboscia inermis, Chaetoceros flexuosus)* compared with the temperate diatom *Phaeodactylum tricornutum* grown under different iron and light conditions. Physiology and western blots were used to determine differences between the responses to each condition. |
| **Methods description** | Trace metal clean culturing, light microscopy, variable fluoresence |
| **Laboratory, field, or other analytical methods** | Microscopy was used to determine biovolume calculations for each species in response to changing light and iron conditions.  A LIFT fluorometer was used to measure photophysiology  Rubisco content was determined through C14ABP binding |
| **Taxonomic species or groups** | *Phaeocystis antarctica, Proboscia inermis, Chaetoceros flexuosus* and *Phaeodactylum tricornutum* |
| **Quality control** | A stage micrometer was used throughout sizing to standardize cell measurements and ensure accurate and precise biovolume calculations. At least 50 cells were sized for each biological replicate.  All culture work was conducted under trace metal clean conditions, and Fv/Fm was collected under strict conditions (detailed in supporting information) to assess Fe contamination of cultures. |
| **Additional information** |  |
|  |  |

**Table 2.** Data dictionary: description of the variables (i.e., columns) in EACH dataset. You must provide sufficient detail for another user to understand and use the data. If there are 10 variables (i.e., columns) in the dataset, then there should be 10 rows in this table that describe each column. Be sure to include all relevant information for your dataset, including the unique identifiers for your dataset or system, dates, replicate numbers, latitude and longitude of sampling locations, etc.

Dataset filename: *provide a filename with extension*

Dataset description: *explain what is in this dataset*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Column name** | **Description** | **Units** | **Code explanation** | **Data format** | **Missing data code** |
| **CELL VOLUME** |  |  |  |  |  |
| Species | Name of species for which data is collected | NA | NA | NA | NA |
| Treatment | Experimental condition under which cultures were grown | NA | HLFe+ = High light and high Fe media  HLFe- = High light and low Fe media  LLFe+ = Low light and high Fe media  LLFe- = Low light and low Fe media | NA | NA |
| Cell length | Valve apical length | µm | NA | NA | NA |
| Cell diameter | Valve transapical width | µm | NA | NA | NA |
| Cell volume | Biovolume as described in the main text | µm3 | NA | NA | NA |
| Surface area | Surface area as described in the main text | µm2 | NA | NA | NA |
|  |  |  |  |  |  |
| **RUBISCO** |  |  |  |  |  |
| Species | Name of species for which data is collected | NA | NA | NA | NA |
| Treatment | Experimental condition under which cultures were grown | NA | HLFe+ = High light and high Fe media  HLFe- = High light and low Fe media  LLFe+ = Low light and high Fe media  LLFe- = Low light and low Fe media | NA | NA |
| Rubisco | Rubisco per ml | µg/ml | NA | NA | NA |
| Protein | Total soluble protein per ml | µg/ml | NA | NA | NA |
| Rubisco (TSP) | Percentage of total soluble protein | % | NA | NA | NA |
|  |  |  |  |  |  |
| **PCA INPUT** |  |  |  |  |  |
| Species | Name of species for which data is collected | NA | NA | NA | NA |
| Light | Experimental treatment (high or low light) | NA | HL = High light  LL = Low light | NA | NA |
| Iron | Experimental treatment (high or low iron) | NA | Fe+ = high iron media  Fe- = low iron media | NA | NA |
| Treatment | Experimental condition under which cultures were grown | NA | HLFe+ = High light and high Fe media  HLFe- = High light and low Fe media  LLFe+ = Low light and high Fe media  LLFe- = Low light and low Fe media | NA | NA |
| growth | Growth of phytoplankton under certain experimental conditions | d-1 | NA | NA | NA |
| C | Cellular carbon normalized to cell volume | mol C L-1 | NA | NA | NA |
| N | Cellular nitrogen normalized to cell volume | mol N L-1 | NA | NA | NA |
| FvFm | Maximum quantum yield of PSII (Fv/Fm) | unitless | NA | NA | NA |
| Sigma | Functional absorption cross section of PSII | Relative - Å2 quanta-1 | NA | NA | NA |
| Chl | Chlorophyll per cell volume | mmol L-1 | NA | NA | NA |
| SAV | Surface Area to Volume ratio | µm-1 | NA | NA | NA |
| petc | Cytochrome b6f per cell | Relative band intensity | NA | NA | NA |
| Atp | ATP Synthase per cell | Relative band intensity | NA | NA | NA |
| Rubisco | Rubisco per cell | pg L8S8 per cell | NA | NA | NA |
| PSII | PSII per cell | Relative band intensity | NA | NA | NA |
|  |  |  |  |  |  |
| **ANOVA\_pt** |  |  |  |  |  |
| Species | Name of species for which data is collected | NA | NA | NA | NA |
| Light | Experimental treatment (high or low light) | NA | HL = High light  LL = Low light | NA | NA |
| Iron | Experimental treatment (high or low iron) | NA | Fe+ = high iron media  Fe- = low iron media | NA | NA |
| Treatment | Experimental condition under which cultures were grown | NA | HLFe+ = High light and high Fe media  HLFe- = High light and low Fe media  LLFe+ = Low light and high Fe media  LLFe- = Low light and low Fe media | NA | NA |
| growth | Growth of phytoplankton under certain experimental conditions | d-1 | NA | NA | NA |
| C | Cellular carbon normalized to cell volume | mol C L-1 | NA | NA | NA |
| N | Cellular nitrogen normalized to cell volume | mol N L-1 | NA | NA | NA |
| FvFm | Maximum quantum yield of PSII (Fv/Fm) | unitless | NA | NA | NA |
| Sigma | Functional absorption cross section of PSII | Relative - Å2 quanta-1 | NA | NA | NA |
| Chl | Chlorophyll normalized to carbon | mmol mol-1 | NA | NA | NA |
| CV | Cell volume | µm3 | NA | NA | NA |
| SAV | Surface Area to Volume ratio | µm-1 | NA | NA | NA |
| petc | Cytochrome b6f per cell | Relative band intensity | NA | NA | NA |
| Atp | ATP Synthase per cell | Relative band intensity | NA | NA | NA |
| Rubisco | Rubisco % of total soluble protein | %TSP | NA | NA | NA |
| PSII | PSII per cell | Relative band intensity | NA | NA | NA |
|  |  |  |  |  |  |
| **ANOVA\_pi** |  |  |  |  |  |
| Species | Name of species for which data is collected | NA | NA | NA | NA |
| Light | Experimental treatment (high or low light) | NA | HL = High light  LL = Low light | NA | NA |
| Iron | Experimental treatment (high or low iron) | NA | Fe+ = high iron media  Fe- = low iron media | NA | NA |
| Treatment | Experimental condition under which cultures were grown | NA | HLFe+ = High light and high Fe media  HLFe- = High light and low Fe media  LLFe+ = Low light and high Fe media  LLFe- = Low light and low Fe media | NA | NA |
| growth | Growth of phytoplankton under certain experimental conditions | d-1 | NA | NA | NA |
| C | Cellular carbon normalized to cell volume | mol C L-1 | NA | NA | NA |
| N | Cellular nitrogen normalized to cell volume | mol N L-1 | NA | NA | NA |
| FvFm | Maximum quantum yield of PSII (Fv/Fm) | unitless | NA | NA | NA |
| Sigma | Functional absorption cross section of PSII | Relative - Å2 quanta-1 | NA | NA | NA |
| Chl | Chlorophyll normalized to carbon | mmol mol-1 | NA | NA | NA |
| CV | Cell volume | µm3 | NA | NA | NA |
| SAV | Surface Area to Volume ratio | µm-1 | NA | NA | NA |
| petc | Cytochrome b6f per cell | Relative band intensity | NA | NA | NA |
| Atp | ATP Synthase per cell | Relative band intensity | NA | NA | NA |
| Rubisco | Rubisco % of total soluble protein | %TSP | NA | NA | NA |
| PSII | PSII per cell | Relative band intensity | NA | NA | NA |
|  |  |  |  |  |  |
| **ANOVA\_pa** |  |  |  |  |  |
| Species | Name of species for which data is collected | NA | NA | NA | NA |
| Light | Experimental treatment (high or low light) | NA | HL = High light  LL = Low light | NA | NA |
| Iron | Experimental treatment (high or low iron) | NA | Fe+ = high iron media  Fe- = low iron media | NA | NA |
| Treatment | Experimental condition under which cultures were grown | NA | HLFe+ = High light and high Fe media  HLFe- = High light and low Fe media  LLFe+ = Low light and high Fe media  LLFe- = Low light and low Fe media | NA | NA |
| growth | Growth of phytoplankton under certain experimental conditions | d-1 | NA | NA | NA |
| C | Cellular carbon normalized to cell volume | mol C L-1 | NA | NA | NA |
| N | Cellular nitrogen normalized to cell volume | mol N L-1 | NA | NA | NA |
| FvFm | Maximum quantum yield of PSII (Fv/Fm) | unitless | NA | NA | NA |
| Sigma | Functional absorption cross section of PSII | Relative - Å2 quanta-1 | NA | NA | NA |
| Chl | Chlorophyll normalized to carbon | mmol mol-1 | NA | NA | NA |
| CV | Cell volume | µm3 | NA | NA | NA |
| SAV | Surface Area to Volume ratio | µm-1 | NA | NA | NA |
| petc | Cytochrome b6f per cell | Relative band intensity | NA | NA | NA |
| Atp | ATP Synthase per cell | Relative band intensity | NA | NA | NA |
| Rubisco | Rubisco % of total soluble protein | %TSP | NA | NA | NA |
| PSII | PSII per cell | Relative band intensity | NA | NA | NA |
|  |  |  |  |  |  |
| **ANOVA\_cf** |  |  |  |  |  |
| Species | Name of species for which data is collected | NA | NA | NA | NA |
| Light | Experimental treatment (high or low light) | NA | HL = High light  LL = Low light | NA | NA |
| Iron | Experimental treatment (high or low iron) | NA | Fe+ = high iron media  Fe- = low iron media | NA | NA |
| Treatment | Experimental condition under which cultures were grown | NA | HLFe+ = High light and high Fe media  HLFe- = High light and low Fe media  LLFe+ = Low light and high Fe media  LLFe- = Low light and low Fe media | NA | NA |
| growth | Growth of phytoplankton under certain experimental conditions | d-1 | NA | NA | NA |
| C | Cellular carbon normalized to cell volume | mol C L-1 | NA | NA | NA |
| N | Cellular nitrogen normalized to cell volume | mol N L-1 | NA | NA | NA |
| FvFm | Maximum quantum yield of PSII (Fv/Fm) | unitless | NA | NA | NA |
| Sigma | Functional absorption cross section of PSII | Relative - Å2 quanta-1 | NA | NA | NA |
| Chl | Chlorophyll normalized to carbon | mmol mol-1 | NA | NA | NA |
| CV | Cell volume | µm3 | NA | NA | NA |
| SAV | Surface Area to Volume ratio | µm-1 | NA | NA | NA |
| petc | Cytochrome b6f per cell | Relative band intensity | NA | NA | NA |
| Atp | ATP Synthase per cell | Relative band intensity | NA | NA | NA |
| Rubisco | Rubisco % of total soluble protein | %TSP | NA | NA | NA |
| PSII | PSII per cell | Relative band intensity | NA | NA | NA |

**Table 3. Data provenance**

If you used data derived from other sources, provide the information here so future users know where the data came from.

|  |  |  |  |
| --- | --- | --- | --- |
| **Dataset title** | **Dataset DOI or URL** | **Creator (name & email)** | **Contact (name & email)** |
|  |  |  |  |
|  |  |  |  |

1. *This document liberally borrows from a similar document provided by the Environmental Data Initiative* [↑](#footnote-ref-1)