

Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Research policies, see [Authors & Referees](#) and the [Editorial Policy Checklist](#).

Statistical parameters

When statistical analyses are reported, confirm that the following items are present in the relevant location (e.g. figure legend, table legend, main text, or Methods section).

n/a Confirmed

- ☐ ☒ The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
- ☐ ☒ An indication of whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
- ☐ ☒ The statistical test(s) used AND whether they are one- or two-sided
Only common tests should be described solely by name; describe more complex techniques in the Methods section.
- ☐ ☒ A description of all covariates tested
- ☒ ☐ A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
- ☐ ☒ A full description of the statistics including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
- ☒ ☐ For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted
Give P values as exact values whenever suitable.
- ☒ ☐ For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
- ☒ ☐ For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
- ☒ ☐ Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated
- ☐ ☒ Clearly defined error bars
State explicitly what error bars represent (e.g. SD, SE, CI)

Our web collection on [statistics for biologists](#) may be useful.

Software and code

Policy information about [availability of computer code](#)

Data collection

No software was used.

Data analysis

The thermal performance curves were fitted using the nonlinear model below with the function nlsLM in the library minpack.lm (Elzhov et al., 2016) using R version 3.4 (R Core Team, 2017).

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors/reviewers upon request. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

Following publication, these data will be made available (i.e. open access) through the IMAS and UTAS. See <http://www.imas.utas.edu.au/data>

All data collected by IMAS researchers are archived, curated, and managed by IMAS, and often supported by related organisations such as the Integrated Marine

Observing System (IMOS), the Australian Ocean Data Network (AODN) and the Tasmanian Partnership for Advanced Computing (TPAC). Our guiding framework is that all data that are not commercial-in-confidence or restricted by legislation should be shared with researchers for analysis and interpretation. IMAS also operates facilities and hosts data sets of national and global interest and for the benefit of the community.

The associated raw data from Figure 1 are available in the S-materials. There are no restrictions on data availability.

Field-specific reporting

Please select the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☒ Life sciences ☐ Behavioural & social sciences ☐ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/authors/policies/ReportingSummary-flat.pdf](https://www.nature.com/authors/policies/ReportingSummary-flat.pdf)

Life sciences study design

All studies must disclose on these points even when the disclosure is negative.

Sample size	No sample size metrics were employed. The sample size was based on experimentally determining to upper and lower bounds across a temperature gradient for phytoplankton growth.
Data exclusions	There were no data exclusions.
Replication	All measurements had three replicates
Randomization	This is not relevant to this study of thermal performance curves.
Blinding	This is not relevant to this study of thermal performance curves

Reporting for specific materials, systems and methods

Materials & experimental systems

n/a	Involved in the study
☐	☒ Unique biological materials
☒	☐ Antibodies
☒	☐ Eukaryotic cell lines
☒	☐ Palaeontology
☐	☒ Animals and other organisms
☒	☐ Human research participants

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Unique biological materials

Policy information about [availability of materials](#)

Obtaining unique materials	The laboratory isolated polar S. Ocean phytoplankton used in this study are maintained under biosecurity regulations, and in most cases must be maintained at temperatures less than 10C. This may pose some logistical limitations for obtaining these unique materials, which are freely available to others.
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Animals and other organisms

Policy information about [studies involving animals](#); [ARRIVE guidelines](#) recommended for reporting animal research

Laboratory animals	This study did not involve lab animals
Wild animals	This study did not involve wild animals.
Field-collected samples	The lab isolated species were obtained from field collected samples - the isolation temperatures and locations are all summarised in S-Materials (S-Table 1). The maintenance conditions for the lab cultured phytoplankton are reported in S-Materials.