**Supplement S1.** Fitted growth-irradiance curves used in the analyses. The fitted curve is Eqn. 1 in the main text. Species name and culture temperature is listed for each experiment.
Skeletonema costatum 22°C
Leptocylindricus danicus 20°C

Irradiance vs. Growth

Growth

Irradiance
Leptocylindricus danicus 20ºC
Corethron criophilum 0°C

Irradiance vs. Growth
Corethron criophilum 2°C
Nitzschia kerguelensis 0°C
Nitzschia kerguelensis 3°C
Nitzschia kerguelensis 4°C
Nitzschia kerguelensis 7°C
Nitzschia turgiduloides 1°C

Graph showing the relationship between irradiance and growth for Nitzschia turgiduloides at 1°C.
Nitzschia turgiduloides 3°C
Nitzschia turgiduloides 5°C

Irradiance vs. Growth
Nitzschia turgiduloides 7°C
Nitzschia turgiduloides 8°C

The graph shows the relationship between irradiance and growth of Nitzschia turgiduloides at 8°C. The data points indicate an increase in growth with increasing irradiance up to a certain point, after which the growth decreases. The maximum growth occurs at an irradiance of approximately 100 units.
Nitzschia cylindrus 0°C
Nitzschia cylindrus 3°C
Nitzschia cylindrus 7ºC
Nitzschia cylindrus 9°C

Growth vs. Irradiance graph.
Chaetoceros deflandrei 5°C
Chaetoceros deflandrei 7°C

Growth vs. Irradiance
Chaetoceros deflandrei 10°C
Chaetoceros deflandrei 13°C

![Graph showing the relationship between irradiance and growth for Chaetoceros deflandrei at 13°C.](image)

- Y-axis labeled: Growth
- X-axis labeled: Irradiance
- The graph shows a curve with points at different irradiance levels indicating the growth pattern of the organism.
Chaetoceros deflandrei 15°C

Irradiance vs. Growth
Rhizosolenia fragilissima 12°C

![Graph showing growth against irradiance for Rhizosolenia fragilissima at 12°C. The graph displays a curve that peaks at around 100 units of irradiance and then decreases.]
Rhizosolenia fragilissima 25ºC

![Graph showing growth of Rhizosolenia fragilissima at 25ºC as a function of irradiance. The graph displays a sigmoidal curve with data points indicating the relationship between irradiance and growth.]
Fragilaria barbararum 0°C

Irradiance vs. Growth

0.0 0.1 0.2 0.3 0.4

0 5 10 15 20

Irradiance
Fragilaria barbararum 5°C
Fragilaria barbararum 15°C
Fragilaria cf. striatula 0°C
Fragilaria cf. striatula 5ºC

Graph showing the growth of Fragilaria cf. striatula at 5ºC as a function of irradiance. The graph displays a curvilinear relationship between growth and irradiance, with growth increasing as irradiance increases. The data points are represented by black dots, and the trend line is a smooth curve.
Fragilaria cf. striatula 15°C
Thalassiosira curviseriata 5°C

- Growth vs. Irradiance graph

- X-axis: Irradiance
- Y-axis: Growth

- Points and curve indicating growth increase with irradiance.
Thalassiosira curviseriata 10°C
Thalassiosira curviseriata 20ºC
Phaeocystis pouchetii 2°C
Phaeocystis pouchetii 5°C
Phaeocystis pouchetii 10°C

Irradiance vs. Growth for Phaeocystis pouchetii at 10°C.
Skeletonema costatum 0°C

![Graph showing growth versus irradiance for Skeletonema costatum at 0°C. The graph displays a sigmoidal curve with data points at specific irradiance levels.]
Skeletonema costatum 5°C

Irradiance

Growth

0.0

0.2

0.4

0.6

0

200

400

600

800

Irradiance
Skeletonema costatum 10°C

Irradiance vs. Growth
Isochrysis galbana 15°C
Rhodomonas salina 15°C
Rhodomonas salina 20°C

Irradiance

Growth
Scenedesmus crassus 20°C
Scenedesmus crassus 27°C
Scenedesmus crassus 32°C

![Graph showing growth against irradiance at 32°C for Scenedesmus crassus. The graph plots growth on the y-axis and irradiance on the x-axis. The data points form a curve indicating a non-linear relationship between growth and irradiance.]
Coelastrum microporum 15°C
Coelastrum microporum 20°C
Coelastrum microporum 25°C
Coelastrum microporum 32°C
Dictyosphaerium pulchellum 15°C
Dictyosphaerium pulchellum 20°C

Growth

Irradiance
Dictyosphaerium pulchellum 25°C

Growth vs. Irradiance
Dictyosphaerium pulchellum 28°C
Scenedesmus quadricauda 20ºC

Growth

Irradiance
Scenedesmus quadricauda 25°C
Scenedesmus quadricauda 27°C
Scenedesmus quadricauda 32°C
Fragilaria bidens 10ºC

Growth vs. Irradiance
Fragilaria bidens 15°C

Irradiance vs. Growth

The graph shows the relationship between irradiance and growth for Fragilaria bidens at 15°C. The data points are represented by black circles, and a green curve is fitted to the data, indicating a peak in growth at a certain irradiance level before decreasing again.
Fragilaria bidens 22°C

![Graph showing growth vs. irradiance for Fragilaria bidens at 22°C. The x-axis represents irradiance, and the y-axis represents growth. The data points and the fitted curve indicate an increase in growth with increasing irradiance up to a certain point, after which growth stabilizes or decreases.]
Fragilaria bidens 22ºC

Growth vs. Irradiance for Fragilaria bidens at 22ºC.
Fragilaria bidens 29°C

Growth vs. Irradiance plot.
Anabaena cylindrica 15ºC
Anabaena cylindrica 20°C

The graph shows the relationship between irradiance and growth for Anabaena cylindrica at 20°C. The data points are plotted on a graph with irradiance on the x-axis and growth on the y-axis. A smooth curve fits through the data points, indicating a peak growth at a certain irradiance level before decreasing as irradiance increases further.
Anabaena cylindrica 29°C
Anabaena cylindrica 32°C

The graph shows the relationship between irradiance and growth for Anabaena cylindrica at 32°C. The data points are represented by black dots, and the green line is a fitted curve that illustrates the growth pattern over different irradiance levels.
Pediastrum boryanum 15°C

![Graph showing growth of Pediastrum boryanum at 15°C as a function of irradiance. The graph displays a peak at an irradiance value of around 100, with growth decreasing as irradiance increases.]
Pediastrum boryanum 25°C

Irradiance vs. Growth

Growth

Irradiance
Pediastrum boryanum 28°C
Pediastrum boryanum 32°C

![Graph showing growth rate against irradiance for Pediastrum boryanum at 32°C. The graph indicates an initial increase in growth with increased irradiance, reaching a peak, and then decreasing.](image-url)
Irradiance

Monoraphidium minutum 15°C
Monoraphidium minutum 25°C
Monoraphidium minutum 30°C
Monoraphidium minutum 35°C
Cryptomonas 979_67 25°C
Cryptomonas 979_67 16°C

Irradiance vs. Growth
Cryptomonas 979_62 21°C

![Graph showing growth vs. irradiance for Cryptomonas 979_62 at 21°C.](image)
Cryptomonas 979_62 12°C
Cryptomonas 979_62 10°C
Cryptomonas 979_62 5°C

Irradiance vs. Growth
Synura sphagnicola 8°C

Growth vs. Irradiance graph.
Synura sphagnicola 15°C
Synura sphagnicola 20ºC

Growth vs Irradiance graph for Synura sphagnicola at 20ºC.
Chlorella vulgaris 10°C
Chlorella vulgaris 15°C

Irradiance vs Growth
Chlorella vulgaris 20ºC

The graph shows the growth of Chlorella vulgaris at 20ºC as a function of irradiance. The data points are plotted along with a smooth curve that indicates an initial increase in growth with increasing irradiance, peaking at approximately 300 units of irradiance, after which the growth decreases.
Chlorella vulgaris 25°C

Irradiance vs. Growth graph showing the relationship between irradiance and growth for Chlorella vulgaris at 25°C.
Fragilaria crotonensis 15°C

The graph shows the relationship between irradiance and growth for Fragilaria crotonensis at 15°C. The data points are represented by black circles, and the green curve indicates a model or theoretical growth pattern. The x-axis represents irradiance, while the y-axis represents growth.
Fragilaria crotonensis 20ºC

Growth

Irradiance
Fragilaria crotonensis 35°C
Staurastrum pingue 10°C

Irradiance vs. Growth
Staurastrum pingue 20°C

Irradiance vs. Growth
Staurastrum pingue 25°C
Staurastrum pingue 30°C
Synechocystis minima 10ºC

Irradiance vs. Growth
Synechocystis minima 20°C
Synechocystis minima 25°C

Growth vs. Irradiance
Synechocystis minima 30ºC

Growth vs. Irradiance
Synechocystis minima 35°C

Growth

Irradiance
Leptocylindricus danicus 5°C
Thalassiosira allenii 4°C

Growth vs. Irradiance
Thalassiosira allenii 11°C
Thalassiosira allenii 16°C
Thalassiosira allenii 20°C

Irradiance vs. Growth

- Growth values range from 0.0 to 1.2.
- Irradiance values range from 0 to 200.
- The graph shows an upward trend in growth with increasing irradiance, peaking around 100 units of irradiance, and then beginning to decline.

The data points are represented by black circles, and the green line connects these points, indicating a logistic growth curve.
Ceratium furca 28°C
Ceratium furca 26°C
Ceratium furca 24°C
Ceratium furca 18°C

Irradiance

Growth

0.0 0.1 0.2 0.3 0.4 0.5 0.6

0 200 400 600 800

Irradiance
Ceratium furca 16°C
Ceratium furca 14°C
Ceratium furca 12°C

Irradiance vs. Growth

- X-axis: Irradiance (0 to 800)
- Y-axis: Growth (0.00 to 0.14)

Points and trend line indicating growth response to irradiance.
Ceratium fusus 30°C
Ceratium fusus 22°C

Irradiance

Growth

0.0

0.1

0.2

0.3

0.4

0.5

0

200

400

600

800

0.0

0.1

0.2

0.3

0.4

0.5

0

200

400

600

800

Growth vs. Irradiance graph for Ceratium fusus at 22°C.
Ceratium fusus 20ºC
Ceratium fusus 18°C
Ceratium fusus 16°C
Ceratium fusus 14°C
Ceratium fusus 12°C
Micractinium pusillum 15°C
Micractinium pusillum 20°C
Micractinium pusillum 25°C
Micractinium pusillum 35°C
Micractinium pusillum 40ºC

Graph showing growth against irradiance.
Microcystis flos-aquae 15°C
Microcystis flos–aquae 20°C
Microcystis flos-aquae 25°C
Microcystis flos-aquae 30°C
Microcystis flos-aquae 35°C

Growth

Irradiance

0.0
0.5
1.0
1.5

0
50
100
150
Chroococcus minutus 15°C
Chroococcus minutus 20ºC
Chroococcus minutus 35°C
Planktothrix agardhii 15°C
Planktothrix agardhii 20°C
Planktothrix agardhii 35°C
Selenastrum minutum 15ºC
Selenastrum minutum 30°C

Irradiance vs. Growth
Selenastrum minutum 35°C
Coelastrum microporum f. astroidea 15°C
Coelastrum microporum f. astroidea 20°C
Coelastrum microporum f. astroidea 25°C
Coelastrum microporum f. astroidea 30ºC
Coelastrum microporum f. astroidea 35°C
Cosmarium subprotumidum 15°C
Cosmarium subprotumidum 20°C

Growth

Irradiance
Cosmarium subprotumidum 25°C
Cosmarium subprotumidum 30°C
Cosmarium subprotumidum 35°C
Asterionella formosa 2°C

Growth vs. Irradiance graph for Asterionella formosa at 2°C.
Asterionella formosa 5°C
Asterionella formosa 11°C
Asterionella formosa 16°C
Acutodesmus obliquus 25°C
Acutodesmus obliquus 30°C
Acutodesmus obliquus 35°C

Growth

Irradiance
Phaeodactylum tricornutum 19°C

Irradiance

Growth

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4

0 50 100 150 200

Irradiance
Phaeodactylum tricornutum 21°C

Irradiance vs. Growth for Phaeodactylum tricornutum at 21°C.
Phaeodactylum tricornutum 23°C

Growth vs. Irradiance
Phaeodactylum tricornutum 25°C
Fragilaria crotonensis 5°C
Fragilaria crotonensis 11°C
Fragilaria crotonensis 17ºC
Dactyliosolen fragilissimus 12°C
Dactyliosolen fragilissimus 25°C
Eucampia zodiacus 8°C
Eucampia zodiacus 9°C
Eucampia zodiacus 12°C

The graph shows the relationship between irradiance and growth of Eucampia zodiacus at 12°C. The data points and the fitted curve indicate a non-linear increase in growth with increasing irradiance.
Eucampia zodiacus 15°C
Eucampia zodiacus 25°C

Growth vs. Irradiance
Coscinodiscus wailesii 9°C

Irradiance vs. Growth

Growth

Irradiance
Coscinodiscus wailesii 15°C

Irradiance vs. Growth
Coscinodiscus wailesii 20°C
Coscinodiscus granii 20°C
Microcystis ichthyoblabe 10°C

Irradiance

Growth
Microcystis ichthyoblabe 15°C
Microcystis ichthyoblabe 20°C

Irradiance vs. Growth
Microcystis ichthyoblabe 30°C
Microcystis ichthyoblabe 35°C
Nannochloropsis oceanica 29°C
Pseudochattonella farcimen 4°C
Pseudochattonella farcimen 6°C
Pseudochattonella farcimen 11°C
Pseudochattonella farcimen 13°C
Pseudochattonella farcimen 16°C
Planktothrix agardhii 5°C

Growth vs. Irradiance
Planktothrix agardhii 10°C
Planktothrix agardhii 15°C
Planktothrix agardhii 20°C

Growth vs. Irradiance
Planktothrix agardhii 25°C
Irradiance vs. Growth for Planktothrix agardhii at 30°C
Planktothrix agardhii 35°C
Ankistrodesmus falcatus 5ºC

Growth vs. Irradiance graph showing the relationship between growth and irradiance for Ankistrodesmus falcatus at 5ºC.
Ankistrodesmus falcatus 10°C
Ankistrodesmus falcatus 15°C
Ankistrodesmus falcatus 20°C

Growth

Irradiance
Ankistrodesmus falcatus 25°C
Ankistrodesmus falcatus 30°C
Oocystella mongolica 10°C
Oocystella mongolica 15°C

Growth vs. Irradiance
Oocystella mongolica 25°C

Irradiance

Growth

0.00 0.05 0.10 0.15 0.20

0 20 40 60 80 100

Irradiance
Oocystella mongolica 30°C
Pseudodidymocystis planctonica 20°C
Monoraphidium contortum 5°C
Monoraphidium contortum 10°C
Monoraphidium contortum 15°C

The graph shows the relationship between irradiance and growth for Monoraphidium contortum at 15°C. The growth values are plotted on the y-axis, while the irradiance values are on the x-axis. The data points are represented by black circles, and a line connects these points, indicating the trend. The graph suggests a positive correlation between irradiance and growth, with increasing growth observed as irradiance increases.
Monoraphidium contortum 20°C
Monoraphidium contortum 25°C
Monoraphidium contortum 30°C
Closterium parvulum 5°C
Closterium parvulum 10°C

Growth vs. Irradiance
Closterium parvulum 15°C
Closterium parvulum 20°C
Ochromonas sp. 17°C

Irradiance vs. Growth

The graph shows a positive correlation between irradiance and growth rate for Ochromonas sp. at 17°C. The growth rate increases with increasing irradiance up to a certain point, after which it plateaus.
Ochromonas sp. 21°C

Irradiance vs. Growth
Ochromonas sp. 25°C

![Graph showing growth vs. irradiance for Ochromonas sp. at 25°C.](image-url)
Diacronema lutheri 17°C
Diacronema lutheri 20°C
Diacronema lutheri 23°C
Diacronema lutheri 25°C

Irradiance vs Growth

- The graph shows the relationship between irradiance and growth for Diacronema lutheri at 25°C.
- The growth increases with increasing irradiance up to a certain point and then decreases.
- The data points are marked with black circles, and the green line represents the trend.

Y-axis: Growth
X-axis: Irradiance
Tetraselmis sp. 17°C

![Graph showing growth vs. irradiance for Tetraselmis sp. at 17°C.](image)
Tetraselmis sp. 20°C
Tetraselmis sp. 25°C

Growth

Irradiance
Tetraselmis sp. 27°C

Growth vs. Irradiance chart.
Cylindrotheca closterium 17°C

Growth vs. Irradiance

The graph shows the growth of Cylindrotheca closterium at 17°C in relation to irradiance. The curve peaks around an irradiance value of 100 units, indicating optimal growth conditions. The growth increases with increasing irradiance up to this point, after which it begins to decrease.
Cylindrotheca closterium 20ºC

Growth

Irradiance
Cylindrotheca closterium 23°C
Cylindrotheca closterium 25°C
Cylindrotheca closterium 27°C

Growth

Irradiance
Cylindrotheca closterium 29°C
Chaetoceros calcitrans 17°C

Irradiance vs. Growth

- Growth increases with increasing irradiance.
- There is a peak in growth at around 100 units of irradiance.
- Beyond this point, growth decreases as irradiance increases.
Chaetoceros calcitrans 20°C

Growth

Irradiance

- The graph shows the growth of Chaetoceros calcitrans at 20°C in relation to irradiance.
- The curve peaks around an irradiance of 100 units, indicating optimal growth conditions.
- Growth decreases as irradiance increases beyond this point.
Chaetoceros calcitrans 23°C
Chaetoceros calcitrans 29°C