This data article contains data on the photosynthetic activity, shares of the main algae groups in the total phytoplankton biomass and the main environmental forces in the Kara Sea. The data were collected from 17 to 29 of September, 2011 in the following different areas: the Kara Sea Shelf with and without river runoff influence, the shelf edge and continental slope. The photosynthetic activity parameters include the relative electron transport rate (rETR) values, the maximum quantum efficiency of PSII (Fv/Fm) and the P/rETR ratio as photosynthetic performance. The main environmental forces include the average day incident light, salinity and water temperature in the upper mixed layer and dissolved nutrients. The data presented in this article are associated with the research article entitled “Assessment of phytoplankton photosynthetic efficiency based on measurement of fluorescence parameters and radiocarbon uptake in the Kara Sea” (Mosharov et al., 2019). The related research article examines the relationships between biological parameters and with environmental characteristics such as temperature, salinity, incident photosynthetically active radiation (PAR) and nutrient concentration.
Specifications table

| Subject area                     | Biology                              |
|---------------------------------|--------------------------------------|
| More specific subject area      | Phytoplankton ecology                |
| Type of data                    | Table                                |
| How data were acquired          | PAM-Fluorometer (Mega-25); the 14C uptake method and ICES photosynthetron (Hydro-Bios), Li-190 Quantum Sensor and Li-1400 data logger (Li-Cor); Microscope (Leica DM 500B); CTD (SBE-19 Plus; Sea Bird Equipment) |
| Data format                     | Raw, filtered, analysed               |
| Experimental factors            | Prior to fluorescence measurements, the water samples were kept in the dark for 20 min. Prior to microscopy counts of phytoplankton cells, water samples were concentrated via inverse filtration (large cells) or stained with fluorochrome primulin, fixed with 3.6% glutaraldehyde solution and filtered through black 0.4-μm pore-size Nuclepore filters (for small cells). |
| Experimental features           | Productive activity of phytoplankton was measured experimentally with two different techniques: fluorescence and carbon fixation estimations. |
| Data source location            | The Kara Sea; 24 stations between 73°43′–78°28′ N and 69°59′–86°39′ E |
| Data accessibility              | Relevant data reported in this article |
| Related research article        | S. A. Mosharov, V. M. Sergeeva, V. V. Kremenetskiy, A. F. Sazhin, S.V. Stepanova. Assessment of phytoplankton photosynthetic efficiency based on measurement of fluorescence parameters and radiocarbon uptake in the Kara Sea. Estuarine, Coastal and Shelf Science (2019) [1] |

Value of the data

- The dataset can be used to study the variability in phytoplankton fluorescence parameters from samples collected in the polar region, where there is low solar radiation.
- Samples were collected along the Kara Sea Shelf with and without river runoff influence, the continental shelf edge and the continental slope. Consequently, these data can be used as a reference for the analysis of ecological variability in coastal and shelf areas.
- The dataset can be used for comparative analysis of light and dark processes of phytoplankton photosynthesis in the different nature conditions.

1. Data

The data presented in this article are related to the estimation of the variability of photosynthetic activity of phytoplankton communities from the surface waters of the Kara Sea. Data are present for the following regions in the Kara Sea: the Kara sea shelf with Yenisei river runoff influence, the eastern coastal shelf, the central shelf near St. Anna trough, the edge of continental shelf and the slope of the St. Anna trough [1]. The sampling was carried out on the research vessel Akademic Mstislav Keldysh in September, 2011. The areas were divided based on the direct measurements of hydrophysical and nutrient data (Table 1). One notably important feature of the data set is that simultaneous measurements of all above mentioned biological and environmental parameters were conducted.

Two different techniques were used to determine the physiological activity of phytoplankton: fluorescence measurements and experimental carbon fixation estimations. The productive potential of phytoplankton was characterized by follow parameters: the relative electron transport rate (rETR₀)
values, the maximum quantum efficiency of photosystem II (PSII) (Fv/Fm), photosynthetic performance (P0/rETR0 ratio, where P0 is the biomass-specific primary production [2]) and chlorophyll a concentration. Those variables that are characteristic of phytoplankton structure were presented as shares of the main groups in the total phytoplankton biomass. These groups include dinoflagellates, diatoms, spores of diatoms, autotrophic flagellates and heterotrophs (Table 2).

2. Experimental design, materials and methods

2.1. Sampling

Surface water samples were collected from 24 stations (between 73°43′–78°28′ N and 69°59′–86°39′ E) in the Kara Sea. The coordinates of the sampling sites are in Tables 1 and 2. The water samples were divided into subsamples, which were used for measurement of different parameters like nutrient and chlorophyll concentrations, experimental carbon fixation estimations (primary production), chlorophyll fluorescence, and abundance and biomass of phytoplankton.

2.2. Phytoplankton productivity parameters measurement

Primary production (PP) was measured onboard using the 14C uptake method [3] and exposed in the photosynthetron (Hydro-Bios, Germany). Biomass-specific PP, P0 (mg C (mg chlorophyll a)−1 day−1) was calculated by normalizing PP at different depths to the corresponding chlorophyll a concentration. The chlorophyll a concentration was measured fluorometrically [4] after filtering onto Whatman GF/F (glass-fibre filters). Surface irradiance (400–700 nm) was measured with a Li-Cor Li-190 Quantum Sensor. Active chlorophyll a fluorescence (Fv/Fm) was measured with a MEGA-25 PAM-fluorometer

| Table 1
| Abiotic parameters for different regions in surface waters. |
| Area                  | Date      | Long  | Lat  | Depth | PAR/day | Sal UML | T UML | DIN  | DIP  | Si  |
|-----------------------|-----------|-------|------|-------|----------|---------|-------|------|------|-----|
| Yenisei SHELF         | 20 Sept   | 79.4  | 73.7 | 32    | 52       | 21.9    | 5.0   | 1.9  | 0.44 | 29.2|
| Yenisei SHELF         | 21 Sept   | 78.9  | 74.0 | 29    | 85       | 17.8    | 5.0   | 1.4  | 0.38 | 24.8|
| Yenisei SHELF         | 22 Sept   | 77.9  | 75.0 | 39    | 220      | 24.6    | 5.2   | 0.7  | 0.16 | 14.9|
| Yenisei SHELF         | 22 Sept   | 77.2  | 75.6 | 48    | 143      | 23.0    | 5.4   | 1.0  | 0.12 | 18.1|
| Yenisei SHELF         | 17 Sept   | 78.6  | 74.3 | 33    | 100      | 26.4    | 4.8   | 0.6  | 0.2  | 8.2 |
| Eastern SHELF         | 24 Sept   | 80.8  | 76.6 | 59    | 82.65    | 28.7    | 4.1   | 0.4  | 0.3  | 3.8 |
| Eastern SHELF         | 23 Sept   | 85.4  | 75.4 | 55    | 80.6     | 29.2    | 3.8   | 1.2  | 0.21 | 2.9 |
| Eastern SHELF         | 23 Sept   | 86.7  | 75.2 | 40    | 80.6     | 18.9    | 3.9   | 2.1  | 0.33 | 29.0|
| Eastern SHELF         | 23 Sept   | 85.6  | 75.3 | 39    | 80.6     | 24.4    | 3.0   | 1.5  | 0.34 | 17.8|
| St. Anna SHELF        | 28 Sept   | 72.6  | 76.3 | 140   | 50       | 19.0    | 5.5   | 0.9  | 0.18 | 30.7|
| St. Anna SHELF        | 25 Sept   | 78.1  | 77.2 | 125   | 87.75    | 27.4    | 4.7   | 0.8  | 0.12 | 8.2 |
| St. Anna SHELF        | 22 Sept   | 76.7  | 76.0 | 64    | 125.4    | 24.3    | 5.7   | 0.6  | 0.17 | 17.3|
| EDGES of St. Anna SHELF | 28 Sept   | 71.7  | 76.5 | 158   | 50       | 24.1    | 4.1   | 1.34 | 0.17 | 4.3 |
| EDGES of St. Anna SHELF | 29 Sept   | 71.5  | 76.6 | 181   | 56       | 27.0    | 4.2   | 1.0  | 0.15 | 14.4|
| EDGES of St. Anna SHELF | 29 Sept   | 71.2  | 76.6 | 244   | 56       | 26.6    | 4.7   | 1.1  | 0.14 | 8.6 |
| EDGES of St. Anna SHELF | 29 Sept   | 71.0  | 76.7 | 320   | 31.36    | 29.6    | 4.1   | 1.23 | 0.12 | 7.83|
| EDGES of St. Anna SHELF | 25 Sept   | 77.7  | 77.4 | 196   | 117      | 27.4    | 4.7   | 0.81 | 0.12 | 7.59|
| EDGES of St. Anna SHELF | 25 Sept   | 77.5  | 77.4 | 219   | 91.26    | 31.2    | 3.9   | 1.37 | 0.12 | 1.76|
| St. Anna SLOPE        | 29 Sept   | 70.5  | 76.8 | 492   | 22.4     | 34      | 3.5   | 0.78 | 0.05 | 1.04|
| St. Anna SLOPE        | 29 Sept   | 70.0  | 77.0 | 536   | 56       | 33.5    | 3.6   | 0.71 | 0.05 | 1.09|
| St. Anna SLOPE        | 25 Sept   | 76.0  | 77.8 | 321   | 117      | 31.6    | 3.4   | 1.49 | 0.09 | 0.74|
| St. Anna SLOPE        | 26 Sept   | 74.8  | 78.0 | 364   | 51       | 31.6    | 3.4   | 1.04 | 0.11 | 0.26|
| St. Anna SLOPE        | 26 Sept   | 73.6  | 78.3 | 414   | 20.4     | 32.8    | 3.4   | 0.6  | 0.06 | 0.14|
| St. Anna SLOPE        | 26 Sept   | 72.8  | 78.5 | 472   | 51       | 32.1    | 2.9   | 0.42 | 0.04 | 0.12|

Long – longitude (°N); Lat – latitude (°E); Depth – total depth (m); PAR/day - average-day incident PAR (μmol photons m−2 s−1); S UML – salinity of upper mixed layer (psu); T UML – temperature of upper mixed layer (°C); DIN – dissolved inorganic nitrogen (DIN = NO2 + NO3 + NH4, μM); DIP – dissolved inorganic phosphorus (μM); Si – dissolved inorganic silicon (μM).
Table 2
Biological parameters for different regions in surface waters.

| Area               | Date      | Long  | Lat  | Fv/Fm | rETR0 | PB0/rETR0 | Chl a | % DINO | % DIA | % DIA spore | % FLA | % HET |
|--------------------|-----------|-------|------|-------|-------|-----------|-------|--------|-------|-------------|-------|-------|
| Yenisei SHELF     | 20 Sept   | 79.4  | 73.7 | 0.706 | 14    | 0.02      | 1.093 | 0.4    | 25.7  | 1.4         | 22.3  | 50.3  |
| Yenisei SHELF     | 21 Sept   | 78.9  | 74.0 | 0.665 | 22    | 0.03      | 1.067 | 8.8    | 27    | 5.9         | 30.4  | 27.8  |
| Yenisei SHELF     | 22 Sept   | 77.9  | 75.0 | 0.652 | 28.3  | 0.04      | 0.457 | 10.7   | 62.1  | 1.6         | 16.8  | 8.9   |
| Yenisei SHELF     | 22 Sept   | 77.2  | 75.6 | 0.639 | 38    | 0.05      | 1.047 | 6.9    | 60.4  | 2.2         | 8.1   | 22.4  |
| Yenisei SHELF     | 17 Sept   | 78.6  | 74.3 | 0.32  | 19.3  | 0.00      | 0.349 | 0.04   | 66.9  | 1.3         | 11.8  | 19.9  |
| Eastern SHELF     | 24 Sept   | 80.8  | 76.6 | 0.466 | 17.4  | 0.07      | 0.272 | 34.8   | 14.9  | 23.3        | 8.8   | 18.1  |
| Eastern SHELF     | 23 Sept   | 85.4  | 75.4 | 0.624 | 25.8  | 0.03      | 0.204 | n/a    | n/a   | n/a         | n/a   | n/a   |
| Eastern SHELF     | 23 Sept   | 86.7  | 75.2 | 0.666 | 30.88 | 0.04      | 0.775 | 8.9    | 72.9  | 0.3         | 4.9   | 13    |
| Eastern SHELF     | 23 Sept   | 85.6  | 75.3 | 0.578 | 21.47 | 0.05      | 0.405 | 71.5   | 12.3  | 4.9         | 7.2   | 4.1   |
| St. Anna SHELF    | 28 Sept   | 72.6  | 76.3 | 0.594 | 12.13 | 0.04      | 1.493 | 3.4    | 0.3   | 0.01        | 45.2  | 51.2  |
| St. Anna SHELF    | 25 Sept   | 78.1  | 77.2 | 0.6   | 24    | 0.04      | 0.682 | 22.5   | 33.2  | 0.8         | 22.3  | 21.3  |
| St. Anna SHELF    | 22 Sept   | 76.7  | 76.0 | 0.626 | 29.6  | 0.05      | 0.806 | 34.6   | 4.6   | 0.0         | 14.3  | 46.5  |
| EDGE of St. Anna SHELF | 28 Sept | 71.7  | 76.5 | 0.645 | 11.46 | 0.02      | 2.289 | 50.7   | 8.3   | 0.0         | 25.1  | 15.9  |
| EDGE of St. Anna SHELF | 29 Sept | 71.5  | 76.6 | 0.581 | 11.49 | 0.02      | 1.35  | 25.7   | 1.6   | 0.4         | 36.7  | 35.6  |
| EDGE of St. Anna SHELF | 29 Sept | 71.2  | 76.6 | 0.604 | 10.94 | 0.02      | 0.754 | 9.1    | 7.7   | 11.4        | 23.1  | 48.6  |
| EDGE of St. Anna SHELF | 29 Sept | 71.0  | 76.7 | 0.629 | 13.67 | 0.01      | 1.139 | 39.4   | 3.8   | 0.1         | 34.3  | 22.3  |
| EDGE of St. Anna SHELF | 29 Sept | 77.7  | 77.4 | 0.611 | 22.17 | 0.03      | 1.16  | 58.7   | 30.8  | 0.1         | 0.1   | 7.3   |
| EDGE of St. Anna SHELF | 23 Sept | 77.5  | 77.4 | 0.559 | 24.83 | 0.04      | 0.621 | 25.1   | 15.8  | 0.7         | 36.2  | 22.1  |
| St. Anna SLOPE    | 29 Sept   | 70.5  | 76.8 | 0.55  | 7.35  | 0.04      | 0.554 | 6.1    | 0.1   | 0.0         | 61.4  | 32.5  |
| St. Anna SLOPE    | 29 Sept   | 70.0  | 77.0 | 0.638 | 9.67  | 0.02      | 0.457 | 19.4   | 0.2   | 0.5         | 41.5  | 38.5  |
| St. Anna SLOPE    | 25 Sept   | 76.0  | 77.8 | 0.714 | 25.21 | 0.02      | 0.462 | 28.4   | 5.3   | 0.5         | 36.5  | 25.3  |
| St. Anna SLOPE    | 26 Sept   | 74.8  | 78.0 | 0.647 | 12    | 0.03      | 0.431 | 41.4   | 1.3   | 1.7         | 23.9  | 31.8  |
| St. Anna SLOPE    | 26 Sept   | 73.6  | 78.3 | 0.608 | 5.58  | 0.05      | 0.554 | 16.9   | 5.5   | 8.9         | 23.5  | 45.2  |
| St. Anna SLOPE    | 26 Sept   | 72.8  | 78.5 | 0.564 | 4.87  | 0.03      | 0.472 | 22.4   | 24.3  | 1.1         | 23.2  | 28.9  |

Long - longitude (°N); Lat – latitude (°E); Fv/Fm – PSII efficiency; rETR0 – relative electron transport rate; PB0/rETR0 – ratio between the biomass-specific primary production and relative electron transport rate; Chl a – chlorophyll a concentration (mg m⁻³); % of different algae groups in the total phytoplankton biomass (%): %DINO – autotrophic dinoflagellates, %DIA – active diatoms, % DIAspore – diatom spores, %FLA – flagellates, %HET – heterotrophs.

(MSU, Russia) after 30 minutes of dark adaptation. Water samples were exposed in the PAM fluorometer to eight light intensities as for the 14C uptake measurements, for 300 s at each step, and steady fluorescence (F_s) and maximum fluorescence (F_m) were measured and the resultant rETR values were estimated.

2.3. Determination of shares of different phytoplankton groups

Phytoplankton cell counts were carried out using luminescent microscopy for small phytoplankton forms with linear size < 10–15 μm on black 0.4 μm pore-size Nuclepore filters [5]. Larger phytoplankton was counted using the concentrate obtained by reversed filtration method [6]. Determination of phytoplankton composition, abundance and biomass were performed with a Leica DM2 500 light microscope. The algae species constructive metabolism type was determined according to the literature [7,8]. Published allometric dependences were used to convert wet phytoplankton biomass to carbon units [9].

Acknowledgements

The study was funded by the Ministry of Science and Higher Education of the Russian Federation (theme no. 0149-2019-0008, processing and analysis of productivity data, preparation of publication) and supported by The Russian Foundation for Basic Research (grant no. 16-35-60068 young_a_dr, processing and analysis of phytoplankton data; grant no. 18-05-60069, hydrophysical and hydrochemical data processing and analysis).
Transparency document. Supporting information

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2019.01.001.

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