

Phytoplankton pigment concentration data series for cruise Pelagia PE125

Principal Investigator

Prof. Paul Tett, Napier University, Edinburgh, UK.

Data originator

Dr. Karen Wild-Allen - Napier University.

Content of data series

Parameter	Unit	Parameter code	Number of samples	Number of stations	Comments
Chl.a (Lorenzen)	µg l ⁻¹	CPHLSPP1	88	18 CTD + 8 NT	none
Phaeop.a (Lorenzen)	µg l ⁻¹	PHAESPP1	88	18 CTD + 8 NT	none
Chl.a (SCOR)	µg l ⁻¹	CPHLSPP1	88	18 CTD + 8 NT	none
Chl.b (SCOR)	ng l ⁻¹	CHLBSSP1	88	18 CTD + 8 NT	none
Chl.c (SCOR)	ng l ⁻¹	CHLCSSP1	88	18 CTD + 8 NT	none
Carotenoids (SCOR)	µg l ⁻¹	CAROSSP1	88	18 CTD + 8 NT	none
Chl.a >5 µm (Lorenzen)	µg l ⁻¹	SCHLSPPA	13	3 CTD	none
Phaeop.a >5 µm (Lorenzen)	µg l ⁻¹	SPHASPPA	13	3 CTD	none
Chl.a >5 µm (SCOR)	µg l ⁻¹	SCHLSPPA	13	3 CTD	none
Chl.b >5 µm (SCOR)	ng l ⁻¹	SCHBSSPA	13	3 CTD	none
Chl.c >5 µm (SCOR)	ng l ⁻¹	SCHCSSPA	13	3 CTD	none
Carotenoids >5 µm (SCOR)	µg l ⁻¹	SCARSSPA	13	3 CTD	none
Chl.a <5 µm (Lorenzen)	µg l ⁻¹	SCHLSPPM	13	3 CTD	none
Phaeop. a <5 µm (Lorenzen)	µg l ⁻¹	SPHASPPM	13	3 CTD	none
Chl.a <5 µm (SCOR)	µg l ⁻¹	SCHLSPPM	13	3 CTD	none
Chl.b <5 µm (SCOR)	ng l ⁻¹	SCHBSSPM	13	3 CTD	none
Chl.c <5 µm (SCOR)	ng l ⁻¹	SCHCSSPM	13	3 CTD	none
Carotenoids <5 µm (SCOR)	µg l ⁻¹	SCARSSPM	13	3 CTD	none

CTD= CTD-Rosette water column sampling station.

NT= surface underway sampling from ship's non-toxic supply.

Originator's protocol

Water samples were collected from the ship's non-toxic water supply and from 12-litres NOEX bottles attached to the CTD-rosette water sampler. Two litres of sea water samples were filtered through Whatman glass fibre filters (GF/F, 0.7 µm nominal pore size) and/or 5 µm Micropore membrane (>5 µm size-fraction). Filters were then placed in 10 ml 90% Analar acetone (10% milliQ water, buffered with sodium bicarbonate), stored in darkness container and refrigerated for 24 hours. Extracted samples were then centrifuged at 10,000 rpm for 10 minutes and decanted into 4 cm pathlength micro-cuvettes. The optical density of the samples were then measured against 90% acetone blanks using a Unicam UV/Vis 4-100 spectrophotometer in 0.5 nm bandwidths from 350 to 750 nm. To evaluate phaeopigment concentration measurements were repeated after the addition of 3 drops of 2M HCL to the sample.

Pigment concentrations were calculated using the following equations:

Lorenzen method:

$$\text{Chlorophyll } a = A * R / (R - 1) * (OD_{665} - OD_{665A}) * E / (V * p)$$

$$\text{Phaeopigment} = A * R / (R - 1) * (R * OD_{665A} - OD_{665}) * E / (V * p)$$

Trichromatic method with Jeffrey & Humphrey (1975) coefficients (SCOR):

$$\begin{aligned}\text{Chlorophyll } a &= (11.850 \text{ OD}_{664} - 1.54 \text{ OD}_{647} - 0.08 \text{ OD}_{630}) * E / (V * p) \\ \text{Chlorophyll } b &= (-5.43 \text{ OD}_{664} + 21.03 \text{ OD}_{647} - 2.66 \text{ OD}_{630}) * E / (V * p) \\ \text{Chlorophyll } c1 + c2 &= (-1.67 \text{ OD}_{664} - 7.60 \text{ OD}_{647} + 24.52 \text{ OD}_{630}) * E / (V * p)\end{aligned}$$

Carotenoids:

$$\text{Carotenoid} = (\text{OD}_{480} - 1.49 \text{ OD}_{510}) * 7.6 E / (V * p)$$

where:

- A is the pigment coefficient ($11 \mu\text{g cm ml}^{-1}$)
- R is the ratio of chl a to phaeopigment absorbance at 665 nm (1.7)
- OD₆₆₅ is the optical density at 665 nm relative to 750 nm
- OD_{665A} is the optical density of the acidified sample at 665 nm relative to 750 nm
- E is the extract volume (ml)
- V is the sample volume filtered (l)
- p is the cuvette pathlength (cm)

BODC processing

In order to standardise parameter units with that held in BODC Parameter Dictionary, chlorophyll *b* and *c* concentrations were converted from $\mu\text{g l}^{-1}$ to ng l^{-1} by multiplying their original values by 1000. The rest of the data were loaded into a database under the ORACLE Relational Database Management System without modification.

Comments on data quality from data originator

- 1) Negative values should be taken as zero and demonstrate the limited accuracy of the technique for determining low pigment concentrations. The algorithms used are optimised for chl *a* determination and as a result larger errors are associated with the other pigments.
- 2) The total pigment concentration obtained by adding the large (>5 μm) and small (GFF to 5 μm) fractions was equivalent to the concentration obtained on a sole GFF filter.

Reference

Jeffrey SW, Humphrey SF (1975) New spectrophotometric equations for determining chlorophylls *a*, *b*, *c1* and *c2* in higher plants, algae and phytoplankton. *Biochem. Biophysiol. Pflanzen*, 167, 191-194.