

Ecology of Phytoplankton

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1. INTRODUCTION

1.1. Objectives

The main objective of our research in the Ross Sea was to obtain a first estimate of the phytoplankton biomass and to define the spatial distribution of the planktonic species with regard to the main environmental factors in an area of the Southern Ocean which practically has not been investigated.

As for the environmental factors considered, besides nutrients (which have been investigated by the group named OCHI), attention has been focused on underwater light field, in order to define the relationships among the visible irradiance, its extinction and the particulate matter, including phytoplankton.

1.2. Participants in the expedition and research.

The research work has been carried out in cooperation with other 11 research groups taking part in the expedition on board the Polar Queen. Closer contacts have been kept with those groups dealing with phytoplankton nutrients, primary production and zooplankton, previously contacted.

The results of the present report have been obtained and worked on by Mario Innamorati and Giovanna Mori, who have taken part in the expedition, and by Luigi Lazzara, Silvana Vanucci, Marco Lici. Microscopic counts are being carried out by Caterina Nuccio.

1.3. Previous studies

This is the first investigations carried out by Italian researchers on Antarctic phytoplankton and its spatial distribution in relation to environmental factors.

It is the first investigation even at international level made in a regular grid of

stations, both with surface and depth samplings and measurements, in Terranova Bay. Wilson et al. (1986) carried out a similar investigation in the Ross Sea but they worked in a Southern area. Previous works have all been carried out near the perennial pack of McMurdo Sound (Bunt et al., 1970; El-Sayed et al., 1983).

1.4. Sampling area

The area investigated is shown in Fig. 1. It covers a grid extending 50 x 40 miles, in 40 stations spaced 5 miles in the area closer to the coast and 10 miles for the others. The stations n. 16, 17, 49, 50, 51 are all situated along a coast-seaward transect, as far as 125 miles from the coast.

Our sampling programme has been carried out in two periods, January 5-15 and January 24-February 14 1988, being coordinated with the other research activities.

The time sequence is reported in Table 1.

2. METHODS

The depth profile in every station and the surface continuous profile of *in vivo* chlorophylls has been registered by means of a MEERESTECHNIK back-scat fluorimeter; downwelling quantum PAR radiations and downwelling, upwelling and scalar underwater radiation has been measured by means of 3 cosine and 1 spherical quantum meter (LI-COR), connected to a Monitor IDRONAUT mod. 401.

Spectral underwater downwelling irradiance at depths of 0, 5, 10, 25 and 50 m and upwelling at 5 m, have been carried out by means of a LI-COR 1800-01 UW spectroradiometer, in Terranova Bay and in the stations n° 3, 13, 14, 17, 46, 47, 48.

In every station, seawater samples have been collected by means of Niskin type

oceanographic bottles, at depths of 0, 10, 25, 50, 100 and 200 m for biological analysis, carried out immediately on board.

Photosynthetic pigments (chlorophyll a, b, c and phaeopigments) have been determined after filtration of 3 l of seawater (Whatman GF/C filters), previous addition of MgCO₃, and extraction in 90% acetone. After 18-20 h spectrophotometric (Jeffrey and Humphrey,

1975) determinations were carried out. With samples whose optical density was < 0.05 a 665 nm the fluorimetric method (Lorenzen 1966) was used. Phaeopigments were determined by the method of Lorenzen modified according to Riemann (1978).

Particulate numbers and their dimensiona spectrum have been determined by means of a Coulter Counter Multisizer.

2.1. Instruments used

Instruments	Manufacturer	Model	Owner
Oxygen Indicator	Orbisphaera		PNRA
Spectrofluorimeter	Perkin Elmer	LS5 B	PNRA
Analog centrifuge	A.L.C.	4236 A	PNRA
Underwater spectroradiometer	LI-COR	LI-1800UW	PNRA
Calibrator	LI-COR	1800-02L	PNRA
Data Logger	LI-COR	LI-1000-32	PNRA
Multiparametric probe (CTD)	MEERESTECHNIK		PNRA
Underwater fluorimeter	MEERESTECHNIK	Back-scat	PNRA
Phototrope and Monitor	IDRONAUT	401	Univ. FI Dip. Biol. Veg.
Multichannel particle counter with Sampling stand and printer	COULTER-COUNTER	Multisizer	PNRA
Glassware and filtration apparatus for pigments and nutrients analysis			PNRA