# Spatial and Temporal Patterns of Nutrient Distributions in the Ross Sea

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## ABSTRACT

The Ross Sea is one of the most peculiar zones in the World Ocean because of its physical, chemical and biological characteristics. On its continental shelf, it is influenced by only one water mass of external origin, the Circumpolar Deep Water (CDW), which, in turn, generates all the other water types by cooling or mixing with water coming from ice melting. From the biological and chemical point of view, the Ross Sea is considered as a typical Continental Shelf Coastal Zone (CSCZ) where, during summer, occasional high nutrient consumption occurs particularly in the Marginal Ice Zone (MIZ) and in some protected coastal areas as Terra Nova Bay.

As a part of the ITALIANTARTIDE Polar Research Project, four oceanographic cruises were carried out in the late austral spring or summer in different years (1987–88, 1989–90, 1994–95 and 1995–96) with the aim of extending our knowledge about the variation in spatial and temporal nutrient patterns in the Ross Sea, in relation with physical and biological processes. Due to a slower recycling rate of Si compared to the N and P cycles, high Si concentrations and different evolution of the N/P and Si/N ratios are typical of CDW and of that part of the Ross Sea which is affected by this water mass. Advection of melt water can have a very important role in the nutrient concentration in the upper mixed layer because the decrease in salinity forces a strong vertical stratification, thereby preventing phytoplankton cells from leaving the euphotic layer. Indeed, nutrient plots suggest that the decrease of N and Si in the surface layer cannot be explained by simple dilution due to sea-ice melting water advection, but phytoplankton uptake must also be taken into account. The High Salinity Shelf Water was also present in some stations. In the Terra Nova Bay, however, this surface water can be modified by summer heating and reach a temperature of 2 °C under particular meteorological conditions. A thermal stratification which is able to support an increased phytoplankton production and a nutrient decrease is thus originated.

## Introduction

The Ross Sea can be considered the largest Continental Shelf and Coastal Zone (CSCZ) of Antarctica where seawater and continental ice can interact directly by ice melting, and thereby modify the characteristics of the water masses involved. In addition, the katabatic winds in the southern and western parts of the Ross Sea make these zones particularly active in producing sea ice and brine.

Although the importance of these processes is mainly reflected on physical features of the Ross Sea (water-mass modification, sea-ice formation, polynya maintenance, bottom-water formation and ventilation of the deep ocean) some effects involve chemical and biological processes, such as nutrient distribution and uptake, phytoplankton blooms, grazing by krill and other zooplankton and, through the trophic net, the ecology of marine birds and mammals.

The Ross Sea is influenced by only one water mass of external origin: the Circumpolar Deep Water (CDW), characterized by relatively high temperature and salinity, high silicic acid and low oxygen concentration. All other water types are

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