Abstract

It is widely recognised that environmental variables can influence community structure over latitudinal scales (e.g. Arntz et al. 1997, Gray 2001 and references therein). The Victoria Land Coast, delimiting the western side of the Ross Sea, represents a gradient extending from 72° to 78° South. It contains a number of environmental spectra relating to cold, aridity, solar radiation, UV, light/dark conditions and highly variable sea ice dynamics. The variability of environmental parameters affects all communities, from nutrient cycles and primary production to top predators, leading to strong changes in community structure and function.

Iceberg scouring is one of the five most significant impacts on any ecosystem (Garwood et al., 1979; Gutt & Starmans, 2001). In the last decade this phenomenon and its influence on benthos, have been widely discussed with respect to global warming (Gutt et al. 1996, Gutt 2000, Starmans & Gutt 2002, Gutt & Piepenburg 2003).

In the light of these considerations, the international research program "Latitudinal Gradient Project (LGP)" has been actuated in 2004. In the framework of this project, the aim of this study was to evaluate the distribution of asteroids, ophiuroids, echinoids and crinoids and their diversity at different spatial scales.

The study has focused on echinoderms because they constitute some of the most conspicuous taxa of the Antarctic benthic communities and often play important trophic role in benthic communities (Dayton 1971, Dell 1972, Dayton et al. 1974, Cerrano et al. 2000); they are also widely distributed and they tend to be large organisms, facilitating efficient sampling (Piepenburg et al. 1997); the echinoderm assemblage seems a good indicator of polar megafaunal assemblage types (Piepenburg & Juterzenka 1994, Piepenburg et al. 1997). Nevertheless information on the echinoderm fauna of Victoria Land coast is not exhaustive yet.

In the Ross Sea, information on the benthic communities is largely derived from a few restricted shallow water areas of McMurdo Sound and Terra Nova Bay, near the permanent scientific installations (Dayton & Oliver 1977, Cattaneo-Vietti et al. 2000 and references therein, Thrush et al., 2006), although, additional information is available from early ship-based sampling (e.g. Bullivant & Dearborn 1967, Dayton et al. 1974).

This study mainly proposes to update and increase the knowledge on echinoderm distribution from the Balleny Islands (68°S) to the central Victoria Land coast, reporting on recent samplings (summer 2004) conducted from the R/Vs Italica and Tangaroa. It also aims to evaluate whether latitude plays any role in influencing broad-scale spatial patterns in the assemblage composition and echinoderm diversity or if other constraints such as depth, oceanography or sea bottom disturbance due to iceberg scouring, are more important.

A total of 15478 specimens were found, belonging to 80 different taxa, confirming the ecological "success" of Antarctic echinoderms.

Results indicate that latitudinal gradient may influence the assemblage structure in subtle and nonlinear ways. Multivariate analysis showed that the Balleny Islands system is set apart from the Victoria Land coast, probably because of a different biogeographic origin (Dawson 1970) and current oceanographic conditions. In a more detailed view, differences arise in the comparison between
relatively close locations of Victoria Land coast (Cape Adare and Cape Hallett), that are subject to similar oceanographic conditions and seasonal variations. Moreover, differences were found in the comparison between inner and outer sides of the two capes, suggesting the role of local factors (sea bottom morphology, hydrographic features,...) in affecting distribution patterns.

Latitude related differences arose when taking into account benthic biodiversity at different spatial scales. Alpha diversity increased from North to South, but beta diversity showed the opposite trend, although it was non-linear. These results suggested that the observed diversity patterns may be due to different iceberg disturbance, increasing from South to North (Gutt 2000, Starmans & Gutt 2002, Gutt & Piepenburg 2003, Teixido et al. 2004). In fact, iceberg disturbance increases in the Northern Sector of the Victoria Land coast, because of hydrographic constraints forcing icebergs to move closer to the coastline (Keys, 1983; Thrush et al. 2006).

Latitudinal and bathymetric distribution has been analysed for each collected species. Some species showed pattern of distribution according to latitudinal gradient. Bathymetric distribution of some species showed important differences, being shallower in Balleny Islands and deeper along Victoria Land coast.

These differences would be due to the more restricted extension of continental shelf in the Balleny Islands area.

Further topics of this study concerned also trophic condition and growth rate of Sterechinus neumayeri, the most abundant echinoid. In particular, test and jaw size and age of specimens (by growth bands in the jaws) has been considered. Analysis of gut content has been employed. The results showed that trophic condition improves from North to South according to latitudinal gradient. Ctenocidaris genus (Echinoidea) hosts many organisms on primary spines. Observations and related analysis, carried out to characterize this phenomenon, showed that ectosymbiont composition changes as a function of host species and its geographic location. These results suggested that environmental conditions as well as primary spine morphology (characteristic of each species) influence the symbiont distribution.

The high morphological variability displayed by specimens of Promachocrinus kerguelensis (the most abundant crinoid), has been investigated. Some morphological characters (e.g. mid-distal pinnules) showed that specimens morphotype is related to the ecological condition of the habitat.

Finally, the comparison between Terra Nova Bay and other investigated locations outcropped its exceptionality. Recorded abundance and diversity values as well as other results, pointed out biological and ecological peculiarity of Terra Nova Bay, thus confirming the importance of new instituted marine ASPA (n°161).

References


