



ANTARCTICA NEW ZEALAND INFORMATION SHEET

THE SOUTHERN OCEAN

The Southern Ocean is generally defined as the ocean region encompassed by the Antarctic Convergence (Polar Front) which is roughly at 60° South in latitude and accounts for more than 12% of the total area of the world's oceans. It forms a zonal belt that circumscribes the Antarctic Continent and links the three major global oceans - Pacific, Atlantic and Indian Oceans. The Southern Ocean, annual sea ice and the adjacent Antarctic ice sheets are integrally linked to form the Antarctic ocean-cryosphere system. This system is one of the most important components of the Earth's climate, as it influences atmospheric composition and circulation, the global heat budget, and ocean circulation. The thermal isolation of the Antarctic continent, maintained by the cold Antarctic Circumpolar Current, the largest current system on earth, has also had a profound effect on sea-level history and the evolution and maintenance of Antarctic life.

The Southern Ocean has been subject to considerable exploitation. This is continuing with the current harvesting of toothfish and interest in krill fishing. There is only a small section of the Southern Ocean south of New Zealand that is not either part of the New Zealand EEZ (defined by the Sub Antarctic Islands) or New Zealand claimed Ross Dependency. New Zealand fishing interests have begun fishing in the Antarctic region south of 60 degrees. There is a high likelihood that illegal and unregulated fishing for toothfish, which is a problem in other parts of the Southern Ocean, will soon extend into New Zealand waters and the Ross Sea. This has potential to have significant impacts on Antarctic dependent and associated ecosystems.

Despite the importance of the Southern Ocean to world climate, its unique ecosystem and associated resources, its role in climate and climate change, and the functioning of its ecosystem are poorly understood.

The Southern Ocean supports one of the largest marine ecosystems on earth. Many of the physical processes that influence production within the Southern Ocean are only found in this region. In particular, the nature and processes associated with the sea ice around Antarctica have a dominant influence on water column structure, nutrient supply and primary production, and supports a tightly coupled biological community (pelagic and benthic) unparalleled in northern polar regions. Biological production associated with sea ice supports not only coastal pelagic systems, but also the rich benthic systems found near shore. The species composition and the pivotal role of the krill species *Euphasia superba* in the transfer of production to higher trophic levels of the Southern Ocean ecosystem is similarly unique.

There are still many gaps in our understanding of the functioning of the Southern Ocean ecosystem, from the coast of the continent to the Polar Front. Future research on factors that govern primary production, trophic links, and natural variability of the physical and biological components of the system over a range of spatial and temporal scales will be pivotal to the sustainable management of Southern Ocean living resources.

The Southern Ocean plays a major role in the present global climate system. The water mass characteristics of over 50% of the World Ocean by volume are due to processes that occur within the

Southern Ocean. It acts as a physical link between the Pacific, Indian and Atlantic oceans, transferring heat and momentum, and is the major source for the densest deep water in the global ocean.

The meridional circulation, associated with the thermohaline interactions of surface waters, carries vast quantities of water from northern abyssal depths. This water up-wells to the surface at the Antarctic Divergence, coupling deep abyssal waters of the ocean with the atmosphere. The air-sea exchange of heat, mass and momentum, and the exchange of properties between water masses in this region is vigorous and maintains the nutrient rich surface waters that support biological production within the Southern Ocean ecosystem.

The thermohaline interactions of the seas with ice and the atmosphere also generate deep convection and this is a major global sink of heat. The formation of Antarctic Bottom Water is closely linked with the growth of winter sea ice around the Antarctic continent, and flows through the oceans to the Northern Hemisphere mainly in Deep Western Boundary Current (DWBC). Antarctic Intermediate Water forms and sinks at the Polar Front and also migrates north below the thermocline into the world oceans, similarly contributing a heat sink in the region.