

The long-term trends in mean total zooplankton abundance and average copepod community size of the Southern Ocean from the SO-CPR activities of the first 25 years

Kunio T. Takahashi^{1,2}, John A. Kitchener³, Karen V. Robinson⁴, Graham W. Hosie⁵, and SO-CPR Survey Team

¹*National Institute of Polar Research, Research Organization of Information and Systems*

²*Department of Polar Science, School of Multidisciplinary Sciences, The Graduate University for Advanced Studies (SOKENDAI)*

³*Australian Antarctic Division, Australia*

⁴*National Institute of Water and Atmospheric Research Ltd., New Zealand*

⁵*Sir Alister Hardy Foundation for Ocean Science, UK*

The Southern Ocean Continuous Plankton Recorder (SO-CPR) Survey commenced in 1991 with the purpose of mapping spatial and temporal variations in zooplankton pattern, and to make use of the sensitivity of plankton to environmental change as an early warning indicator of the health of the Southern Ocean ecosystem. The CPR can collect surface zooplankton continuously for 450 nautical miles during a single tow at normal ship speed. Therefore, it is ideal for sampling large areas quickly and mapping the distribution of the surface zooplankton community in relation to ocean environments over large ocean scales. We compared the total zooplankton abundance and average copepod community size between two regions of the Southern Ocean; the East Antarctic region from 60 to 160°E where there has been the highest density of CPR tows to date, and the Ross Sea region between New Zealand and the Ross Sea, 160°E to 150°W where CPR tows have been conducted regularly since 2006. The four predominant latitudinal zones Sab-Antarctic Zone (SAZ), Polar Frontal Zone (PFZ), Permanent Open Ocean Zone (POOZ), and Sea-Ice Zone (SIZ) were compared within the East Antarctic and Ross Sea regions. The Total Zooplankton Abundance is the sum of abundance of all zooplankton collected in a section (sample) of CPR silk expressed as numbers per cubic meter, each sample normally representing 5 nautical miles of tow which equates to ~1.5 m³ of water filtered. The large inter-annual variation in zooplankton abundance in the Ross Sea region contrasts with the observed patterns in the East Antarctic region where there is less inter-annual variation in total zooplankton abundance. The Average Copepod Community Size (ACCS) metric was used to compare dominance in copepod species between regions. There was no significant trend in the ACCS in the Ross Sea region during the sampling period. In the East Antarctic region, the ACCS metric showed a significant positive trend from 1991 to 2013, suggesting a shift towards larger copepod species. As with the study of long term changes in abundance above, sampling in the Ross Sea region between 160°E and 150°W is still relatively too short to make clear comment on trends, other than the Ross Sea region does not show the same patterns as the Eastern Antarctic region despite the PFZ and POOZ of the Ross Sea region being “downstream” of the Eastern Antarctic region in relation to the ACC.