

Consideration on Kerguelen-Davis Oscillation Index (KDOI) influencing variability on environmental ecosystem in the Prydz Bay region, east Antarctica: data exploration

Mikio Naganobu¹, Hiroto Murase¹, Koji Matsuoka² and Kunio Kutsuwada³

¹National Research Institute of Far Seas Fisheries, ²Institute of Cetacean Research,

³School of Marine Science and Technology, Tokai University

Key words: Antarctic Ocean, Westerlies fluctuation, KDOI, DPOI, environmental ecosystem

Antarctic krill, *Euphausia superba*, is a keystone species of the Antarctic ecosystem (Fig. 1). Environmental variability effecting on Antarctic krill is important so that krill stock affects populations of its predators such as whales, seals, birds and other species. Naganobu *et al.* (1999) found significant correlation between krill recruitment and strength of westerly winds determined by sea-level pressure differences across the Drake Passage during 1982-1998 (so called as the Drake Passage Oscillation Index (DPOI)) in the Antarctic Peninsula region.

The report of the Intergovernmental Panel on Climate Change reviewed DPOI as a factor with physical impacts on the biology of the Antarctic Ocean and took interest in its variability (IPCC, 2001). In addition, we also found significant correlation between DPOI and MTEM-200 (the mean temperature from the surface to 200m) (Fig. 2) (Kutsuwada *et al.*, 2010). On the other hand, DPOI has a high correlation with the ocean zonal wind in the Antarctic sectors of the Pacific and Indian Ocean surrounding the Antarctic Continent (Yoda *et al.*, 2012).

Therefore we initiated data exploration for the similar DPOI's approach focusing environmental ecosystem on krill and whales in the Prydz Bay region, east Antarctica and re-arranged several original datasets such as the Second International BIOMASS (SIBEX) survey by the *R/V Kaiyo Maru* and others (Naganobu *et al.*, 2012).

We discovered complicated seasonal change of water conditions (temperature, salinity, current), primary production, zooplankton (including krill) and predators (whales, birds and others) along sea ice melting and interannual changes through these datasets. However, it is difficult to explain such changes only based on biology.

Therefore, we are considering another index of sea-level pressure differences between Port-aux-Français, Kerguelen Islands and Davis Base, Antarctica and term it as KDOI (Fig. 3). It would be relatively easy to analyze relationship between variability of environmental ecosystem in the Prydz Bay region and KDOI. Relevant data exploration and arrangements are required to obtain KDOI for understanding of the regional and entire scale approaches on the Antarctic environmental ecosystem.

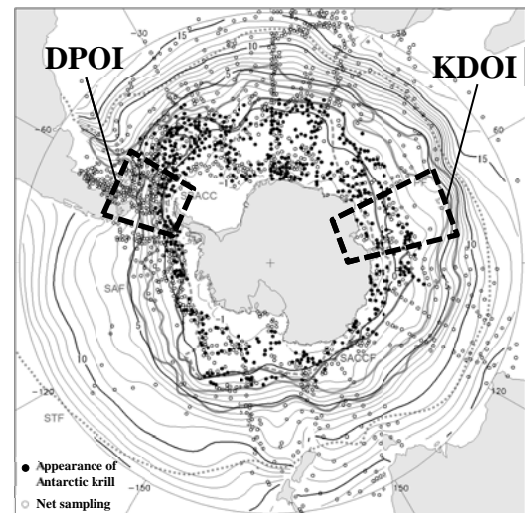


Fig. 1: Two study areas in connecting with DPOI and KDOI are indicated on the geographical distribution of Antarctic krill (after Marr, 1962) combined with isolines of MTEM-200 and oceanic fronts in the entire Antarctic Ocean (after Naganobu *et al.*, 2008).

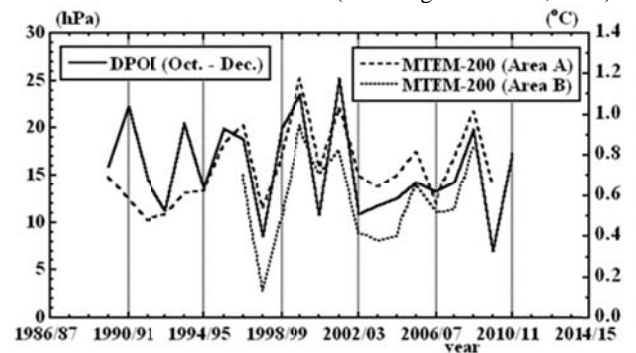


Fig. 2: DPOI is the key environmental index with significant correlations between DPOI and MTEM-200 in the Antarctic Peninsula region (from Kutsuwada *et al.*, 2010) influencing to the Antarctic krill ecosystem.

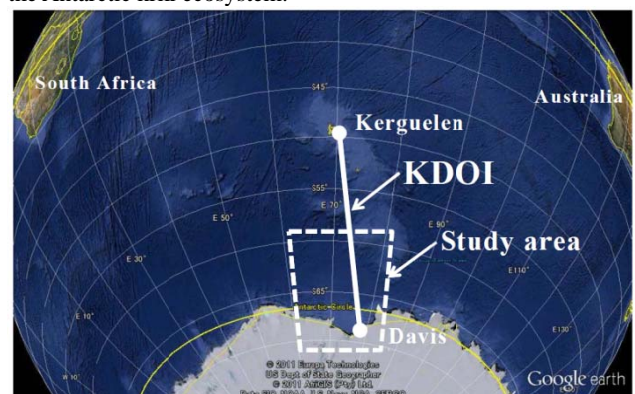


Fig. 3: The study area such as SIBEX and others in connecting with KDOI (between Kerguelen Islands and Davis Base, Antarctica) comparing with DPOI from the viewpoint of circumpolar structure.