

On-shelf predation pressure smooths out the wrinkles in krill swarms

Sophie Fielding, Geraint Tarling (British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, UK)

Antarctic krill are obligate swimmers, but the size and shape of their swarms varies widely. Acoustic observations of krill and fish have revealed that the ratio of the surface-area to volume (termed roughness or R) of swarms and schools converges around a constant value of 3.3. It is hypothesised that R is driven by two basic conflicting needs: oxygen demand, which leads to disaggregation (rough swarms and high R); and predator avoidance, which leads to tighter aggregations (smoother swarms and lower R). We examined R from Antarctic krill swarms detected in daytime acoustic surveys carried out over 12 years (2002-2014) in an area to the north of South Georgia, Scotia Sea, encompassing both on-shelf (water depth < 500m) and off-shelf regions. Swarms observed on-shelf were significantly smoother than those off-shelf. In addition, the relationship between R and depth of swarm in the water column was positive and significant on-shelf but not significant off-shelf. In on-shelf regions therefore, swarms located in the upper part of the water column adopted a smoother shape than those located deeper. We postulate that the plentiful air breathing predators, such as penguins and seals, around South Georgia impose a predation pressure on the shallow krill swarms that smooths their shape and decreases their R . The strength of advective forces in the region means that swarms move rapidly in and out of on-shelf regions, indicating that swarm shape is phenotypically plastic and highly responsive to the predatory environment.

Keywords: Antarctic krill, swarms, acoustic backscatter

Contact author: Sophie Fielding, British Antarctic Survey, email sof@bas.ac.uk