Abstract

A bespoke, single-beam, 120 kHz echo-sounder was integrated into an ocean glider and deployed for two short periods in the Weddell Sea. A schools algorithm was used to identify krill swarms within the acoustic data, and converted to krill density using a target strength model. The glider-derived krill density for two survey boxes was an order of magnitude lower than concurrent ship-borne acoustic measurements, although vertical distribution profiles were similar.

Underwater gliders permit long temporal measurements of an area at low-cost. However, the changing orientation of the vehicle (roll and pitch), undulating depth profiles (for forward propulsion) and slow speed introduce complexity to interpreting sampling effort. A Monte Carlo simulation of glider sampling within ship-borne acoustic measurements of Antarctic krill indicated that the glider required an order of magnitude more time than the ship to appropriately resolve the abundance of krill within a small region (<100 km²).

Instruments and Deployment

A Seaglider was deployed in the Weddell Sea in January 2012. It was fitted with an ES853 120 kHz echo-sounder, and calibrated with a tungsten carbide sphere (Foote et al., 1987). The ES853 has a range of 100 m, resolution of 0.5 m vertical bins and is capable of detecting a target of -70 dB at a range of 40 m. It was mounted such that on a typical dive it was pointed downwards during the downcast for comparison with ship-borne measurements. 

The glider was deployed in two different regions, and during its missions simultaneous ship-based acoustic measurements were undertaken (Boxes 1 and 2). In addition Rectangular Midwater Trawls were made on acoustic targets to ground truth the acoustic signals.

Krig Density

Acoustic backscatter attributed to krill was identified using a schools analysis technique. The 120 kHz backscatter was then converted to krill density using an acoustic scattering model (SDWBA, Demer and Conti, 2005).

Discussion

• Underwater gliders represent a new opportunity to survey the marine ecosystem. We detected krill from a glider and derived density estimates for it.

• The varying aspect of the glider, and therefore the echo-sounder, increases the complexity of processing acoustics signals for accurate target strength calculation Krill density profiles from the glider showed similar distribution to ship profiles.

• A Monte Carlo simulation showed that more dives, than were available, were required for glider derived densities to appropriately approximate the ship derived krill densities.

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