COMMENT

ESTIMATING STANDING STOCK OF KRILL USING MAXIMUM ENTROPY

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The paper by Heywood et al. (2006) describes a maximum entropy image reconstruction (MaxEnt) of the krill distribution using data from the CCAMLR-2000 Synoptic Survey. The reconstructed distribution is used to estimate the standing stock of krill in the area and compare it with the estimate using the Jolly and Hampton (1990) method. The estimated standing stock using MaxEnt is approximately twice that using the Jolly and Hampton method but with approximately the same standard deviation. The authors state that the MaxEnt method offers a better estimate of standing stock because it takes account of spatial structure.

Whilst it is true that the Jolly and Hampton approach takes no account of spatial structure, it should be recalled that the method was designed purely to estimate standing stock. The MaxEnt approach provides insights into spatial structure but at the same time should provide an estimate of standing stock close to that of the Jolly and Hampton method. The estimates of standing stock are so different that it is totally incorrect to state that the MaxEnt estimate is 'plausible' in comparison with the Jolly and Hampton results presented by Demer and Conti (2005). Something is wrong with the estimated standing stock by either or both methods. The Jolly and Hampton approach is simple, robust and, as Heywood et al. indicate, is suited to the survey design. The MaxEnt approach does not have these attributes.

The spatial scale of the data used for the MaxEnt simulation is one nautical mile, an arbitrary unit chosen at the time that the echo-integration method was being developed. As such it does not relate to any spatial scale determined from the krill distribution or dependent species. Interactions with these groups operate on a number of vertical and horizontal spatial scales. Hence, if the acoustic data are to be used to provide evidence to support the view that the MaxEnt approach provides 'plausible' results, appropriate spatial scales need investigation taking account of the natural distribution in the predator and prey fields. Acoustically, the range is horizontally from ping by ping to miles and vertically from the pulse length to the integrated range. In the absence of such tests, MaxEnt simulations should not be considered in the development of management advice.

Arising from these points I feel it is premature to consider using the MaxEnt approach for estimating standing stock. Also in this preliminary form the MaxEnt approach should not be considered as providing 'plausible' indications of distribution and standing stock for incorporation into ecosystem models as stated by the authors.

References

Demer, D.A. and S.G. Conti. 2005. New target-strength model indicates more krill in the Southern Ocean. *ICES J. Mar. Sci.*, 62: 25–32.

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