

**Appendix B. Technical comments regarding the *Illex illecebrosus* stock assessment, from an external reviewer (Mike Bell from CEFAS in Lowestoft, England).**

*Scope of the meeting*

The purpose of the meeting was to review the information and methods available for the SARC 37 short-finned squid stock assessment. The stock was last assessed in 1999 (SARC 29), using weekly landings and effort data from the Vessel Trip Records (VTR) database in the Rago Assessment Model. The main advance since 1999 has been the collection of survey data in May 2002 that has generated new information on age and size distributions in the southern part of the stock area prior to the start of the fishery. New observations on fully mature females have been particularly important in moving forward the state of understanding – 84 mature females were recorded in the survey catches, whereas only a handful have previously been observed by biologists.

This document describes my views, as an outside observer, of the effectiveness of the stock assessment process, in terms of both procedure (representation, meeting process) and scientific quality (biological and fisheries data, analytical approach).

*Procedural aspects*

The meeting focused on three aspects of the assessments – the biological and environmental context, data on quantities and composition of fishery removals, and analytical approaches used to synthesise the available data and understanding into the best scientific appreciation of current stock status with respect to overfishing thresholds. A clear agenda covering these topics had been drawn up before the meeting, together with comprehensive supporting notes. Each topic was dealt with thoroughly, and effective chairmanship ensured that the discussions remained ‘on track’ and moved efficiently through the agenda. Those present at the meeting included the scientists responsible for each aspect of the assessment, together with a squid fishing industry representative also involved in management. Where appropriate, additional scientists were drawn in to comment on specific aspects of the assessment.

My view of the meeting process is entirely positive. The discussions were held in an atmosphere of constructive, open debate, and, as an outsider with no previous knowledge of this particular stock or species, I was very effectively made aware of the biological, fisheries and management issues relating to this assessment. The meeting would have been further enhanced by participation of more squid industry representatives, but it could not be said that the outcome of this meeting has thereby suffered. The next stage of the subcommittee process is to finalise the assessment and presentation of information. This first meeting has effectively prepared for this, and it is to be anticipated that the final outcome will represent the best scientific understanding of the current status of the *Illex* squid stock that is possible given the current state of knowledge.

*Scientific quality – data and biological information*

Considerable uncertainty exists about the relationship of the fished portion of the *Illex* stock with the stock as a whole. The assessed part of the stock covers part of the shelf edge, onto which the squid migrate from deeper waters offshore. The assessment results are taken to apply to the whole of the shelf edge area, thus representing a ‘worst case’ scenario – an upper limit for F. In this sense the assessment is quite rightly precautionary in its approach, but it will be important in

future to determine the connectivity within the stock as a whole – both between different parts of the shelf edge and, most importantly between the shelf edge and offshore components of the stock. Critically, it will be important to determine the relationship between spawning activity and onshore migration. The assessment is, again, a worst case scenario in that it assumes that all spawning takes place on the shelf edge – i.e. the fished stock is the spawning stock, thus SSB and egg per recruit considerations are paramount in determining overfishing thresholds. Temperature has been identified as an important factor in determining the strength of the onshore migration. According to the precautionary hypothesis implicitly assumed by the assessment, this represents a control on the size of the spawning (i.e. exploited) stock by defining the extent of spawning habitat in a given year. An alternative hypothesis would be that temperature simply determines how large a fraction of the total stock becomes available to the fishery on the shelf edge. There is at least anecdotal evidence that large (i.e. reproductively mature) squid exist within the offshore component. The two hypotheses differ strongly in their implications for the vulnerability of the stock to overfishing.

These and other biological issues were very clearly highlighted during the meeting, and underline the need for further biological studies. Large strides have already been made since the previous assessment in 1999, stemming particularly from observations made from the results of the May 2002 survey. Maximal use was made of the available material from survey catches – inferences about age, growth and, most significantly, maturity – mature females had previously only been observed in small numbers, so researchers took full advantage of the opportunity to study the sample of 84 that was taken during this survey. Aside from the obvious need to study stock connectivity, biological studies should concentrate on extending observations of age, growth and maturity to other times of the year, particularly the autumn. Further studies on uncertainties in age determination are also desirable, principally so that this source of uncertainty can be accounted for in the analytical assessments.

Biological understanding of this *Illex* stock is the principal limitation for assessment, since the fishery data appear to be very good. In particular, it was notable that there is good agreement between VTR records and other sources of information on landings. More detailed analysis of CPUE records is planned in the near future, accounting for spatial and gear-specific influences in a generalised linear modelling approach.

#### *Scientific quality – analytical approach*

Excellent use is being made of the available information on the responses of *Illex* to exploitation. In particular, recent survey data are being used to generate parameters for biologically realistic ‘per recruit’ models from which biological reference points can be derived. Whilst it is true that such modelling would benefit from more species-specific information on biological parameters such as natural mortality and fecundity, and more data on changes in growth and maturity through the fishing season, these per recruit models and supporting analyses are of the highest scientific quality and represent the ‘state of the art’ for *Illex* assessment at the present time.

Likewise, the assessment approaches developed for *Illex* are of very high scientific quality – both the new and the old versions of the Rago assessment model are innovative and designed to make best use of the available observations. The science that has been applied to *Illex* assessment has clearly progressed over the years, yet the assessment scientists have not lost sight of the importance of continuity between years – the outcomes of new assessment approaches are

compared with those of previously used approaches, the outcomes of the new per recruit models are compared with those from traditional per recruit models.

### *Summary*

In summary, considered in the context of uncertainties about the relationship of the exploited to the total stock, the scientific quality of the *Illex* assessment is very high in terms of both the analytical approaches and the data (however limited) to which they are applied. A very effective synthesis is made of all available observations in drawing together an overall appreciation of stock status within a framework which is rightly precautionary in nature. Full consideration of statistical and other uncertainties is made within the quantitative analyses, and the sensitivity of assessment outcomes to feasible ranges of values of uncertain biological parameters is investigated. The final assessments presented at the SARC are thus expected to be both rigorous and defensible.