1   Executive summary

The Workshop on Age reading of European Sardine (*Sardina pilchardus*) (NE Atlantic and Mediterranean) [WKARAS 2], was held at the Instituto Português do Mar e da Atmosfera (IPMA) (Portuguese Institute for the Sea and the Atmosphere) Lisbon, Portugal, from 18 to 22 February 2019. The terms of reference of this Workshop were addressed as specified in Section 2.

19 researchers from eight marine research institutes located in France, Spain, Portugal, Greece, Croatia and Morocco attended this Workshop (Section 3). The Workshop's Agenda is also presented in Section 3. The summary of activities carried out in the different laboratories regarding otolith sampling and preparation methodologies for age reading are presented in Section 8 (Table 8.1).

This Workshop was preceded by a sardine otolith age reading exchange in 2017 in order to assess otoliths' age readings agreement between readers of the Northeast Atlantic and the Mediterranean Sea and to identify any age readings issues in each area. The results of this exchange were presented during the Workshop (Section 5), and its report is shown in Annex 1. A total of 31 readers from 10 laboratories of both areas participated in this exchange. 380 images of otoliths' pairs collected from fish samples taken in 11 locations and uploaded in WebGR were individually analyzed by the participants for age attribution following a reference age reading protocol. R scripts based on Eltink's MS Excel spreadsheet (Eltink, 2000) following the recommendations of the "Guidelines and tools for age reading comparisons" (Eltink *et al.*, 2000) were used for age readings comparative analyses.

In order to clarify the causes of age readings discrepancies between readers, discussions based on joint analyses of projected images of selected otoliths among those used for the 2017 exchange were held during the workshop. Review of age reading criteria used for growth rings identification applied in each area was undertaken and age reading validations were discussed as well.

The use in each area of a reference collection of otoliths' images with ≥80% of age reading agreement between readers was discussed and pointed out as a suitable tool to improve age readings accuracy and to contribute for a higher agreement between readers in each area. As a contribution for the construction of the reference collections, a selection of images of otoliths from exchange 2017 with ≥80% age reading agreement between the readers was undertaken during the joint discussion (see Section 7).

In order to assess age reading discrepancies and their causes in each area and the effects of the discussions held on the reading agreement between readers, a small age reading calibration exercise took place during the workshop, based on individual analysis through SmartDots of a sample of otoliths images selected from those used in the 2017 exchange. This small calibration exercise results and their analyses are shown in Annex 2. Overall the age reading agreement (PA), coefficient of Variation (CV) and Average Percentage Error (APE) obtained by advanced readers in relation to those achieved by their equivalent "experts"+"intermediate" in each area in the 2017 Exchange, are not much different from each other (Table 1.1). Despite the previous discussions on the *annulus* identification by image analysis during joint sessions, difficulties persisted mainly on the edge type classification and on the first growth ring identification.