

# **2014 Anchovy Otolith Exchange Programme From Atlantic and Mediterranean areas.**

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## **1- INTRODUCTION**

The Planning Group on Commercial Catch, Discards and Biological Sampling (PGCCDBS) meeting in February 2014, identified anchovy as one of the species requiring confirmation of the ages being assigned by Fisheries Institutes. The planning group indicated that an otolith exchange on anchovy should be organized in 2014, in order to ascertain the current level of precision among institutes and the difficulties that the age reading of anchovy otoliths present. The last exchange of otoliths and anchovy workshop was held in 2009, five years ago, and it is advisable to do one every 3-5 years.

To that purpose an exchange programme of anchovy otoliths is organized by IEO and AZTI between July 2014 and January 2015 before a Working Group on Biological Parameters (WGBIOP), will meet in Malaga, Spain, June 2015

## **2- OBJECTIVES**

The exchange will have the following common objectives for all areas, from Atlantic and Mediterranean areas (Although the analysis will be made separately by areas):

- 1- Evaluate the current precision in otolith age reading of anchovy among readers of fishery and surveys samples throughout the year.
- 2- Identify major difficulties in anchovy otolith interpretation for age determinations concerning observed disagreements (otolith edge recognition and/or identification of true rings or checks).
- 3- Report results to the WGBIOP that will take place in June 2015.

### 3- MATERIAL AND METHODS

**3.1 SETS OF OTOLITHS:** The definitive adopted sets of otoliths are in the following table.

**Table 1.**

| Stock               | Institute providing data | Areas                                        | Calibration Exercise (CE)<br>in WebGR | Nº images for Exchange by months |            |                         |             | Length range |
|---------------------|--------------------------|----------------------------------------------|---------------------------------------|----------------------------------|------------|-------------------------|-------------|--------------|
|                     |                          |                                              |                                       | First half of the year           |            | Second half of the year |             |              |
|                     |                          |                                              |                                       | Nº images                        | Months     | Nº images               | Months      |              |
| English Channel     | IFREMER                  | VIIed                                        | ANE_VII                               | -                                | -          | 20                      | Sept-Oct    | 9.5-20 cm    |
| Bay of Biscay       | IFREMER/AZTI             | VIIIa                                        | ANE_VIII                              | 10                               | March      | 22                      | Sept        | 13.5-17 cm   |
|                     | AZTI                     | VIIIb                                        |                                       | 15                               | April      | 3                       | Sept        | 8-17 cm      |
|                     | IEO-Santander            | VIIIc                                        |                                       | 10                               | March-June | 10                      | Aug-Nov     | 9.5-18 cm    |
| Division IXa        | IPMA                     | IXa CN                                       | ANE_IXa                               | 10                               | April-May  | 10                      | August-Sept | 11-15.5 cm   |
|                     | IEO-Cadiz                | IXa South                                    |                                       | 36                               | March-June | 36                      | July-Nov    | 7-16 cm      |
| GSA01               | IEO-Málaga               | Northern Alboran Sea                         | ANE_GSA01                             | 35                               | May        | 35                      | August      | 10.5-16 cm   |
| GSA06               | IEO-Málaga               | Western Mediterranean<br>(Northern of Spain) | ANE_GSA06                             | 30                               | April-June | 30                      | August      | 11-16.5 cm   |
| GSA07               | IFREMER                  | Gulf of Lion                                 | ANE_GSA07                             | 18                               | February   | 20                      | July        | 9-14.5 cm    |
| GSA16               | IAMC-CNR                 | Strait of Sicily                             | ANE_GSA16                             | 32                               | April-May  | 34                      | Sept        | 8-17 cm      |
| GSA10               | COISPA                   | Southern Thyrrenian                          | ANE_GSA10                             | 25                               | May        | 30                      | August-Sept | 8-15 cm      |
| GSA19               | COISPA                   | Western Ionian                               | ANE_GSA19                             | 25                               | April-May  | 30                      | August-Sept | 8-14 cm      |
| GSA22               | ELGO                     | Aegean Sea                                   | ANE_GSA22                             | 36                               | June       | 34                      | September   | 8-13 cm      |
| <b>Total Images</b> |                          |                                              |                                       | 282                              |            | 294                     |             |              |
|                     |                          |                                              |                                       | 576                              |            |                         |             |              |

### 3.2 INFORMATION OF ANCHOVY STOCKS/AREAS in Anchovy Exchange 2014

**Table 2.**

| Anchovy Stock   | Area                  | Analytical Stock Assessment?                 | Organization/ Working Group     | Countries involved /Institutes         | Conventional birth dates   | Season of fishery                                                                                                           | Peak of catch                                                    | Spawning Season              | Spawning peak            | Season of recruitment at age 0 |
|-----------------|-----------------------|----------------------------------------------|---------------------------------|----------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------|--------------------------|--------------------------------|
| English Channel | ICES Subarea VII      | No                                           | ICES WGHANSA                    | England and France/CEFAS, IFREMER      | 1st of January             | All year                                                                                                                    | -                                                                | -                            | -                        | -                              |
| Bay of Biscay   | ICES Subarea VIII     | Yes                                          | ICES WGHANSA                    | France and Spain/IFREMER, AZTI and IEO | 1 <sup>st</sup> of January | March-November                                                                                                              | April-June for Spain; June-September for France                  | April-August                 | May-June                 | Autumn (September-October)     |
| Division IXa    | ICES Division IXa     | Not yet (trend-based qualitative assessment) | ICES WGHANSA                    | Portugal and Spain/IPMA and IEO        | 1 <sup>st</sup> of January | February-November for Ixa South, Spain; Occasional for Portugal in IXA Cnorth, Csouth and South, and for Spain in Ixa North | June-July (IXA South, Spain); No peak for the rest of the areas. | April-November for Ixa South | June-July for Ixa South; | Autumn (September-November)    |
| GSA01           | Northern Alboran Sea  | Yes                                          | CGPM (WG small pelagic species) | Spain/IEO                              | 1 <sup>st</sup> of July    | All year                                                                                                                    | Summer/Autumn                                                    | May-October                  | July                     | Autumn                         |
| GSA06           | Western Mediterranean | Yes                                          | CGPM (WG small pelagic species) | Spain/IEO                              | 1 <sup>st</sup> of July    | All year                                                                                                                    | Summer                                                           | May-October                  | July                     | Autumn                         |
| GSA16           | Strait of Sicily      | Yes                                          | CGPM (WG small pelagic species) | Italy/IAMC-CNR                         | 1 <sup>st</sup> of July    | All year                                                                                                                    | Summer                                                           | May-October                  | July-August              | Autumn (September-December)    |
| GSA10           | Southern Thyrrenian   | No                                           | -                               | Italy/COISPA                           | 1 <sup>st</sup> of July    | Summer-Autumn                                                                                                               | July                                                             | Spring                       | May-June                 | Summer and early autumn        |
| GSA19           | Western Ionian        | Yes                                          | STECF-14-08                     | Italy/COISPA                           | 1 <sup>st</sup> of July    | Summer-Autumn                                                                                                               | June                                                             | Spring                       | May-June                 | Summer and early autumn        |
| GSA07           | Gulf of Lion          | Yes                                          | CGPM (WG small pelagic species) | France/IFREMER                         | 1st of January             | All year                                                                                                                    | July                                                             | May-August                   | July                     | Autumn                         |
| GSA22           | Aegean Sea            | Yes                                          | CGPM (WG small pelagic species) | Greece/ELGO                            | 1st of June                | March to November                                                                                                           | July                                                             | Spring-Autumn                | June-July                | March                          |

### 3.3 PARTICIPANTS AND QUALIFICATION OF READERS:

Table 3.

| Country         | Institute & postal address                                                                                                                                                                                                      | Participants in exchange | Email                                                                                | Readers or Not ?      | Age reading expertise level Anchovy |             |                 | Age reading expertise level Other species                 |                        |                 | Anchovy Stock/Area of expertise                                                                                     |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|-----------------------|-------------------------------------|-------------|-----------------|-----------------------------------------------------------|------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------|
|                 |                                                                                                                                                                                                                                 |                          |                                                                                      |                       | High/Medium/Low                     | Years       | No. Of otoliths | Species                                                   | Years                  | No. Of otoliths |                                                                                                                     |
| Spain-IEO       | Instituto Español de Oceanografía (IEO)                                                                                                                                                                                         | Begoña Villamor          | <a href="mailto:begoña.villamor@st.ieo.es">begoña.villamor@st.ieo.es</a>             | No (Age coordinator)  |                                     |             |                 | Trachurus trachurus, Scomber scombrus                     | 2007-2014<br>2007-2011 | >20000<br>13000 | Bay of Biscay (ICES Subarea VIII)                                                                                   |
|                 | Promontorio de San Martín s/n                                                                                                                                                                                                   | Clara Dueñas-Liaño       | <a href="mailto:clara.duenas@st.ieo.es">clara.duenas@st.ieo.es</a>                   | yes                   | High                                | 2007-2014   | 17000           | Trachurus trachurus, Scomber scombrus                     | 1 year<br>1 year       | 600<br>700      |                                                                                                                     |
|                 | 39004 Santander (Cantabria)                                                                                                                                                                                                     | Ana Antolínez            | <a href="mailto:ana.antolinez@st.ieo.es">ana.antolinez@st.ieo.es</a>                 | yes                   | Low                                 | 1 year      | 300             | Scomber scombrus, Scomber colias                          | 2007-2014<br>2011-2014 | >20000<br>2200  |                                                                                                                     |
|                 | Spain                                                                                                                                                                                                                           | Charo Navarro            | <a href="mailto:charo.navarro@st.ieo.es">charo.navarro@st.ieo.es</a>                 | yes                   | High                                | 2008-2012   | 13400           |                                                           |                        |                 |                                                                                                                     |
|                 | Instituto Español de Oceanografía (IEO)                                                                                                                                                                                         | Fernando Ramos           | <a href="mailto:fernando.ramos@cd.ieo.es">fernando.ramos@cd.ieo.es</a>               | No                    |                                     |             |                 |                                                           |                        |                 |                                                                                                                     |
|                 | Puerto pesquero, Muelle de Levante s/n<br>11006 Cádiz<br>Spain                                                                                                                                                                  | Jorge Tornero            | <a href="mailto:jorge.tornero@cd.ieo.es">jorge.tornero@cd.ieo.es</a>                 | yes                   | High                                | 2009-2014   | 15000           | none                                                      | none                   | none            |                                                                                                                     |
|                 | Instituto Español de Oceanografía (IEO)<br>Puerto Pesquero s/n<br>29640 Fuengirola-Málaga<br>Spain                                                                                                                              | Pedro Torres             | <a href="mailto:pedro.torres@ma.ieo.es">pedro.torres@ma.ieo.es</a>                   | yes                   | High                                | 2003-2014   | 12000           | Sardina pilchardus                                        | 2012-2014              | 4500            | Mediterranean Geographical Sub<br>GSOA1 (Northern Alboran sea)<br>GSA06 (Northern Spain)                            |
| Spain-AZTI      | Herrera Kaia - Portu aldea z/g                                                                                                                                                                                                  | Andrés Uriarte           | <a href="mailto:auriarte@azti.es">auriarte@azti.es</a>                               | yes (Age coordinator) | High                                | 1985 - 2014 | >50000          | Trachurus trachurus, Scomber scombrus, Sardina pilchardus | 1995 - 2014            | > 20000         | Bay of Biscay (ICES Subarea VIII)                                                                                   |
|                 | 20110 Pasaia - Gipuzkoa                                                                                                                                                                                                         | Iñaki Rico               | <a href="mailto:irico@azti.es">irico@azti.es</a>                                     | yes                   | High                                | 1990 - 2014 | >50000          |                                                           |                        |                 |                                                                                                                     |
|                 | Basque Country<br>Spain                                                                                                                                                                                                         | Beatriz Beldarrain       | <a href="mailto:bbeldarrain@azti.es">bbeldarrain@azti.es</a>                         | yes                   | low                                 |             |                 |                                                           |                        |                 |                                                                                                                     |
| UK-Cefas        | Cefas<br>Pakefield Road<br>Lowestoft, Suffolk, NR33 0HT<br>UK                                                                                                                                                                   | Mark Etherton            | <a href="mailto:mark.etherton@cefass.co.uk">mark.etherton@cefass.co.uk</a>           | yes                   | Low                                 | 2010-2014   | 2000            | Around 15 other species                                   | 1992-2014              | >100,000        | ICES Subarea VII                                                                                                    |
| Portugal - IPMA | Instituto Português do Mar e da Atmosfera<br>Departamento do Mar e Recursos Marinhos<br>Divisão de Modelação e Recursos da Pesca<br>Av. Brasília, 1449-006 LISBOA, PORTUGAL                                                     | Eduardo Soares           | <a href="mailto:esoares@ipma.pt">esoares@ipma.pt</a>                                 | yes                   | Low                                 | 2 years     | 6700            | Sardina pilchardus                                        | 1994-2014              | >20000          | Portuguese coast (ICES Division IXa)                                                                                |
| Italy-COISPA    | COISPA Tecnologia e Ricerca<br>Satzione Sperimentale per lo studio delle risorse del mare<br>via dei Trulli 18/20 70126 Bari - Italy                                                                                            | Carbonara Pierluigi      | <a href="mailto:carbonara@coispa.it">carbonara@coispa.it</a>                         | yes (Age coordinator) | High                                | 2009-11     | 2000            | DCF target species a                                      | 2006-2014              | >30000          | GSA 10 (Southern Thyrrenian);<br>GSA 18 (Southern Adriatic); GSA<br>19 (Western Ionian)                             |
|                 |                                                                                                                                                                                                                                 | Casciaro Loredana        | <a href="mailto:casciaro@coispa.it">casciaro@coispa.it</a>                           | yes                   | medium                              | 2011-12     | 1800            | S. smaris, M. barbat                                      | 2011-2014              | 10000           |                                                                                                                     |
|                 |                                                                                                                                                                                                                                 | Gaudio Palma             | <a href="mailto:gaudio@coispa.it">gaudio@coispa.it</a>                               | yes                   | low                                 | 2013        | 800             | B. boops                                                  | 2014                   | 3000            |                                                                                                                     |
| Italy-IAMC-CNR  | Istituto per l'Ambiente Marino Costiero - IAMC<br>(Institute for Coastal Marine Environment)<br>Consiglio Nazionale delle Ricerche - CNR<br>Via del Mare, n°3 91021 Torretta Granitola<br>(Fz. Campobello di Mazara, Tp), Italy | Gualtierio Basilone      | <a href="mailto:gualtierio.basilone@iamc.cnr.it">gualtierio.basilone@iamc.cnr.it</a> | no (Age coordinator)  |                                     |             |                 |                                                           |                        |                 |                                                                                                                     |
|                 |                                                                                                                                                                                                                                 | Salvatore Gancitano      | <a href="mailto:salvatore.gancitano@cnr.it">salvatore.gancitano@cnr.it</a>           | yes                   | high                                | 1994-2014   | 1000            | Merluccius merluccius<br>Coryphaena hippurus              | 1994-2014              | 10000<br>10000  | GS16 zone (Strait of Sicily)                                                                                        |
|                 |                                                                                                                                                                                                                                 | Salvatore Mangano        | <a href="mailto:salvatore.mangano@iamc.cnr.it">salvatore.mangano@iamc.cnr.it</a>     | yes                   | low                                 | 1 year      | 300             | Sardina pilchardus                                        | 1 year                 | 300             |                                                                                                                     |
|                 |                                                                                                                                                                                                                                 | Maurizio Pulizzi         | <a href="mailto:maurizio.pulizzi@iamc.cnr.it">maurizio.pulizzi@iamc.cnr.it</a>       | yes                   | low                                 | 1 year      | 300             | Sardina pilchardus                                        | 1 year                 | 300             |                                                                                                                     |
| Greece-Fri      | ELGO-Fisheries Research Institute<br>640 07 Nea Peramos<br>Kavala Greece                                                                                                                                                        | Argyris Sapounidis       | <a href="mailto:asapoun@inale.gr">asapoun@inale.gr</a>                               | No (Age coordinator)  | Low                                 | 2013        | 200             | Sardina pilchardus                                        | 2013                   | 200             |                                                                                                                     |
|                 |                                                                                                                                                                                                                                 | Dimitra Panora           | <a href="mailto:dpanora@inale.gr">dpanora@inale.gr</a>                               | yes                   | Low                                 | 2013        | 200             | Sardina pilchardus                                        | 2013                   | 200             |                                                                                                                     |
|                 |                                                                                                                                                                                                                                 | Christina Milani         | <a href="mailto:christinamilani@hotmail.com">christinamilani@hotmail.com</a>         | yes                   |                                     |             |                 |                                                           |                        |                 |                                                                                                                     |
| France-IFREMER  | IFREMER<br>150 quai Gambetta<br>BP 699<br>62 321 Boulogne sur mer, France                                                                                                                                                       | Kélig Mahé               | <a href="mailto:Kelig.Mahé@ifremer.fr">Kelig.Mahé@ifremer.fr</a>                     | No (Age coordinator)  |                                     |             |                 |                                                           |                        |                 | Bay of Biscay (ICES Subarea VIII)/Mediterranean sea (gulf of<br>Lions, 37.1.2)<br>Bay of Biscay (ICES Subarea VIII) |
|                 |                                                                                                                                                                                                                                 | Elise Bellamy            | <a href="mailto:Elise.Bellamy@ifremer.fr">Elise.Bellamy@ifremer.fr</a>               | yes                   | low                                 | 2013-2014   | 4000            | others 5 species                                          | 2013-2014              | 10000           |                                                                                                                     |
|                 |                                                                                                                                                                                                                                 | Patrick Grellier         | <a href="mailto:Patrick.Grellier@ifremer.fr">Patrick.Grellier@ifremer.fr</a>         | yes                   | High                                | 1995-2014   | 2000            |                                                           |                        |                 |                                                                                                                     |

**Table 4.** Summary of the readers

| Reader              | Email                                                                            | Expertise level/Years |     |
|---------------------|----------------------------------------------------------------------------------|-----------------------|-----|
| Andrés Uriarte      | <a href="mailto:auriarte@azti.es">auriarte@azti.es</a>                           | High                  | >20 |
| Iñaki Rico          | <a href="mailto:irico@azti.es">irico@azti.es</a>                                 | High                  | >20 |
| Patrick Grellier    | <a href="mailto:Patrick.Grellier@ifremer.fr">Patrick.Grellier@ifremer.fr</a>     | High                  | >20 |
| Salvatore Gancitano | <a href="mailto:salvatore.gancitano@cnr.it">salvatore.gancitano@cnr.it</a>       | high                  | >20 |
| Pedro Torres        | <a href="mailto:pedro.torres@ma.ieo.es">pedro.torres@ma.ieo.es</a>               | High                  | >10 |
| Clara Dueñas        | <a href="mailto:clara.duenas@st.ieo.es">clara.duenas@st.ieo.es</a>               | High                  | >5  |
| Charo Navarro       | <a href="mailto:charo.navarro@st.ieo.es">charo.navarro@st.ieo.es</a>             | High                  | >5  |
| Jorge Tornero       | <a href="mailto:jorge.tornero@cd.ieo.es">jorge.tornero@cd.ieo.es</a>             | High                  | >5  |
| Pierluigi Carbonara | <a href="mailto:carbonara@coispa.it">carbonara@coispa.it</a>                     | High                  | >5  |
| Loredana Casciaro   | <a href="mailto:casciaro@coispa.it">casciaro@coispa.it</a>                       | medium                | 4   |
| Mark Etherton       | <a href="mailto:mark.etherton@cefas.co.uk">mark.etherton@cefas.co.uk</a>         | Low                   | 3   |
| Eduardo Soares      | <a href="mailto:esoares@jpma.pt">esoares@jpma.pt</a>                             | Low                   | 2   |
| Ana Antolinez       | <a href="mailto:ana.antolinez@st.ieo.es">ana.antolinez@st.ieo.es</a>             | Low                   | 1   |
| Beatriz Beldarrain  | <a href="mailto:bbeldarrain@azti.es">bbeldarrain@azti.es</a>                     | low                   | 1   |
| Gaudio Palma        | <a href="mailto:gaudio@coispa.it">gaudio@coispa.it</a>                           | low                   | 1   |
| Salvatore Mangano   | <a href="mailto:salvatore.mangano@iamc.cnr.it">salvatore.mangano@iamc.cnr.it</a> | low                   | 1   |
| Maurizio Pulizzi    | <a href="mailto:maurizio.pulizzi@iamc.cnr.it">maurizio.pulizzi@iamc.cnr.it</a>   | low                   | 1   |
| Dimitra Panora      | <a href="mailto:dpanora@inale.gr">dpanora@inale.gr</a>                           | Low                   | 1   |
| Christina Milani    | <a href="mailto:crismilani13@hotmail.com">crismilani13@hotmail.com</a>           | Low                   | 1   |
| Elise Bellamy       | <a href="mailto:Elise.Bellamy@ifremer.fr">Elise.Bellamy@ifremer.fr</a>           | low                   | 1   |

### 3.4 AGE DETERMINATION PROCEDURES

The WebGR will be used for the determination of age and growth rings. See WebGR Workshop-manual file. Readers should indicate the annual age determination and position of the winter rings supporting his/her interpretation of the age. Checks should not be marked though if present they could be mentioned in the remark field of the reading

#### Minimum knowledge for age determination is:

Age reading is to be made, preferable without consulting its size, based on otolith examination according to the date of capture and general knowledge of the seasonal otolith growth pattern during the year and being aware of the conventional birth dates and other info as:

- a) **Conventional birth** dates for increasing in one year the age of an anchovy, when trespassing that date, is **1<sup>st</sup> of January** for English Channel (ICES Divsion VII), Bay of Biscay (ICES

Subarea VIII: VIIIa, VIIIb and VIIIc), Portugal Coast (ICES Division IXa CN), Gulf of Cadiz (ICES Division IXa S) and Gulf of Lion (GSA07). Nevertheless for some Mediterranean areas, is **1<sup>st</sup> of June** for Aegean Sea (GSA22) and **1<sup>st</sup> of July** for Alboran Sea (GSA01), Western Mediterranean (GSA06), Strait of Sicily (GSA16), Southern Thyrrenian (GSA10), Western Ionian (GSA19). See Table 2

- b) Spawning time is usually in spring for Atlantic areas and in spring-summer for Mediterranean areas. Maximum growth in spring and summer. See Table 2
- c) True Annual rings will be those formed in winter each year. Other rings may be present or appear throughout the year and cause problems in age determination (checks).

**We recommend** reading the otoliths without regarding the length, but if the reader usually does take into account the length or is unfamiliar with the sets of otoliths and/or the otoliths are particularly difficult, then the reader may want to have a look to the size of the individual. We are not against that at all but if the reader uses the length, we would want to know it. In that case put the word “Length” in the field of Remarks.

**Growth Pattern of anchovy otoliths:** The method of age determination is based on the knowledge of the annual and seasonal pattern of growth of the otoliths, including the seasonal otolith edge formation and of the most typical checks, as described in WKARA (ICES 2009):

a ) Typical annual growth of the otoliths is established, by which annulus width during the first, second and third years of life (corresponding to 0, 1 and 2 years old groups) decreases progressively. Older ages present a rather similar width to the one experienced at previous ages.

b ) Maximum otolith growth (opaque ring formation) takes place in summer months, and it decreases in winter time (hyaline ring formation). However, in some areas, the starting of the opaque edge during spring time changes with ages, being remarkably sooner at age 1 than at older ages (*as in the case of the Bay of Biscay Uriarte et al. 2007*). As a result of this, in spring 1 year old anchovy have typically already started the deposition of the opaque growth ring, whereas 2 years old or older fishes have mostly hyaline edges (or at the end of the spring in early formation of the opaque ring).

c ) Typical checks occur before and after the first winter ring is formed, during age 0 and age 1 of anchovy. The check before the true hyaline winter ring is generally present around the nucleus, with a faint and poorly de-fined structure. Preliminary results based on microstructure analysis suggest that this is actually a check (laid down at about 0.8 mm from the nucleus) (Hernandez et al., WD 2009 and 2013). The most typical ring formed after the first true hyaline ring is formed during June/July in many of the 1 years old anchovy at the peak of their first spawning period, which is considered to be a spawning check. According to its position in relation to the total expected annual growth this checks are named C15 or C18 if laid down around 50% or 80% of expected annual growth of the 1 year old fishes. (C08 would be a check laid down at the 80% of the expected growth for the 0 group, etc.).

d ) The number of check rings is highly variable. In some cases, check rings do not have an annual periodicity. Anchovies lay down different numbers of checks. Usually checks tend to be weaker or more diffuse than true annual rings and often they are not completely formed all otolith around, their position will often differ from the expected position of the true annual rings.

#### **4- AGENDA FOR THE EXCHANGE OF OTOLITHS**

The preparation of the sets of otoliths and submission to the coordinator has to be completed during the month of October.

**The exchange will start the first of November and will end by 31 January.**

Good luck with your readings!

## REFERENCES

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