Understanding the Population Structure of the European Anchovy (Engraulis encrasicolus) in the Black Sea, Mediterranean Sea and the Northeast Atlantic Ocean by using Otolith Shape Analysis

Gizem Akkus1, Sharif Jemaa2,3, Ali Cemal Gucu1, Paul Marchal4, Pierluigi Carbonara5, Mahmoud Bacha1, Rachid Amara2, Bruno Emande5, Claire Saraux5, Kélig Mahé6

ABSTRACT

European anchovy, Engraulis encrasicolus, is a small pelagic coastal marine fish largely spread from the North Sea to central Africa, including the Mediterranean and the Black and Azov Seas. The aim of this study is to identify the potential different populations of European anchovies and their relationship between the Northeast Atlantic, the Western and Eastern Mediterranean and the Black Sea. The outlines of 2535 pairs of sagittal otoliths were collected from 20 different regions in the Mediterranean and the Black Sea with existing ones available from a previous study. Elliptical Fourier Analysis (EPA) was used to analyze shape variation among locations. Before examining geographical differentiation by Linear discriminant (LDA) and Hierarchical Clustering Analysis, potentially confounding sources of variation (sex, fish length, otolith side and sampling year) were tested by partial Redundancy analysis (RDA). Sex, sampling year and otolith side had no significant effect on otolith shape. However, after accounting for ontogenic factors, the geographical area had a significant effect on otolith shape. Three different groups of anchovies were identified: Atlantic-Southwestern Mediterranean, Northwestern Mediterranean and Eastern Mediterranean-Black Sea with a classification success of 91%. These results have implications for the stock management of European anchovy populations from the North Sea to the Black Sea.

INTRODUCTION

• The European Anchovy is a small pelagic and coastal marine fish.
• Genetic methods may not be sensitive enough to detect population structure due to high gene flow. Otolith shape might be a useful tool to identify population structures as its geographical variation may be related to phenotypic local adaptation.

MATERIALS AND METHODS

Table 3. Otolith shape classification success percentage for 3 different groups.

<table>
<thead>
<tr>
<th>Area</th>
<th>Otolith Shape Classification Success (%)</th>
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<tbody>
<tr>
<td>Atlantic</td>
<td>54%</td>
</tr>
<tr>
<td>Mediterranean</td>
<td>57%</td>
</tr>
<tr>
<td>Black Sea</td>
<td>51%</td>
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Possible Effects of Total Fish Length, Sex, Sampling Year, Geographical Area

• RDA with permutation test was applied for testing total length (TL) effect; then sex, sampling year and geographical area effects were tested.
• Geographical area has a significant effect on otolith shape.

CONCLUSIONS

• Three different groups of European anchovies were identified:
  ➢ Atlantic-Southwestern Mediterranean
  ➢ Northwestern Mediterranean
  ➢ Eastern Mediterranean-Black Sea

These results have implications for stock management from the North Sea to the Black Sea.

Further study will focus on the Black Sea to investigate growth patterns and environmental effects on otolith shape.

Reference