Discrimination of the redfish (*Sebastes mentella*) stock components in the Irminger Sea and adjacent waters based on meristics, morphometry and biological characteristics

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The biological-fisheries data were collected in 2004 and 2005 during commercial catches of redfish in the Irminger Sea and adjacent waters (Fig. 1 and 2). Meristic and morphometric measurements were performed on digital images of the redfish. The objective of the study was to confirm the hypothesis of depth segregation of the two morphologically different pelagic forms of *S. mentella* in the Irminger Sea and adjacent waters.

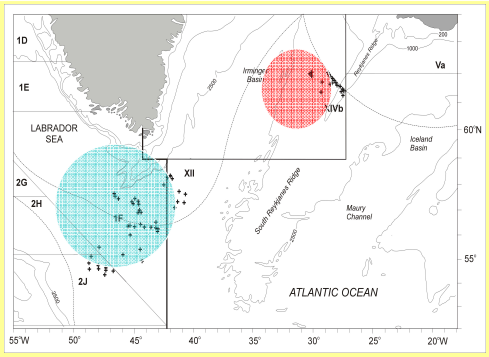

Fig. 1. Research areas.
•(blue): SW region - catches were conducted below 500m depth;
•(red): NE region – catches were conducted above 500m depth

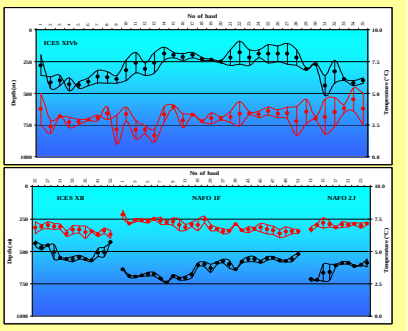

Fig. 2. Mean depth of trawl and mean water temperature at depth during redfish catches in different areas in 2004 (upper) and 2005 (lower).

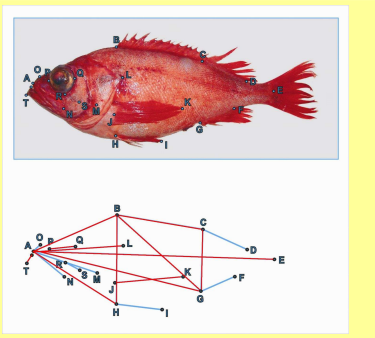

Fig. 3. Measurement scheme for redfish morphologic characters.
(***significant differences in relation to depth marked with red lines***)

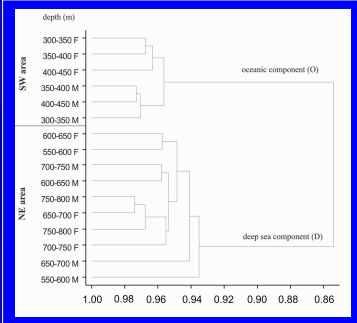

Fig. 4. Dendrogram obtained from the Cluster Analysis of mean values of morphometric and meristic characters measured in redfish by depth and sex (F – females, M – males).

Morphometric-meristic characteristics of the pelagic redfish (*Sebastes mentella*).

The general linear model (GLM) indicated that 12 out of the 20 characters tested exhibited the highest significance level of the differences in relation to the depth (red lines on Fig. 3). The majority of characters differed with sex of fish, which indicates sexual dimorphism. The results of the Mann-Whitney and Kolmogorov-Smirnov tests indicated that among the 7 meristic counts analyzed, statistical significance related to the depth were confirmed for only 4.

The classification of the individual fish to a particular stock component was based on Cluster Analysis, Principal Components Analysis and Discriminant Analysis.

The Cluster Analysis detected two distinct groups within our samples:
1 – fish caught in shallower water (300 – 450 m) – "oceanic" component;
2 – fish caught in deep water (550 – 800 m) –" deep sea" component.

Within these two groups possible sex-subgroups could be established, especially in the group of "oceanic" component (Fig. 4). The results indicate that the "oceanic" component is a more homogeneous group cluster than the "deep sea" component.

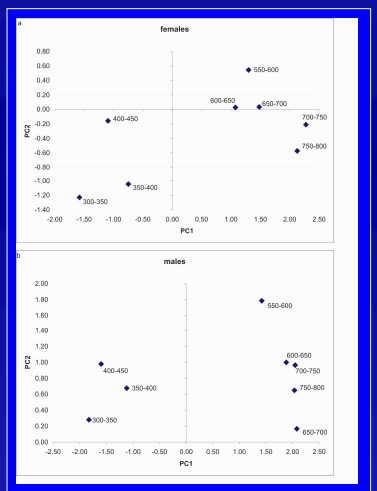

Fig. 5. Ordination of samples using PCA: centroids (average scores) for catch depth of females (a) and males (b) redfish.

Percent of variance explained:
PC1 34%
PC2 14%
PC3 8%

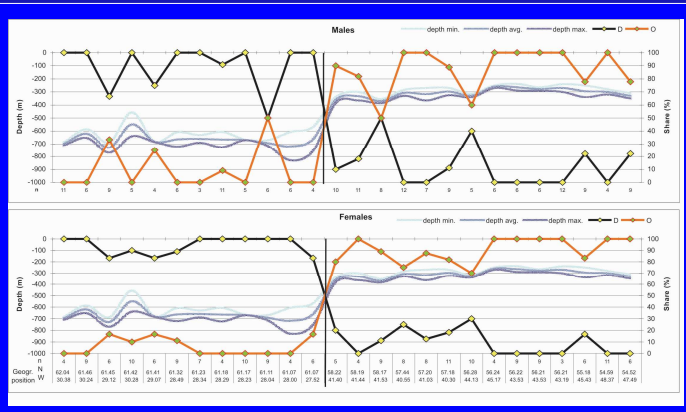

Fig. 6. The share of deep-sea and oceanic redfish stock components in different areas. The stations are plotted from north (left) to south (right) in the Irminger Sea.

These results were confirmed by Principal Component Analysis, which revealed separation of samples into two groups of catch depth (Fig 5).
The results obtained in Discriminant Analysis indicate that the highest share of the redfish "deep sea" component (D) was in the northeastern area (Reykjanes Ridge - NEAFC XIVb), to which 94% of the females and nearly 90% of the males were allocated.

In the southwestern area (NEAFC XII, NAFO 1F and 2J) the "oceanic" (O) redfish component dominated. Its share in the various sub-areas fluctuated from 84 to 100% for females and from 84 to 91% for males.

The analysis of individual hauls in terms of geographical position and trawling depth indicated distinctly the different share of pelagic components of the S. mentella stock in the investigated areas (Fig. 6). The analysis of data also indicated that in hauls in which both stock components occurred the minority component was not always represented by both sexes.

Among the "oceanic" components in the northeastern area, the percentage share of males (62%) was higher than females. A similar phenomenon can be observed in the southwestern area where the male component of the deep sea redfish is more numerous (56%) than that of the female component (Fig. 6). It can be concluded that male redfish are more mobile than the females.

The research results indicate that in the northeastern fishing grounds in waters below 500 m the "oceanic" (O) component of *S. mentella* occurred with only a small share (8.1%), while in the southwestern area in waters above 500 m, the deep water (D) component of S. mentella occurred with a small but slightly higher share (11.5%).

Conclusion

Our results, based on studies of commercial catches in the North Atlantic in two areas, confirmed earlier observations, which is quite important for the management of the two components of this population. The results from the current work support the ICES conclusion that there are two biological pelagic stocks inhabiting the Irminger Sea, and the management units currently used as geographic proxies for these stocks.