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Definition of Mackerel Stocks at the West Coast
of Africa by a Serological Method

by

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The mackerel Scomber colias (G.) is an important fish of the trawl fishery in the shelf waters of the Atlantic ocean at the coast of West Africa. Major concentrations of mackerel were recorded at the coast of Senegal and in the Gulf of Guinea near Abidjan-Takoradi. Investigations carried out in these regions during the winter/spring period 1960-62 showed that distinct differences exist between the stocks of mackerel with regard to several biological and ecological indices. In the region of Senegal a regular sequence of size composition was recorded from February/March (M mean = 33.00 cm) to May/June (M mean = 24.00 cm). In March 1961 mackerel with a length of 29 - 43 cm were at maturity stage 4 having maturity indices of 8 - 9. Mature mackerel were observed here in other seasons too (November/December and May). At the same time in the region of the Gulf of Guinea during the winter/spring period only small mackerel of 24 - 26 cm were recorded, the number of larger fish of this series tending to decrease from winter to summer. 95% of mackerel were in maturity stage 2 having maturity indices 0.5 - 1.3.

No spawning of mackerel was observed in the region of the coast of Ghana. In the course of the investigations carried out in this region for more than 6 months no fish were encountered having gonads in stages of maturity near to spawning. It is supposed that at least a part of the stock migrate from the Gulf of Guinea region to the region of Senegal - Rio de Oro. Since marking of mackerel presents many difficulties especially in this region we had to resort to indirect indices to ascertain whether mackerel of different regions belong to one or to several genetic groups.

Using material free from age variability a morphological comparison was carried out of many characters of mackerel from all these regions. A statistical analysis of this material revealed definite differences for each character. Since very small distinctions are observed in mackerel even on a genetic level (Zambriborschch, 1955) these data cannot be fully relied on in forming a judgement on the local or inter-mixed natura of mackerel stocks from the above regions.

In addition to the morphologic characters, determinations of the rate of growth of mackerel from different parts of the coast of Senegal, Gulf of Guinea and Cape Frio (South-Western Africa) were made. Significant differences were found to exist between the mackerels of all the three regions (Table 1).

Table 1

Region Age	Mean body length (according to Smith) corresponding to a definite age (in cm)				
	1	2	3	4	5
Coast of Senegal	20.40	25.00	29.75	34.00	-
Gulf of Guinea	17.02	20.85	23.72	25.80	-
Cape Frio	20.75	29.14	38.24	46.50	53.10

Owing to the difficulty in determining the age of tropical fishes and, hence, the dubiousness of the data of back calculations, this indice was considered as complementary, and a more objective criterion was used as the basis of the analysis of these differences, i.e., the degree of commonness of antigens in mackerel from different parts of the west coast of Africa. The reliability of this indice has been proved by several authors (Taliev, 1941, 1946; Altuckov & Apekin, 1963; Saks &

Sokolova, 1961; Ridgway, Clontz, Matsumoto, 1950 and others). The material was collected and worked up by the described comparative immunological method (Taliev, 1940; Saks & Sokolova, 1961; Boyden, 1926, 1958 and others).

Polivalent samples of the dorsal muscle tissue of mackerel were homogenised and extracted with saline solution (0.85% solution of NaCl) during 72 hours in the cold. To avoid protein denaturation a merthiolate solution (concentration 1:10000) was used for fixation. After centrifugation and filtration the extracts were kept in the cold. Immunisations of rabbits were carried out during three weeks. The rabbits were immunised intravenously (protein content 1 mg/ml) with a simultaneous subcutaneous injection of adjuvant.

The obtained antisera were used in the reaction of ring-precipitation and precipitation in agar. Eight antisera were compared in the reactions (two to each antigen of mackerel from Senegal, Gulf of Guinea, Cape Frio and the Black Sea mackerel Scomber scombrus (L.) a different genus).

On the other hand, not only antigens against which were obtained antisera, but doubles too were used in the reactions. On the summary diagram (Figure 1) mean values of the intensity of the ring-precipitation reaction for antisera N 13 and N 13-II (double) (against the Gulf of Guinea antigen of mackerel) are given. The diagram shows the relation between the values of the antigen dilution and the time of the appearance of the precipitation ring. The extreme upper line shows the course of the homologous reaction (antiserum 13 and antigen 13); below are curves of the reaction with antigens of mackerel from Senegal (13-3) and Cape Frio (13-7). For comparison of the intensity of reaction in closely related forms of mackerel a curve showing the course of reaction of antiserum and antigen of Scomber scombrus (L.) (13 - 27) is given.

The difference of the homologous (13-13) and heterologous (13-3) and (13-7) reactions (almost double) on the background of the profound difference with the antigen of Scomber scombrus (L.) forms in our opinion a convincing evidence of the definite serological differences between the investigated forms probably on a sub-species or even lower level.

More than 2000 cross reactions of precipitation in agar were carried out besides the ring precipitation. Two of these are shown in Figures 2 and 3.

Both the first cross reaction of two antisera (13 and 3) with two different antigens (13 and 3) and the second detitrating reaction with the same antigens demonstrate clearly the serological heterogeneity of the investigated forms and corroborate the results of the reaction of the ring precipitation.

Summing up the results of the immunological comparison of mackerel from different parts of the West African coast it may be said that their antigen heterogeneity, established both in the reaction of ring precipitation and in the reaction of precipitation in agar, seems to indicate a definite genetic inadequacy. This is a very important point when analysing the distribution, locality and migrations of the stocks of mackerel at the West Coast of Africa

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