For the attention of Dr. D. Møller

Mr. Chairman, ladies and gentlemen,

Although I sincerely deplore that I have to inform you that the author of the first paper in this introductory session, Dr. Møller, cannot be here to-day, I consider it both an honour and a pleasure to read his contribution entitled - "Concepts used in the biochemical and serological identification of fish stocks".

I may, however, say a few introductory words. Dr. Møller announced and prepared his paper as a contribution for a general discussion, stating the point of view of a population geneticist. In presenting his thoughts now in the introductory session of this meeting, I think it may be of interest, and entirely in agreement with Dr. Møller's intentions, to present his view point side to side with the concepts of identification of the "unit stocks", involved in fisheries management, in order to verify if fisheries biologists, and we, serologists, are speaking the same language.

To do this I will precede the thoughts presented by Dr. Møller, by citing for you part of the report prepared by Mr. Parrish in 1963 on request of the Advisory Committee on Marine Resources Research that outlined the concepts of the "unit stocks", involved in fisheries managements, the problems of their identification by the "classical" methods of Fisheries biology, and envisaged the application of serological and biochemical methods.

I may cite now from Mr. Parrish's report, entitled "Notes on the identification of sub-populations of fish by serological and biochemical methods", that was distributed in 1964 as F.A.O. Fisheries technical paper, No. 30, the formulation of the concept of the "basic" population sub-division in fisheries assessment work, as stated/ The main features of this concept are the following:

> '.... a unit stock may be considered as a relatively homogeneous and self-contained population, whose losses by emigration and accessions by immigration, if any, are negligible in relation to the rates of growth and mortality...'

As stated by Mr. Parrish:
'It is clear that the range of possible biological situations satisfying this definition is very wide and varies greatly for different species of fish'.

However, for most species the following two main categories of "unit stocks" may be distinguished:

> ' (a) Geographically isolated groups which are prevented from mixing freely and interbreeding with members of neighbouring groups by migration barriers.
>
> (b) Reproductively isolated groups, inhabiting the same general locality, which occur and are exploited together during part (or all) of their life cycles, and which possess different vital statistics.

The first of these categories are sometimes very well defined ecologically, as when, for example, a demersal species is split into stocks on oceanic banks, separated from one another by depth or "water type" barriers. The second category however presents greater difficulties, especially amongst some of the pelagic species (e.g. herrings, sardines, tunas, mackerels and salmonids), the populations of which are known to be subdivided into "stocks", but the distributions of each of which often overlap during a large part of their lives, and between the members of which there are no easily recognisable morphological differences.'

/ at the joint ICNAF/ICES/FAO Scientific Workshop in Lisbon, in 1957.

The methods of investigation that I, in my introduction have referred to as the "classical" methods were differentiated by Mr. Parrish into the following two main categories:-

' (a) "Direct" studies of the distribution, movements, age and size composition, ecology and dynamics of the population throughout its range (e.g. tagging, experimental and exploratory fishing, egg and larval surveys, etc.).

(b) "Indirect" studies of the differences between measurable morphological and physiological characters of individuals within the population.'

The progress made in using these approaches 'in identifying major subdivisions within, for example, the north-east Atlantic herring, the Pacific sardine and the North Atlantic cod populations, has fully justified the approach. However, with these and other species it has failed to provide sufficiently clear evidence of further possible subdivisions within each of the major ones, or of the rates of mixing of individuals of different groups outside the spawning season and their interbreeding rates (if any). The reasons for this stem largely from the fact that:

(a) The statistical distributions of most of the characters of different sub-groups within a population are very similar. Therefore, it is seldom possible for them to be used as labels for individual fish and analyses of them have to be made, statistically, on large samples.

(b) Most of the morphological and physiological characters exhibit plasticity under the influence of environmental factors, and their values may therefore differ significantly between year classes, or local groups within an otherwise homogeneous stock.

(c) Because of their environmental plasticity, no obvious genetic or evolutionary significance, and hence permanente, can usually be attached to the observed differences between the group values.'

As concluded by Mr. Parrish it was for these reasons that fishery biologists have turned their attention to the search for new characters more closely linked with the genotype and less subject to phenotypic variations.

I will now proceed by presenting to you the concepts and criteria of the biochemical and serological studies of fish stocks as given by Dr. Møller.

It is proposed by Dr. Møller that in discussing the identification of "unit"stocks involved in fisheries assessment, use be made of the term 'population', defined by Dobzhansky in 1951, as a 'reproductive community of individuals which share in a common gene pool.'

This definition of population satisfies the unit stock concept used in fisheries research in underlining the most important factor in maintenance of the system, the common gene pool. The definition is fairly theoretical, and the existence of plain gene pools may be doubted. However, the term expresses clearly what we are trying to identify.

Having defined the identification of fish stocks as an identification of gene pools, it is, in practice, an identification of genetic characters and determinations of the frequency of these characters in different localities.

If the research is successful, the characters must be proved genetically, either by breeding and rearing individuals or by application of the Hardy-Weinberg law. Exceptions in the heredity of a character may be detected if the frequency of the character shows the same trait in population studies as non-genetic characters like length, sex, etc. of the specimens. The amount of necessary data should be large enough to show statistical significance.

It will be an advantage if the character could be reproduced by other scientists. This will be possible when the character used is clearly defined and all methods are reported clearly and in detail.

Difference between two stocks is proved if the difference between the frequencies of the same genetic character in the two stocks is statistically significant. However, before applying the result as a base for fishery regulations, the difference should have been shown two or three times in different seasons.

It may be strongly recommended that characteristics from more than one system are used. Two to three independent genetic systems should be a minimum in identification of stocks. The number of genetic systems, however, is of course dependent on their complexity, in casu the number of alleles involved.

Similarity in values of frequencies of one or more characters in two stocks does not prove similarity between the stocks. A strong indication of similarity between stocks, however, may be said to be present when four to five frequencies of different characters from different systems show the same values.

As stated by Dr. Møller in the final paragraph of his paper the concepts and criteria he has presented do not give a full coverage of the subject. It is hoped however, that this report may be a starting point for the further discussions throughout this meeting.