Concepts used in the biochemical and serological identification of fish stocks

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Introduction

The significance of the biochemical and serological identification of fish stocks, beyond the general biological value, is based upon the information this research can give to the population dynamics. In the book of Beverton and Holt (1957) "On the dynamics of exploited fish populations", the population is described "as a self-maintaining open system, exchanging materials with the environment and usually tending to a steady state". They do not clarify, however, the characteristics of this system according to other systems or the limits of their mathematical model. The goal in identification of fish stocks, therefore, would be to identify the group of individuals which appear to correspond most closely to this theoretical model.

Only a few of the exploited fish populations is within the boundaries of one country. It is therefore of importance both for understanding between individual scientists and for the rational basis for internationally agreed fishery regulations that the scientists from the different countries concerned with the identification of fish stocks, use the same concepts, the same definitions of these concepts, and explore the matter along the same lines.

Concepts

The population as conceived by Beverton and Holt (1957) tends to be defined on the basis of phenotypic characters which reflect the interaction between the genotype and the environment. The biochemical and serological identification of fish stocks are concerned with the genotype. The environmental effects are therefore irrelevant and must be ignored or eliminated.

The concepts that the identification of stocks must come not from fishery research, but from the modern biological theory as initiated in the new systematics. My proposals are therefore founded on this literature. However, instead of referring to all the different reports in this field, I have tried to simplify by using the works of Dobzhansky (1951) and Mayr (1963) only. I also have reduced the number of concepts. The terms mentioned represent an absolute minimum of the concepts which should be in use by scientists working in the fish stocks identification field on the international level.

Many kinds of terminology are in use today, and it is unlikely that complete agreement on terminology problems will be reached in the foreseeable future. Other terminologies than those mentioned here, have been established. However, it should be possible to obtain the same meaning of the well known words "population", "species", and "stock".

Proposal: Population is "a reproductive community of individuals which share in a common gene pool" (Dobzhansky, 1951).

Population is used in many fields and in each field with a particular meaning. I like to use the same term in the field of identification of stocks too, because the term by itself expresses the unit in research dealing with groups of individuals.

A characteristic for the population, as defined by Beverton and Holt (1957) is that the individuals are formed by the same genetic constitution. The definition of population satisfies the unit population in population dynamics with an underlining of the most important factor in maintenance of the system, the common gene pool. The definition is fairly theoretical, and I doubt the existence of plain gene pools. However, the term expresses clearly what we are trying to identify.

Proposal: Species is "groups of actually or potentially interbreeding natural populations which are reproductively isolated from other such groups" (Mayr, 1940) or, similarly, are "groups of populations the gene exchange between which is limited or prevented in nature by one, or by a combination of several, reproductive isolating mechanisms" (Dobzhansky, 1951).

The definition of species is approved commonly by biologists today. The term contains two concepts, interbreeding by the individuals and reproductive isolation between the group and other groups of individuals. This infers that the term is clearly different from the typological species concept.

Proposal: Stock is a group of individuals found together in the same particular area and subjected to a particular fishery.

According to Webster's dictionary the meaning of stock could correspond to a strain, race, or other related group of animals or plants. In fisheries the term is commonly used in fishery management, and in this connection the term does not necessarily refer to any relationship among the individuals. It can, therefore, refer to aggregation of individuals from one or from more than one population. The stock limits are defined by more or less arbitrary geographical borders operating at certain times of the year.

Identification of fish stocks

~~Biochemi~~

The identification of fish stocks is an identification of gene pools. In practice this is an identification of genetic characters with determinations of the frequency of ~~these characters~~ in different localities.

If the research is successful, the ~~character~~s must be proved genetically, either by breeding and rearing individuals or by the Hardy-Weinberg law. An exception in the ~~heredity~~ of a character can be ~~proved~~ by the frequency of the character ~~when this frequency~~ shows the same ~~trait~~ in populations ~~studies~~ as other genetic characters. The amount of ~~necessary~~ data should be large enough to show statistical significance.

It ~~also will be~~ an advantage if the character could be ~~reproduced~~ by other scientists. That is, that one knows which kind of character one is using, and that all methods are reported clearly and in detail.

Proved difference between two stocks is shown if the difference between values of frequencies of the same ~~genetic~~ character in the two stocks is statistically significant. However, ~~by applying the result~~ as a base for fishery regulations, the difference should be apparent two or three times in different seasons. The difference does not show that the stocks belong to different species. ~~By definition~~ one has then to ~~show~~ that the stocks are reproductively isolated from each other.

~~I strongly~~ recommend ~~the use of~~ more than characteristics from one system. ~~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 the complexity of the systems ~~which are in use~~.

Similarity in values of frequencies ~~of one or more characters~~ in two stocks do not prove ~~similarity between the stocks~~. A strong indication of similarity between stocks, however, can probably be said to ~~be present~~ when ~~four to~~ five frequencies of different characters from different systems have the same values (~~unequal~~) in ~~the~~ stocks.

This paper is probably too short to give full coverage ~~of the~~ subject. I do not expect it to cover all the different aspects which are present in an identification of fish stocks. I hope, ~~however~~, the report could form some sort of base or starting point in a discussion which could end with some sort of a recommendation for future workers in this field.

Literature

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