Fish Population Dynamics

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MODELS

- A description of a fishery consists of three basic elements:
- 1) the **input** (the fishing effort, e.g. the number of fishing days)
- 2) the **output** (the fish landed) and
- 3) the **processes** which link input and output (the biological processes and the fishing operations)

- Fish stock assessment aims at describing those processes, the link between input and output and the tools used for that are called "*models*". A model is a simplified description of the links between input data and output data. It consists of a series of instructions on how to perform calculations and it is constructed on the basis of what we can observe or measure, such as for example fishing effort and landings.

- The actual processes which go from a certain number of days fishing with a certain number of boats to a certain number of fish being landed are extremely complicated. However, the basic principles are usually well understood, so that by processing the input data by aid of models we can predict the output.

- A model is a good one if it can predict the output with a reasonable precision. However, since it is a simplification of reality it will rarely (and only by chance) be exact.

- The instructions for the calculations that make up the model are given in the form of mathematical equations. These are composed of three elements: "*variables*", "*parameters*" and "*operators*". For example, the mathematical equation:

- y = 2.5 + 3*x

- has the variables y and x, the parameters 2.5 and 3 and the operators "+" and "*" The equation is used to predict the value of y for some value of x.

GENERAL PROCEDURE OF FISH STOCK ASSESSMENT

INPUT: FISHERIES DATA (+ ASSUMPTIONS)

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PROCESS: Analyses of historical data

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OUTPUT: ESTIMATES OF GROWTH AND MORTALITY PARAMETERS
INPUT:

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⇓

PROCESS: Predictions of yield for a range of
alternative exploitation levels

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OUTPUT: OPTIMUM FISHING LEVEL
MAXIMUM SUSTAINABLE YIELD

- Two main groups of fish stock assessment models are covered in this manual: "*holistic models*" and "*analytical models*". The simple holistic models use fewer population parameters than the analytical models. They consider a fish stock as a homogeneous biomass and do not take into account, for example, the length or age-structure of the stock. The analytical models are based on a more detailed description of the stock and they are more demanding in terms of quality and quantity of the input data. On the other hand, as a compensation, they are also believed to give more reliable predictions.

- The type of model to be used depends on the quality and quantity of input data. If data are available for an advanced analytical model then such a model should be used, while the simple models should be reserved for situations when data are limited. We are often in the situation where a complete set of input data for an analytical approach is not available, but where the available data exceed the demand of the simple models. As an alternative to using simple models in this case, the lacking input data can be replaced by assumptions or qualified guesswork. Often, the lacking parameter for a particular stock can be replaced by known parameters from another, similar stock.