LECTURE NOTE ON FIS 318

FIS 318: FISHERIES STOCK ASSESSMENT (2 UNITS)

This Cours e is taught by three (3) lecturers: Dr I.T Omoniyi, Dr W.O. Abdul and Dr (Mrs.) N. B Ikenweiwe.

The Course Synopsis is further outlined on lecture basis as follows:

Lecture 1: Brief definition of fish stock assessment

Lectures 2-3: Methods/Techniques of stock management in fisheries

Lectures 4-6: Estimation of Population number in fisheries (Mark-recapture, Catch per unit effort, direct enumeration)

Lectures 7-8: Marking and   Tagging

Lectures 9-10: Age and growth determination

Lectures 11-12: Echo method in stock assessment

INTRODUCTION TO FISH STOCK ASESSMENT

Briefly, a fish stock assessment is an evaluation of the state of the stock as relating to changes in the abundance or composition of the stock to changes in the amount of fishing. It involves the use of theories, laws, models and methods propagated by various scientists. There are two general approaches used which are:

The population model (typified by works of Schaefer, 1954, 1957) in which the stock is treated as a single entity subject to simple laws of population growth and the Analytic

approach (typified by works of Ricker, (1958, 1975) which considers the abundance of the population as determined by the net effect of the growth, reproduction and mortality of individual members of the stock.

Stock assessment has been in use for over a century in temperate countries to evaluate fisheries resources in their waters while it is a relatively recent application in the tropical waters. Nowadays, stock assessment has been enhanced by the use of special computer software packages to solve problems associated with fisheries management.

The basic purpose/use of stock assessment is to provide information or advice on the optimum exploitation, utilization and conservation of the fish (as resources) living in water. It involves conducting research work into knowledge of biological characteristics of particular fish species, taking length and weight frequencies, its reproductive biology, food and feeding habits, the age and growth parameters and other conditions of the fish in relation to its aquatic environment. Stock assessment is used to know maximum sustainable yield (MSY), fish mortality, the input and output into the fisheries. The various environmental changes as they affect biological and physical features of a fish species, family or the group need to be assessed by using a model for its stock assessment. To conduct fish assessment study, a scientist embarks on investigation involving a Survey. Firstly, the site must be defined whether it is a marine or freshwater environment or whether it is a small or large water body. The survey could be a Research or Commercial survey.

Research survey involves a detailed investigation of the fish based on the objectives. It involves taking the bio-data of the fish (length, weight, sex etc), the food of the fish including the percentage composition. Other factors include the environmental features such as time, weather, position of catch, physico-chemical parameters of the water body. Commercial

survey involves taking note of basic and important information of commercial usefulness e.g length-weight frequencies, percentage composition etc which are strictly for economic purpose. For example as it is done by fishing companies. This survey is biased because most vital information are either missing or deliberately not investigated e.g most commercial data are devoid of information on actual composition landing and position. It is believed that such information may be used as indication of taxation and to avoid rivalry with other fishing companies.

The data collection depends on the size of water body. If it is a small pond, total cropping can be done which involves the removal of all the fish in the water. But for a large water body e.g lakes, reservoirs, randomized samplings can be carried out which involve taking samples in random locations.

METHODS/TECHNIQUES OF STOCK MANAGEMENT IN FISHERIES

Usually, a scientist needs to have the problems of management in mind when carrying out an appraisal of a fishery stock and in presenting the results. There are three aspects of management to be considered:

- The type of objectives i.e what ultimately is to be achieved
- Choice of the policies (what characteristic of the fishery are to be altered and to what value)
- The techniques (what practical form the regulations should take)

The basic objectives in managing a fishery resource include the general social and economic objectives e.g as more food, a better living for the individual fishermen, more employment and a more pleasant environment and fishing as a sport especially as noted in rich countries.

However, these diverse objectives are not easily realized. For instance, the total supply of food is unlikely to be obtained by taking the maximum possible yield from a stock but by using appreciably less effort, accepting some reduction in yield from the stock and using the effort and resources saved to produce a more than equivalent increase in yield from some other less heavily exploited fishery.

To fulfill these objectives, a desired situation is brought about by a variety of techniques of regulations which include:

- Closed area and closed seasons

- Limitation of total catch

- Limitation of the total amount of fishing (i.e amount of gears used or length of time they are in use)

- Restrictions on types of gears used

- Restrictions on the sizes of fishes that are landed.

Attend classes for full discussion on each of the above techniques of regulation in fisheries management.

For example, size limits. Limiting the size of fishes retained is one of the oldest of all regulations applied to fisheries. This involves returning captured individuals smaller than a prescribed minimum size to the water body. Restriction of gear sizes theoretically achieve the same goal as size limits but prevents the fish being caught in the first instance.

Traditionally, the reason for the application of a size limited is to prevent the marketing of fish considered too small and to allow individual fish to spawn before being caught. This reason is related to growth rate over fishing and whether or not size limits are effective in this

respect. It depends on the growth and mortality rates of the target species. If the growth rates are relatively high to mortality, then the economical value of the catch may be increased by delaying the size at capture. Also, closely associated with this method of management is rejection of spawning females. This needs to be considered in stock recruitment relationship because of the biological benefits of the females in fast growing species with high fecundity. Note that this regulation of protecting female only be applied sensibly to species in which the sexes can be distinguished easily by fishers and for which catching method does not harm the individual caught. Since it is not easy to determine sex of most fish by external examination, this method achieves a better result if the application of closed season during spawning period is considered along or as an alternative.

Attend lecture hours to enjoy the critical review/discussion on other techniques at managing fisheries resources.

AGE AND GROWTH IN FISHES

Age is defined as duration of existence measured in seconds, minutes, hours or years. Age data in conjunction with length and weight measurement can give information on stock composition, length at maturity, life span, mortality rate. The knowledge of age and length provides growth pattern in a given population. Age in fish species is usually determined by interpretation and counting of growth checks or growth zones which appear on the hard parts of the fish. When such zones or checks are formed once a year they are known by various names-year marks, annual rings, annual marks, annuli (annulus-singular). These growth zones/checks are formed during alternative period of fast and slow growth or period of no growth at all. Such growth zones reflect changes in environmental and internal factors.

In temperate region of the World, the period of little or no growth usually occurs in a year beginning in winter and extending to spring or early summer. A general rule which may apply is that the more widely the seasons differ with respect to temperature, the more sharply the annual marks/checks may be indicated. In the tropics, marked variations in temperatures do not occur during the year. Therefore tropical fishes exhibit a continuous growth throughout the year, nonetheless, growth marks have been shown to form on the hard parts of many tropical fishes.

Methods used in determining the age of fish

Ages of fishes can be determined either directly or indirectly. In the direct method, growth marks present on the hard parts are interpreted to provide information on the ages of different fishes. Hard parts used include:

Scales

Otoliths

Opercula bones

Vertebrae

Spines

Attend class on the discussion of each hard part to determine age of fishes.

In an analysis of age and growth, an unbiased sample of the fish population is required. Such sample must indicate date of capture, the gear used and place of catch. Sample is then subjected to a length and weight analysis. The sex and stage of gonads are recorded. The material to be used for age determination is extracted. From the data, the growth in relation to many factors e.g sex can be determined to understand growth pattern between sexes.

Age of fish can be determined by length-frequency distribution as used by Peterson. It is called Peterson method where standard length of each fish is taken. When a large sample is available, a frequency distribution is made and the modes obtained give the age distribution/year-class. The method gives uni-modal sizes distribution to depict all fish of same age group. The method can be easily used if there is no large overlap in the size of individuals of the adjacent age group. In general term, the method is quite useful but suffers from restriction to a short period of the year.

Illustrate during lecture hours.

Growth is defined as a phenomenon of the end product of a net balance between anabolic and catabolic processes going on within the body of an organism. It results in increase in cell differentiation, tissue multiplication and general increase in biomass. It is expressed physically as an increase in length, size, weight etc. Growth rate can be positive or negative. There are many methods used in fisheries growth studies. These include:

i Direct observation

ii By tagging and marking, both of which are direct methods of measuring fish growth.

iii. Back calculation is an indirect method.

Discussions on all these methods would be made during lecture hours. You are not studying in the University through correspondence. Attend classes regularly and punctually.

Dr. I .T Omoniyi