

Sampling for Collection of Biological Data

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Introduction

In Fisheries Science the word stock is defined as a sub-set of one species having the same growth and mortality parameters, and inhabiting a particular geographical area. Most of the parameters in the stock assessment cannot be obtained or measured throughout the whole population. In fish population studies, it is impossible to measure the whole population and also the fish caught. Hence a sample of the population is collected assuming that a reasonable estimate can be obtained of the true value of the sample population. Random sampling can be defined as a sampling from a population where each entry has an equal chance of being drawn. In practical terms this means that any fish from the stock under investigation have the same probability of being sampled. Care should be taken to sample from a mixed or unsorted catch of commercial landing.

Field sampling

Fish landing centres provide a landing ground for a variety of crafts. The gear combination like mechanised trawl nets from multiday and single day operations, mechanised purse seines, mechanised drift gillnets, mechanised hook and lines, outboard hook and lines, outboard ring seines and non-mechanised sectors. Sampling was done at weekly intervals from as far as possible and if not and at fortnightly intervals. On each sampling day the units to be sampled were selected following Alagaraja (1984) and from each of the vessels sampled, information on depth, mesh size, catch etc. were collected.

Area of the trawling operation

•by enquiry

Depth of trawling

•by enquiry

Mesh size of the cod end of trawl net used

•by direct observation

The total fish catch

•by observation

The sampling strategy for species composition and body is to be designed to take into account the differences arising out of sorting the catch on board, depth and area of fishing. Catch sampling is carried out at the landing centre and care should be taken to avoid 'bias' affecting the sampling. Regarding the size of the 'sub-sample' it should be 1-2 kg from smaller fishes, 4-5 kg for medium sized fishes and 6-9 kg for bigger fishes. From each unit collect a random sample and place in a plastic bag, note down the total catch of fish in the boat. Using the raising factor the abundance of the different species in the catch can be calculated. Total length (TL) has to be taken at the landing centre using the measuring board and individual total weight (w) is collected using portable balance. Also record all the additional information i.e. total catch, mesh size, number of hauls, hooks and any other significant observation on weather and social issues.

Sampling from the landing centre can be performed directly and the routine length frequency and weight of the data can be collected for population analysis studies. The sampling for the inshore gears will allow to gather information on the temporal patterns of the population structure of same species in shallow coastal waters and an impact of such gear on them.

Laboratory analysis

Fish samples collected from the lading centre are kept in the ice box in separate bags have to be analysed as soon as possible in the same day. Individual total length (TL) measurements from tip of the snout to tips of the largest caudal fin rays are made with the fish placed on its right side, snout to the left on the measuring board. Note down the weight of the fish. Cut open the fish and examine sex and stage of fish. If difficulty arises to do the sex, examine the gonads using lens or dissection microscope. Then the different stages of sexual maturity have to be identified. It is possible to collect more data from the individual fish such as otolith, gonad weight, individual body weight and egg numbers and ova diameter frequency.

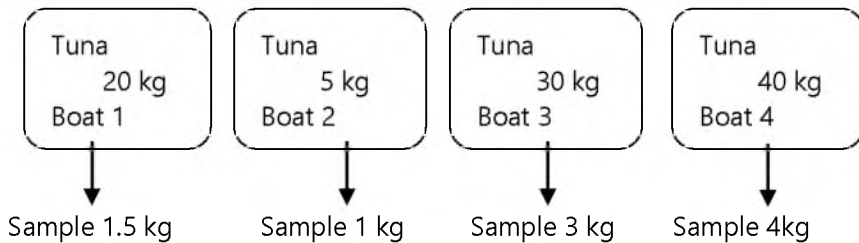
Analysis of fish samples: In the laboratory thaw and sort the samples by species. Take weight of each species in each plastic bag and raise to the estimated catch of species in the boat sampled. Take data on length on each species in each bag and weigh to the total catch of the above species in the boat. Then estimate weights of each species in the different boats sampled and pool and raise to the total catch of species for the day. Similarly the estimate length composition of the catch of each species from different boats and pool and raise to the total catch of the species estimated on the day. The data on species composition and length composition collected on each observation day were weighted respectively to the estimated total catch of the group and species obtained on that day and pooled and then raised to the estimated catch of the month.

Total catch weight: The estimated weight of the total catch obtained during that day by the sampled fishing unit.

Sample weight: Is the weight of the unsorted sample, all species mixed.

Sample species weight: Is the weight in the sample made by that species alone. It means the summation of the length groups of total weight.

Scheme of sampling of species illustrated



For studies on species composition of tuna and length composition, each species in each sample were first weighted to the total catch of tuna in the boat. Thus from the above example, from the 1.5 kg of species collected from Boat 1 containing 20 kg of tuna, the weight of each species in the sample is first raised proportionately to 20 kg. When each sample is thus raised to the catch of the boat the total tuna catch of the 4 boats are added up (i.e. $20+5+30+40=95$ kg) and the species composition and length composition of each boat is also added up to get the consolidated estimate in the 4 boats (95 kg) sampled. The consolidated tuna catch of the boat is raised to the day's catch and the consolidated species and length composition of the four boats are also raised to the day's catch to get the estimate for the day.

Maturation studies

After measuring the length and weight of each specimen, the belly was cut open to note the sex, colour and general appearance of the gonads, which were then carefully removed and preserve in 5% formalin, in labelled bottles. If the spawning is synchronous in the population, the studies on the maturation and spawning were carried out mainly on the basis of the ovaries otherwise the development of male gonads was also to be carried out separately.

i. Quantification of ovaries into different stages of maturation: Examine the appearance of the ovaries in fresh condition and note down the proportion of the area occupied by them in the body cavity. The structure and diameter range of the intraovarian ova were considered for quantification of ovaries into different stages of maturation.

ii. Ova diameter frequency distribution: For measurement of ova diameters, take transverse sections from the anterior, middle and posterior regions of the ovary, then tease ova out on micro slides taking utmost care to separate out all the ova in the samples. Observe ova

diameter under the microscope, using an ocular micrometer, at a set magnification where, one micrometer division equals XXX mm. Measure the ova from the different regions of the ovary to see whether differences in the distribution of ova in different regions of the ovary occur.

In the immature ovaries in which the ova were minute and it is not possible to arrange them in rows; they were spread evenly on the slide and the diameters of the ova lying parallel to two horizontal guidelines on the slide were measured. In mature ovaries, samples for diameter measurements were taken after noting the total weight of the ovary and the sample weight. Arrange the ova diameters into groups by micrometer division (md) class intervals (i.e., 1-3, 4-6, 7-9 etc.) to determine the frequency distribution of ova in the ovary.

iii. Determination of length at first maturity: For determining the length at first maturity (L50), specimens with ovaries in stages IV and V of maturation have to be considered as mature and the proportion of such mature fish in each length group determined. The length at which about 50% of the fish are mature, has been taken as the L50. As almost all the adult fish during the spawning season (or at least peak spawning season) are expected to be in mature stage, it is desirable to consider representative samples collected during this period for this purpose to eliminate the possibility of growth in length influencing the estimate of the length at first maturity. The following table tries to sum up the plan to be adopted during the course of scientific investigations and the type of data to be collected and the checklist to be prepared before venturing into such data collection.

iv. Spawning: The periodicity of spawning has been determined using the ova diameter frequency distribution in mature ovaries following Hickling and Rutenberg (1936) and De Jong (1940). The spawning period was determined using the data on maturation stages in different months and the months of occurrence of gravid fishes has been taken as the spawning period. For this purpose only fishes of and above the length at first maturity (L50) were considered as this would help in determining the peak spawning period more satisfactorily. The gonado-somatic index has also been studied for the purpose.

v. Fecundity: The estimated number of mature ova in ovaries represents the fecundity. (Total weight of ovary/weight of the sample) X Number of mature ova in the sample

Data records and files

Forms are the paper sheets used to the data either in the field or in the laboratory, whereas the tables are computer spreadsheets used for data input. First data collect in the forms and later input into the computer. The main purpose of the form is to make data collection work quicker and simple. This can be modified on the basis of experience gained during

the initial weeks of sampling and modifications and adjustments aim to make available form more user friendly and to avoid confusion (Form No.1 and Form No.2).

Data input tables

There are two main types of spreadsheets: table for L/F and weight data and tables for maintaining maturation stages. All the tables are containing mainly weekly data; it is likely that the analysis work will be carried out on monthly basis. Monthly summary tables are prepared. Fishery data includes landing data, fishing effort, in the form of number of boat, number of hauls and number of hours. Catch, effort and the ratio of catch per unit effort give the index of abundance of stock. In biological point of view effort as a measure of mortality caused by fishing effort as a measure of the abundance of diversity of fish stock. Sampling for a single rapidly determined measure (total length) for large number of species from the field.

Raising factor

The use of raising factors is very vital step in combining and analysing sample data. Unless the sampling system used is very simple, the length distribution of the fish measured will be difficult from the estimated distribution of the population being sampled. When several samples have been taken from a population, each giving an estimate depending on the raising factor used on the actual distribution of the sample. In the case of fish are sorted into fairly precise size categories, the most important information about the size distribution of fish in the landing as a whole is the record of the quantities landed of each category. Here more than one set of raising factors may be used.

It is often better to sample from the landing centre where the entire sampling procedure can be controlled directly. All the other types of sampling may knowingly or unknowingly will create bias data. Assuming that the length sampling is unbiased, then the bias can only be introduced it, for fish of a particular size, fish of certain ages are more likely to appear in age sample.

L/F data

The length data have to be group into 5/10 mm class intervals. Raise the data on length-frequency distribution of a sample to the estimated total catch of the species on the date of observation from each of the centres separately. Pool the estimated length-frequency distribution of all the sampling days and then raise to the estimated total catch of the species from each of the centres. Thus the length-frequency distribution in the estimated catch of a species from each of the two selected landing centres was obtained. It is this data that formed the basic input for analysis of von Bertalanffy growth parameters and to extract population parameters using the FISAT package.

File names

Care must be taken for naming data files as a huge amount of data will be collected. Naming of L/F, weight and sexual maturity data is illustrated below.

File name start with 2 letters of species name. It is followed by 1 number indicating the year (2000=1, 2001=2, 2003=3) by two numbers referring to the month (January=01, December=12) by two letters, the first letter to mean the kind of data (Length and weight data=L, sexual maturity stage data= S) and last letter is the state/place code (Kochi=K, Tuticorin=T, Mumbai=M).

<i>Sardinella longiceps</i>	SL
<i>Thunnus albacore</i>	TA
<i>Liza parsia</i>	LZ
<i>Epinephelus tauvina</i>	ET

Ex: L/F and w data of the *Sardinella longiceps* collected by the month of January 2000 from Kochi is SL101LK.

References

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- De Jong, J. K., 1940. A preliminary investigation of the spawning habits of some fishes of the Java Sea. Treubia, 17: 307-327.
- Hickling, C. F. and Rutenberg, E., 1936. The ovary as an indicator of the spawning period in fishes. J. mar. biol. Ass. UK., 21: 311-317.
- Sparre, P. and S. C.Venama. Introduction to tropical fish stock assessment .Part 1. Manual FAO Fisheries Technical Paper No.306.1, Rev.1 Rome, FAO, 376p.

Form 1- Collection of length data

Sample number		Date	
Species		Station	
Fishing vessel		Gear and mesh size	
Total catch (kg)		Sample (kg)	

Length (mm)

										Total								Total
20										50								
21										51								
22										52								
.										.								
.										.								
.										.								
48										78								
49										79								

Length group	No	Weight (g)
20-24		
25-29		
30-34		
.		
.		
75-79		

Form 2 - Collection of maturity data

Maturity sample

Length class (mm)	Immature (unidentified)		Female					Male					
	1	Total	2	3	4	5	Total	2	3	4	5	Total	
20-24													
25-29													
.													
.													
95-99													
100-104													
Total													
Observations:													