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Chapter on data collection methodology used in fisheries and  
aquaculture

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For inclusion in

Agricultural Production Estimation Methodology Manual

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## **1. Methodology for Estimating Aquaculture Production**

### **Introduction**

Fish production in fish farming is understood as fish harvest per unit area that is equivalent to amount of fish harvested per unit area of a pond or cage (i.e. tones per hectare) in one particular year (January to December). Parameters measured are basically two: total harvest of each species and area of fish pond or cage from where the fish was harvested. The yields (output per unit area) are calculated on annual basis.

### **Sample size and sampling method**

The basis of sampling in fish farming is through a household survey with a particular attention to selection of both villages and households in a given area, usually following jurisdiction of a Traditional Authority.

### ***Selection of villages for the survey***

Step 1: Select at least 5 villages from each Traditional Authority where aquaculture is being practiced. The list can be obtained from the DC or Development Facilitator or a District Fisheries Officer.

Step 2: Prepare a list of villages in alphabetical order (where the TA cuts across more than one EPA). Make sure that the villages are listed in order of the EPAs so that each EPA has villages selected. The villages should be only that are those involved in aquaculture.

Step 3: Divide the total number of villages by 5. The result will be  $n$ .

Step 4: Randomly pick a number ( $r$ ) in between 1 and  $n$ .

Step 5: The  $r^{\text{th}}$  village on the list becomes the first village to be sampled from the list.

Step 6: Select the next village by adding  $n$  to  $r$ .

Step 7: Continue selecting.

### ***Selection of households from the sampled Traditional Authority***

The data recorder should randomly select a minimum of 15 households per Traditional Authority using the following steps:

Step 1: With the assistance of the village head or other local leadership, prepare a list of households in the TA by gender or household head. The households should only be those engaged in aquaculture in fish ponds or cages. The District Fisheries Office can verify the list.

Step 2: Divide the total number of households by 15. The result shall be  $n$ .

Step 3: Randomly pick a number ( $r$ ) in between 1 and  $n$ .

Step 4: The  $r^{\text{th}}$  household on the list becomes the first to be sampled from the list.

Step 5: Select the next household by adding  $n$  to  $r$ .

Step 6: Continue to select the next  $n^{\text{th}}$  household until the required number of households has been reached.

### **Data collection method**

Use of tailor-made questionnaires is recommended for data collection. Data should be collected by interviewing knowledgeable members of the household (these should be household heads, husband, wife or older children). The survey should focus on area of ponds and total quantities of fish by species harvested from each pond. Where possible, the data forms can be distributed to the fish farmers only to be returned once they are duly completed.

Estimating the unit area of each pond or cage becomes a pre-requisite in this regard. In addition, fish harvest from each pond need to be calculated by considering pond

number and type of species harvested, area of pond (m<sup>2</sup> or ha) and convenient unit of measurement e.g. bucket with its estimated weight in kg-equivalent per unit. This should give rise to the quantity of fish by species harvested in kg.

### **Data collection period and frequency**

Data collection should be done on monthly basis and the reporting period should be on annual basis i.e. January to December each year.

### **Method of data analysis**

The data collected from all the sampled households should be entered onto an MS Excel spreadsheet or a specialized statistical software package.

The computer analysis should follow the following steps:

Step 1: Calculate the area of all ponds for each household and compute total area of all the sampled households.

Step 2: Calculate the total quantity of each fish species harvested from each pond or cage for the sampled households during the year.

Step 3: Calculate the mean yield of each fish species per household by dividing the total yield (fish production) by the total hectarage (area of ponds) for all the sampled households.

Step 4: Using the average data on fish production per unit area from the sampled households, calculations can be made to estimate total fish production in a given area (hectarage of ponds).

Step 5: When the exercise is repeated in subsequent years, status and trends in fish production from fish farming can be determined.

## **2. Methodology for Estimating Production from Capture-based fisheries**

### **Introduction**

The capture-based fisheries use two sets of data collection systems: one is a monthly sample-based survey whereas the other is an annual census-based survey or frame survey.

### ***Catch Assessment Survey (CAS)***

The sample-based survey known as Catch Assessment Survey (CAS) was established for Malawi's fisheries by FAO in 1976. It involves sampling fresh fish catches and fishing effort at four (4) statistically selected fishing sites within a statistical area or Minor Stratum (MS). Sample-based Catch and Effort records are collected during the first 16 days of the month, spending 4 days at each selected fishing site. The completed data forms are sent to District Fisheries Offices for entry, processing and reporting. Due to data processing inconsistencies in the districts, the FRU collects the completed forms from all the districts offices and processes the data.

### ***Malawi Traditional Fisheries (MTF)***

Back-to-back with CAS, a Malawi Traditional Fisheries (MTF - another form of a monthly sample-based survey) was piloted in 1991 through the FAO Chambo Project, and today continues as such, in Lake Malawi - Mangochi waters, Upper Shire River and Lake Malombe. The basic difference between the CAS and MTF is that the former uses fishing boat-based raising factors whereas the latter uses fishing gear-based raising factors in the estimation of total catch and total fishing effort.

### ***Frame Survey (FS)***

The annual census-based survey or frame survey enumerates total fishing effort by considering a basic fishing economic unit which usually consists of numbers and types of fishing crafts, fishing gears and operators.

### **Estimating fishing effort, fish production and catch per unit of effort**

By combining both sample and census-based surveys, one is able to estimate total fish production, total fishing effort and catch per unit of effort (cpue), which is an indicator for the status of exploiting the capture-base fisheries.

#### **Mathematical calculations**

Step 1: Calculate monthly sample-based fishing effort,  $f$ , by summing up all effort values for the month.

Step 2: Calculate monthly sample-based catch,  $c$ , by summing up all catch values for the month.

Step 3: Compute sample-based catch per unit of effort,  $cpue$ , by dividing sample-based catch,  $c$ , by the sample-based effort,  $f$ . That is,  $cpue = \frac{c}{f}$ .

Step 4: Calculate total fishing effort,  $E$ , based on the results from the annual census (frame survey), fish craft or gear activity coefficient. That is,  $E = \sum GxBACxN$  where  $G$  is the total number of fishing crafts or gears enumerated in a recent annual census,  $BAC$  is a boat activity coefficient (a ratio between active fishing crafts and those crafts known to exist on the sampling sites) and  $N$  is the total number of possible fishing days in a particular time period.

Step 5: Compute annual total fish production,  $Y$ , by multiplying sample-based catch per unit of effort,  $cpue$ , with the total fishing effort,  $E$ . That is,  $Y = cpue \times E$  or

$$Y = \frac{c}{f} \times E.$$