

SAMPLING METHODOLOGY EMPLOYED BY CMFRI FOR MONITORING THE FISHERY AND ESTIMATION OF MARINE FISH LANDINGS IN INDIA

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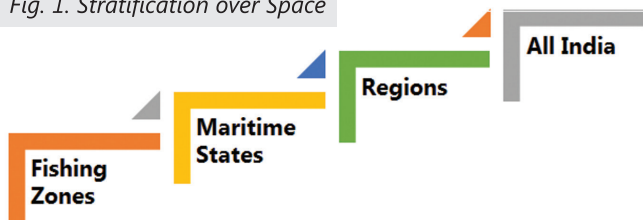
ICAR-Central Marine Fisheries Research Institute

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Fisheries sector plays a key role in Indian economy. The sector supports livelihood, nutritional security, and subsistence to large number of people as well as foreign exchange earnings. India's coast line stretches about 8129 km. There are 1355 landing centres scattered along the coastline of the main land as per the records from National Marine Fisheries Data Centre at Central Marine Fisheries Research Institute (CMFRI). Marine fish landings take place almost all along the coast line throughout the day and sometimes during night. Under these circumstances, collection of statistics by complete enumeration would involve a very large number of enumerators and a huge amount of money apart from the time involved in collection of data. Therefore, a possible solution for quantifying marine fish landings is adoption of a suitable sampling technique. As, monitoring and assessment of the exploited marine fishery resources of India is one of the important mandates of the CMFRI, institute made attempts to evolve the scientific methods for collection of data on catch and effort, since its inception in 1947. Pilot surveys were conducted along the coastline of India and different sampling designs were tested.

CMFRI introduced collection of marine fish statistics through a stratified sampling design along the west coast of India in the year 1959 and extended to other states over the years. Keeping in

Fig. 1. Stratification over Space



pace with the changing marine fisheries scenario, the sampling design has been modified over the periods. Presently, CMFRI estimate marine fish landings based on a multi-stage stratified random sampling technique, stratification is done over space and time. Each maritime state is divided into suitable, non-overlapping zones on the basis of fishing intensity and geographical considerations (Fig. 1). The number of landing centres varies from zone to zone.

Reprinted from the CMFRI, FRAD. 2014. Training Manual on Fish Stock Assessment and Management, p.150.



Over space, each zone is regarded as a stratum and over time, a calendar month is considered as a stratum. Consequently, a zone and a calendar month constitute a space-time stratum. Suppose, in a zone, if there are 5 landing centres and 30 fishing days in the month; then $5 \times 30 = 150$ landing centre days, combination of centre and day constitute the primary stage units (PSU). The fishing craft that land on a landing centre day forms the second stage units (SSU). Furthermore, the fish landings vary considerably among the landing centres in a multi-centre zone, mainly in different seasons and hence a zone is further stratified into substrata viz., major, minor and very minor. The centres in which either mechanised crafts or 100 or more non-mechanised/motorised crafts are operating are considered as major centres. Likewise, other strata are defined based on the number and type of fishing crafts operating.

Further, a month is divided into three groups each with ten days. A day is selected at random from the first five days of a month and 5 successive days are selected automatically. Three clusters of two successive days are made from the above selected days. To illustrate the selection of landing centres and days, let us consider a fishing zone in a month. Initially, select a date at random from the first five days, let it be 3. Then from the first 10 day group, three clusters of 2 days (3,4) (5,6) and (7,8) can be formed. From the second group of 10 days, the clusters are systematically selected with an interval of 10 days. The clusters of days formed are (13,14) (15,16) and (17,18). Similar selection can be done for the next group of ten days. Accordingly, 9 clusters of two days can be formed in a month. Afterwards, 9 centres are selected with replacement from the total number of landing centres in a zone and allotted to the 9 cluster days as explained before. Thus, a combination of a landing centre and a day (landing centre day) forms the Primary Stage Units. A landing centre day has been divided into 3 periods as given in the infographic. That means a landing centre day is 24 hour duration which starts at noon of the first day and ends at noon of the following day.

The marine fish landings data collection is done by the technical staff of CMFRI. Usually, one staff is identified to collect data from each zone. Data collection starts from period 1 on each selected landing centre day.

The staff will be present throughout the periods 1 and 2 at the centres.

The data on landings during period 3 (night landings) is usually collected from the landing centre by enquiry on the following day morning.

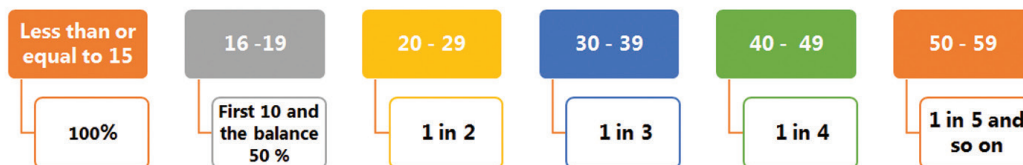
The observations on the 3 periods

contribute the data for one landing centre day (24hrs). So, in a 10 day period, data from 3 centre-days are sampled and thus in a month 9 landing centre days are sampled.

Period 1	• 1200-1800 hours on 1 st day
Period 2	• 0600-1200 hours on 2 nd day
Period 3	• 1800 hours to next morning 0600 hours



After reaching the landing centre, if the landed number of crafts is large, it may not be practical to record the catches of all crafts landed during an observation period. In that situation, sampling of crafts become essential. When the total number of crafts landed is 15 or less, the total landings from all the crafts are enumerated for catch composition and other particulars. When the total number of crafts exceeds 15, the following procedure is followed to sample the number of crafts.



The catches are normally removed in baskets of standard volume from the crafts. The weight of fish contained in these baskets being known, the total weight of the fish in each boat under observation has been obtained. The procedures of selection of the landing centre days and the crafts landed on the selected day for single centre zones are the same as in the case of a stratum in a multi-centre zone. From the landings of the observed fishing units, the landings for all the units landed during the observation period are estimated. By adding the quantities landed during the two 6- hour's periods and during the night (12-hours) the quantity landed for a day (24-hours) at a centre that is the landings for each centre day included in the sample is estimated. From these, the monthly zonal landings are obtained. From the zonal estimates, district-wise, state-wise and all India landings are arrived. The corresponding sampling errors are also estimated. The estimation procedure is detailed in Srinath *et.al.* (2005).

Administration of the Survey

The survey staff is given 10-12 weeks training course immediately after recruitment and is posted to the survey centres. Each survey centre each centre is provided with literature connected with the identification of fish, a reference collection of local fish species, crustaceans and molluscs, field notebooks and registers. The programme of work for the following month is carefully designed by the staff of Fishery Resources Assessment Division at the CMFRI headquarters. Generally one field staff is allotted to each zone to collect the fish landings data. At the end of every month, the survey staff receives the programme of work for the next month by post, that includes the names of landing centres to be observed and details such as dates and time for observations at each landing centre. The field staff are instructed to send the data collected during every month to reach the Institute's headquarters at least by the end of first week of the subsequent month.



Surprise inspections are carried out by the supervisory staff of the Institute and the enumerators are inspected while at work in the field and their field notebooks and diaries are scrutinised. The estimated zonal landings are always compared with the previous year's survey figures, and if any variation which cannot be explained is observed, the technique of interpenetrating sub-samples is adopted to detect observational errors. Zonal workshops are held periodically to review the progress of work and update the sampling frame and to impart refresher courses to the field staff. Non-response occurs when the regular field staff is not available to observe the centre-day included in the sample. Usually, arrangements are made at the Headquarters/Research/Regional Centre to minimise the non-response.

In the existing sampling methodology, the interest is to estimate gear-wise, species-wise landings for the state in a month, fishing effort according to different types of fishing crafts and also in terms of man hours. The analysis is carried out at CMFRI headquarters. Before the data is processed for analysis it will be ensured that the data collection is made as per the approved schedule, by checking the appropriate proforma. The responsibilities and functions of staff at the headquarters are data coding, estimation and database management. The data analysis is computerised and estimates are made using the software developed by the Fishery Resources Assessment Division of the Institute. The processed data are again counter-checked for errors. When discrepancies are detected, the estimation procedure is scrutinised in detail.



Suggested Reading

M. Srinath, Somy Kuriakose and K.G. Mini, 2005. Methodology for the Estimation of Marine Fish Landings in India, CMFRI Special Publication No. 86, p.57

