J. Ind. Soc. Agril. Statist.
59(2), 2005 : 172-177

Proceedings of the Symposium on "Use of Emerging Statistical Techniques in Agriculture"

Chairman : Dr. K.C. Seal
Convenor : Dr. V.K. Bhatia

At the outset chairman introduced the topic and requested Dr. S.D. Sharma, Director, IASRI, to initiate the discussions. After this Prof. Aloke Dey, ISI was also requested to throw some more light on this topic. Followed by these remarks, the following five speakers presented their papers:

1. Analysis of Longitudinal Categorical Data Using Generalised Estimating Equations - presented by Dr. B. Singh, IVRI, Izatnagar.
2. Use of Emerging Statistical Techniques in Animal Sciences - presented by Dr. K.C. Raut, ISAS, New Delhi.
3. Application of Statistical Techniques in Bioinformatics - presented by Dr. Vijayaraghava Kumar, College of Agriculture, Kerala.
4. Applications of Some Emerging Statistical Procedures in Agriculture - presented by Dr. B.S. Kulkarni, ANGRAU, Hyderabad.
5. Modeling Marine Fish Landings and Environment Using VARX Models - presented by Dr. T.V. Sathianandan, MRC of CMFRI, Chennai.

Dr. S.D. Sharma, Director, IASRI, New Delhi in his remarks emphasized the greater role the statisticians have to play in the light of various threats for not applying the sophisticated statistical techniques along with fast changing culture of computer uses. He pointed out that time has come for statisticians to show their presence felt and prove themselves their indispensability. He further pointed out that statisticians should advice the users of agriculture/ animal sciences appropriately after duly examining the underline inherent assumptions. Subsequently he drew the attention of statisticians to carry out research so that the methodologies are developed for the areas of cost effective surveys, market research, small area estimation, application of remote sensing, bioinformatics, forecasting, data mining, ANN and fuzzy regression etc.

Prof. Aloke Dey in his remarks, pointed out that the research in statistics can be classified in two ways. (a) Development of new methodologies/ techniques and (b) Application of existing techniques in non-trivial manner to derive newer inferences. Case studies carried out for specific user with specific objectives are also of interest but its use is limited in nature. Further, he stressed that computer is not a threat but has helped in studying complex underlying phenomena by applying various computer intensive techniques. Though the area of interest for statisticians are many folds, to name few of them, he pointed out that research need to be carried out in DNA sequencing and genome mapping, statistical modeling for complex biological systems, design and methodologies for agroforestry experiments, risk analysis and design for micro arrays etc.

Chairman in his remarks, emphasized on the dissemination process of the techniques developed along with agencies for its implementation.

Dr. B. Singh in his paper, highlighted the technique for binary response in the longitudinal data.

Dr. K.C. Raut while highlighting the research carried out in the areas of animal sciences pointed out newer areas where due emphasis in future need to be done.

Dr. Vijayaraghava Kumar pointed out the uses of statistical techniques in the area of bioinformatics.

Dr. B.S. Kulkarni pointed out that with the more computer uses, the application of multivariate techniques are now possible and illustrated its application in studying the rainfall behavior. He further stressed the greater role of interdisciplinary research.

Dr. T.V. Sathianadan highlighted the modeling techniques for fish landing through the modified time series analysis.

After these presentations, many participants namely, Dr. B.N. Singh, Dr. S. Ray, Dr. V.K. Sharma, Dr. M. Neelakantan, Dr. D.K. Jain, Dr. V.T. Prabhakaran and others expressed their own views on the use of emerging statistical techniques in agriculture.

After the detailed discussion finally the following recommendations were emerged out.

1. Dissemination process be further strengthened so that the newer methodologies developed are applied to the different areas of agriculture and animal sciences research.
2. Developing more trustworthy methodologies for forecasting the agricultural production, by using various latest techniques of spatial sampling, remote sensing and fuzzy regression etc.
3. To strengthen the research and its application in the newer areas such as bayesian techniques, bioinformatics, remote sensing, designs for specific demand driven situations etc. and to organize workshops so as to have a close collaboration among the statisticians placed at different research organizations. In this process, the involvement of Govt. and Planning Department Agencies are needed and to be further strengthened.
4. To develop suitable statistical techniques after duly examining the ground realities and its application in livestock, fishery and agriculture sector.
5. The graphical techniques and the residual analysis should also be exploited to derive trends and behaviour in the biological phenomena.

1. Analysis of Longitudinal Categorical Data Using Generalized Estimating Equations

B. Singh

Longitudinal studies play an important role in bio-statistical analysis. In such studies the repeated observations of a response variable and a set of covariates are observed on each individual/ animal across two or more occasions. A distinction is sometimes made between longitudinal designs, where animals are followed for extended periods, and repeated measures designs, in which measurements are collected over a relatively short time period frequently under experimental conditions. In follow up studies, the outcome is the time until the occurrence of a particular endpoint such as death, disease, conceive, etc. Although such studies may involve a long term follow up of individuals/ animals, the analysis of change in serial measurements is not of central interest. The discussion here is restricted to that part of longitudinal studies in which serial measurements are the outcome of interest.

In longitudinal studies in animal research, the response at each occasion is often categorical and in particular binary (e.g., sick/ well, conceived/ not conceived, cured/ not cured). There are two commonly used approaches for modeling repeated categorical response variables: (1) Transitional models describe the probability distribution of a subject's future events given the subject' prior history; whereas (2) Marginal models address net changes in the population and utilize various methodological strategies to account for the correlation between repeated measurements. The models considered here are marginal models which relate the expected values on an animal's response at time t to the covariates.

Generalized Linear Model

One of the first approach to the analysis of repeated categorical responses was developed by Koch *et al.* (1977) using the generalized weighted least squares method. This method is non-iterative and inefficient when frequencies within categories are small and it can not be used with continuous covariates. An alternative approach is due to Liang and Zeger (1986) using generalized estimating equations. The marginal distribution of the dependent variable is assumed to follow a generalized linear model. The class of generalized linear models is an extension of classical linear models.

An important characteristic of generalized linear models is that they assume independent observations, so that, for example, the data showing the auto-correlations of time series are excluded. A second assumption about the error structure is that there is a single error term in the model thus, for instance, models for analysis of designed experiments of the kind giving rise to more than one error terms, the simplest example being the split plot design with its two error terms associated with between main plot and within main plot comparisons, are also excluded.

Indian Veterinary Research Institute, Izatnagar

2. Use of Emerging Statistical Techniques in Animal Sciences

K.C. Raut

The application of statistical techniques in the field of animal sciences was made as early as in 1944 when critical analysis of 10 years data on goat breeding project at Etah (U.P.) was undertaken by Dr. P.V. Sukhatme. This study led to the recognition of the need, in India, for application of statistical techniques to animal sciences. As a result, several investigations both of methodological and basic nature were followed and statistical techniques became integral part of research and development in animal sciences. During the last five decades, the findings have helped in giving quantitatively and qualitatively pointed direction in planning as well as assessing the progress made. The methodological studies so far undertaken are mainly related to animal breeding/ nutrition, population projection and planning studies, animal productivity, assessment and evaluation studies. However, the advanced statistical techniques have not been applied to animal sciences to the desired extent. There is enough scope for application of advanced methodologies to various disciplines of animal sciences.

Some of the important aspects in which studies have been made are listed with a view to examine to what extent further work can be done or improved.

1. Statistical methodologies developed and adopted with or without modification
2. Methodological studies carried out and need to be adopted
3. Research investigations need to be undertaken to bridge the gap

- An integrated plan has been developed for estimating output of important livestock products every year with sufficient precision.
- A satisfactory technique has been developed for estimating the cost of production of milk in a compact area and has been adopted by some states.
- The operational feasibility of the plan for systematic sampling of milk records to estimate the milk production was studied and tried successfully in key village blocks. This has also been adopted by some state departments for assessing improvement in terms of milk production brought about by cattle development schemes.
- A satisfactory technique was evolved to grade the wool on the basis of quality, as judged from fibre characteristics which affects the ultimate manufacturing products. Based on these studies definite standards were formulated and adopted.
- An operational research study provided tools for improving the efficiency of the Rinderpest Eradication Campaign. While assessing the progress of the Rinderpest Eradication Campaign, the operational efficiency was critically examined which resulted in estimating the optimum team size required for vaccination of animals in the village in order to have maximum outturn of number of ampoules containing the vaccine with the object of reducing wastage.
- Analysing large body of data collected from the survey of bacteriological quality of milk (organoleptic value, metheline blue reduction time, bacteria count, acidity percentage etc.) acceptable standards of milk fixed so as to improve the keeping quality and to ensure the supply of good quality milk.
- Some of the statistical techniques developed in the field of statistical genetics and breeding have been successfully utilized for getting better knowledge of genetic composition of the herd and in selection for improvement of the stock.

Some of the techniques developed but needs to be widely adopted are as follows:

- The organized dairies can fruitfully utilize the technique developed by IASRI based on a series of investigations to assess the impact of milk supply schemes on rural

economy in respect of milk production and its utilization, employment and income.

- Appropriate technique has been developed on estimation of cost of poultry and egg production under commercial management conditions as well as under small scale poultry farming conditions. Such studies would indicate the procedure of working out the scale of poultry farming and the profitability particularly in Integrated Rural Development Programme.
- Based on surveys carried out at various centres, a satisfactory method for estimation of fertility and mortality rates of bovines as well as ovines has been worked out. This will be useful in construction of life table and population projection.
- The study to know the economics of pig rearing both under farm and village conditions carried out in view of the importance of piggery by weaker sections of rural community.
- Sampling methodology for estimation of cultivated fodder production has been obtained. The procedure for working out cost of production of various cultivated fodder crops has also been suggested. Such studies would help in knowing not only the economics of fodder production and its utilization but the potentiality of the sources for employment.
- Animals get their feed through stall feeding as well as through grazing. Methodology has been developed to estimate the feed availability to bovines through stall feeding. Similarly, IASRI has developed the techniques for estimation of herbage available to animals through grazing. Subsequently, studies have been undertaken for estimation of feed intake by animals both through stall feeding and grazing on a day and thereby knowing the nutritional status of livestock.
- Appropriate technique has been developed to estimate the cost of rearing calves and maintenance of bovines under rural management conditions.
- Modifying the existing methodology, a study has been undertaken for estimating the breed-wise sheep numbers, average wool yield, total wool production and seasonal variation at district level as well as to know various practices of sheep rearing in the area and the socio-economic status of farmers engaged in sheep rearing.

There are areas where further work is necessary:

- Although utilizing secondary data, some estimates of the grains used as animal feed are available, special studies need to be undertaken to get some reasonable and satisfactory results.
- Pilot studies have been undertaken by IASRI in collaboration with other organizations for assessment of harvest and post harvest losses of commodities like milk, wool, meat, egg and poultry meat etc. at producer, market and consumer levels. More such studies at other centres for each of these commodities are desirable.
- Study on the comparative economics of dairy, mixed and arable farming at different centres showed the importance and significant contribution particularly employment opportunities for small and marginal farmers. Subsequently, another study was initiated to know the comparative performance of mixed farming involving crop, livestock, poultry and fish. More such studies need to be undertaken. Recently, studies are undertaken to work out the economy of agroforestry in which livestock is one of the component.
- Management is considered to be an important factor in enhancing livestock products. Regardless how well the animal is bred and fed unless management is proper, the animal's potential will never be fully realized. Most of the management factors are qualitative. Although a beginning has been done to quantify management factors and their influence on production, more studies need to be made in different agro-climatic regions.
- Mortality of calves during lactation length of their dams adversely affects the lactation length, lactation yield, yield per day of calving interval and persistency. Limited studies have shown quantitatively the extent of loss done to calf mortality on milk yield and other production traits. Such studies need to be carried out in different regions covering various animal husbandry regions. It will provide useful indicators for judging the efficiency of improvement programmes.
- Limited studies have been undertaken to know the relative efficiency of work performance of indigenous and crossbred bullocks. Scientifically planned experiments need to be carried out to measure the draught capacity of bullocks in different agro-climatic

regions as well as of different breeds particularly crossbred males.

Although considerable work is being done at various research institutes on applied problems in the field of animal sciences covering the entire gamut of statistical disciplines, there is considerable data gap both for planners and research workers. The gaps in researches can be examined from two directions. The first one is to improve the techniques already used in earlier and current projects and the second one is the detection of new areas where suitable methods can be found and modified for use in practical situations. There are some priority areas where research methodologies may be developed as well as adopted keeping in view that the problems are of immediate practical use and balance between basic and applied research. Some such priority areas of research are indicated.

- Nutrition surveys to estimate availability of nutrients for livestock from fodders, grassland and grazing in different regions in collaboration with other institutes with facilities for chemical analysis of feeds etc.
- Estimation of pig population at shorter intervals in addition to other items like age specific mortality and fertility, age at farrowing etc.
- Small area estimation of various aspects of development in livestock sector as well as indicators useful for fixing insurance premium
- Index of overall impact of development
- Draught capacity of bullocks of different breeds in various agro-climatic zones
- Comparative economics of different systems of farming keeping in view the employment potential
- The sample survey approach for estimation of future population of animals and for projection is time-consuming and expensive. Livestock census provides enough data to formulate statistical models which can measure objectively the growth parameters of populations. Such studies of statistical modeling for population growth will be helpful in formulating plans as the livestock have to share the available feeds.
- Statistical modeling in animal epidemiology to make predictions of disease incidence or prevalence

While solving the challenging problems stated, the methods to be adopted need not be of the beaten track and may require probing in new directions. After suitable methodologies are evolved the policy makers, administrators and all those involved in decision making for livestock improvement should meet together and to this learned body, the utility and adoption of the statistical methodologies developed should be emphasized.

Indian Society of Agricultural Statistics, New Delhi

3. Application of Statistical Techniques in Bioinformatics

Vijayaraghava Kumar

The role of statistical sciences in Biology is well known in various names as Statistical Genetics, Agricultural Statistics, Biometrics, Biostatistics etc. But during the last two decades genetics and molecular biology witnessed an information revolution due to the development of DNA (Deoxyribose Nucleic Acid) sequencing techniques as well as the progressive use of computer based technologies. Bioinformatics is a field of science in which biology and mathematical sciences like Statistics, Computer Science and Information Technology merge into a new discipline. Three of the important sub-disciplines within Bioinformatics involving statistical applications are (i) Development of statistical algorithms to assess relationship among large data sets, (ii) Analysis and interpretation of various types of data including nucleotide and amino acid sequences and (iii) Development of tools for efficient access and management of different types of information. Basic ideas on bioinformatics where statistics is applied along with an attempt to make a glimpse of the important statistical tools used in this discipline like gene mapping and sequences of DNA/ Amino acid, Dynamic programming, Multiple sequence alignments, Hidden Markov models and some other applications are made in the present paper.

Today it is the information and communication technologies that create changes in the level of prosperity in biological research fields. Genes responsible for important traits were being identified by studying the natural variations in gene pool. Molecular data will be the new raw material and statistical methods are the technologies to manage these data to extract knowledge.

College of Agriculture, Thiruvananthapuram, Kerala

4. Applications of Some Emerging Statistical Procedures in Agriculture

B.S. Kulkarni

Agricultural Statistics is a challenging field, which provides variety of solutions for drawing inferences in different disciplines of agriculture. Design of Experiments, Sample Surveys and Statistical Inference are the most commonly explored branches. Multivariate Analysis is yet another branch that is relatively less explored may be due to the complex computations involved in its application. Since the advent of computers, development of various statistical softwares have made its application convenient and within reach of the researchers.

A statistician is expected to acquire an inter-disciplinary outlook in the application of statistical procedures. Hence, instead of highlighting the 'emerging' statistical procedures, some of the situations that require not the routine "prescriptions" but a little modification, in terms of the inter-disciplinary approach are described in the present paper.

Estimation of Rainfall

Rainfall estimates play an important role in agricultural planning. Generally, these estimates are obtained by fitting statistical distributions to the rainfall data of periods (week/ month) of the season, recorded over the years. The estimates are obtained independently for the periods of the season, ignoring the inter-dependence of the occurrence of rainfall in these periods. Further, there could be several years with similar rainfall of the total season but dissimilar in its occurrence in different periods. These dissimilarities in the period wise rainfall could be either favourable or unfavourable to the crop. Under this situation, identification of various rainfall patterns that emerge from the rainfall data would be a rational approach than obtaining the univariate probabilistic estimates of rainfall, independently for each of the periods.

Forecasting the Agricultural Production

Forecasting the agricultural production based on pre-historic data is yet another challenging task. Technological innovations in the crop that are released from time to time and the process of its adoption by the farmers are often reflected in the production data, besides the effect of weather factors. The effect of the technological innovations would be generally in the form of quantal jumps that stabilize after the technology is fully adopted over a period of time. These jumps obviously deviate from the normal trend and can be identified in the form of breaks or points of discontinuity. It is also obvious that a separate trend would be exhibited by the data of the sub periods formed by these jumps. The conventional growth models, therefore, are not appropriate for studying the dynamics of the data, as these are based on the assumption of continuity in the year-to-year variations. Spline models offer a convincing solution to deal with this situation.

Two simple procedures, viz. Cluster Analysis under multivariate analysis and Spline Models are described. There are several other 'emerging' procedures such as Simultaneous Equations Models, Non Linear Models and Artificial Neural Networks Models (Silverman and Dracup, 2000). However, the application of these procedures would be effective and useful only through the inter-disciplinary outlook!

Acharya N.G. Ranga Agricultural University, Hyderabad

5. Modeling Marine Fish Landings and Environment Using VARX Models

T.V. Sathianandan

The relationship between monthly landings of oil sardine, mackerel, stolephrus, elasmobranches and environmental variables were studied and used for developing multiple time series models of the type Vector Autoregressive model with environmental variables as exogenous variables (VARX model). Landings of these species/ groups at Cochin Fisheries Harbour and environmental variables recorded at Cochin during 1988-97 were used for the study. Six different VARX models were fitted using the four landings time series as output vector and two environmental time series, one each to represent temperature and rainfall, as exogenous vector. The results revealed that an increase in highest rainfall is expected to cause increased landings of stolephrus, increase in values of highest and lowest temperatures and highest rainfall are not favourable for good landings of mackerel, the series on number of rainy days has significant negative effect on the series on elasmobranches landings and increase in highest temperature is expected to cause reduction in oil sardine landings.

MRC of CMFRI, Chennai

J. Ind. Soc. Agril. Statist.
59(2), 2005 : 178-182

Proceedings of the Symposium on "Fishery Statistical Systems in India"

Chairman : Dr. R.S. Biradar
Convenors : Dr. M. Srinath
Sh. K. Balan

The following invited lectures were presented each of which were followed by detailed discussion.

1. Marine Fisheries Statistical System in India: Present Status and Future Requirements - presented by Dr. K. Alagaraja, CMFRI, Kochi.
2. Statistical System in India with Special Reference to Brackishwater Aquaculture - presented by Dr. M. Krishnan, CIBA, Chennai.
3. Statistical System in India with Special Reference to Fishery Technology including Post Heartest Technology and Socio-economics - presented by Dr. G.R. Unnithan, CIFT, Cochin.
4. Inland Fisheries Statistics in India - Present Status, Problems and Prospective - presented by Dr. R.A. Gupta, CIFRI, Barrackpore.

The following recommendations emerged out of the lectures and the ensuring discussions.

(i) Taking view of the huge involvement of human, financial and computational resources in data collection and preparation of statistical reports, indicators and diagnostics in identifying problem areas and deciding the type of corrective action required, an all inclusive aquaculture information system should be formulated.

(ii) Common data bank comprising all major fisheries statistics must be evolved which should be accessible to all stakeholders, including government departments.

(iii) A cost effective and sustainable system of statistical data collection with special reference to inland fisheries should be devised and put into action.

(iv) A national agency with sufficient expertise, wherewithal and technical standing should be entrusted with the collection of state wise fishery statistics including the information on economic parameters pertaining to the fishing community.

(v) In view of the above it is high time that a Central Institute of Fishery Statistics is established to void such lacunae and to maintain high standards in the scientific sampling of data.

1. Marine Fisheries Statistical System in India : Present Status and Future Requirements

K. Alagaraja

Indian fisheries, particularly marine fisheries, have undergone many changes over time. In 1950s sky was the limit for fisheries development. In 1960s maximum sustainable yield was the aim. In 1980s industry entered in fishery activities at various stages starting from fishing to development of exports. Hence the aim was maximizing profits. Many problems arose due to this since the importance was and even now is, on producing quick and maximum possible profits. At present the aim of fisheries is development of sustainable fisheries without creating ecological and socio-economic conflicts.

The main concern in fisheries sector is, hence, to assess the resource availability, efficiency of fishing operations and to develop mariculture as an industry on a sound base and create industry based infrastructure facilities and credit options. The importance of rational fisheries management in optimal sustainable use of the

available resources is the major thrust in fisheries research and development. This account deals with the major aspects of the above topics and the development of statistical system in marine sector.

To develop a suitable system one should know the nature of resources. Fish is an important component in man's livelihood. From time immemorial it plays a very important role in all facets of human progress. Religiously, aesthetically, philosophically, politically, socially and economically its contribution has no parallel in the history.

In the present paper some aspects related to marine fisheries system in India like fishery resources vs. other resources; production activities - capture fisheries, culture fisheries and capalture fisheries; disposal; marketing; financing and computer application are dealt with.

Some of the contributions made by the CMFRI scientists in fisheries research, from the data collected by the sample surveys are also given.

Database management and computer application should go hand-in-hand for any successful activity. For easy accessibility, it is better that all such information is stored at a place accessible to the interested workers. NMLRDC of the CMFRI is well equipped for this purpose. Since various organizations are involved in collection of data on different aspects of fisheries, duplication of information collected, want of uniformity in the collection procedure and lack of a common time frame in collection of data particularly in frame surveys by different states in different years are major hurdles in compilation of information on national level.

At present research institutes engaged in fisheries research are not able to attend to collection of fisheries statistics as per the demand of various research projects for want of finance. Least interest is shown in collection of vital information on scientific basis when budget limitations crop up. Funds allotted to collection of data are conveniently siphoned to other works jeopardising the very aim of collection of vital data. In order to avoid such lapses and to maintain uniformity, regularity and scientific approach and to cover all aspects of fisheries it is high time that a Central Institute of Fishery Statistics is established to avoid such lapses and to maintain high standards in the scientific sampling of data.

Scope for Future Research

1. Two stage sampling for total catch estimates and three stage sampling for species-wise catch estimates are used. Error estimates are made on the basis of first stage sampling, assuming the errors at higher stages are negligible. However, for SRSWR error estimates based on first stage units only are needed. It is worth studying the errors at higher stages for improving the sampling efficiency.
2. In stock assessment studies *von Bertalanffy*'s growth model is considered in the length frequency approach. It is worth trying general growth models.

Central Marine Fisheries Research Institute, Kochi

2. Statistical System in India with Special Reference to Brackishwater Aquaculture

M. Krishnan and C. Sarada

Globally, aquaculture has expanded, diversified, intensified and has technologically advanced in the last few decades. World aquaculture production is likely to continue to grow driven by a static supply from marine fish landings. In the coming decades aquaculture is likely to be the greatest source of fish production (Delgado *et al.* 2003). According to Food and Agricultural Organisation (FAO) aquaculture production excluding aquatic plants for the year 2002 was 39.8 million tons with a farm gate value of US$ 53.8 billion. The production shows an average annual increase of 9.3 per cent during the period 1992-2002. Our country ranks second contributing 1.942 million tons to global production with an annual percent growth rate of 6.2 per cent for 2000-2002 (Lowther, 2004a).

This characteristic growth of the aquaculture sector has increased the need for accurate and reliable information to develop rational and sustainable management policies.

At the global level, FAO shoulders the responsibility of collecting and disseminating aquaculture statistics. It does this by drawing on national level statistics contributed by individual countries. The FAO Advisory Committee on Fisheries Research (ACFR), through its working committee on Status and Trends in Fisheries (WP/STRF) recently recommended that the global system of status and trends in reporting be improved to support

policy making and management more effectively. However, aquaculture was excluded from the strategy because of perceived differences in information requirement recognizing that the aquaculture sector deserved a dedicative initiative. The Fisheries Sub–Committee on Aquaculture (COFI/SCA) during its first session in April 2002, designated information needs for aquaculture as a priority area for attention at the global level. Consequently, the FAO Fisheries Department organized an Expert consultation on improving Global Status and Trends Reporting on Aquaculture in Rome, in January 2004. The aim was to review available information on completeness, scope and procedures for the preparation of FAO status and trend reports on aquaculture (that is, information collection, quality control, analysis and dissemination), as well as the nature and quality of the information on which it is based and the timeliness of reporting (Love (2004), Lowther (2004b)).

In the present paper related aspects of aquaculture statistics like origin and growth; administrative structure and current status of data collection, type of data collected; methodology; analysis and significance of survey items are dealt with. Type of aquaculture statistics are also listed. Some problems involved with aquaculture statistics are also highlighted.

Central Institute of Brackishwater Aquaculture, Chennai

3. Statistical System in India with Special Reference to Fishery Technology including Post Harvest Technology and Socio-economics

G.R. Unnithan

The statistical system in fishery technology in India is very vast and multi-disciplinary in the sense that it encompasses many disciplines like fishing technology, fish processing, fish quality control, fishery economics, management, marketing and fishery extension. The generation of data by various governmental and other agencies, data management and consequent information generation for the overall economic development of the country are the major components of the system. As the ultimate objective of technology development is the effective and optimum utilization of the available resources and to increase the production through technology adoption, collection and monitoring of quality data at every stage is essential for which an efficient statistical system is to be ensured. With the introduction of WTO and other economic reforms, the fishery technology scenario has become very competitive like many other sub-sectors in agriculture and the country has to be fully geared up for meeting the global challenges.

The statistical system can play a more dominant role in providing tools for policy making and implementation and in directing the impact of technology in sustaining the nutritional safety and socio-economic upliftment of people living below the poverty line by assimilation of the dynamic techno-economic world scenario and emerging opportunities through effective coordination, speedy dissemination of information by networking and appropriate human resource development in the system.

'Fishery Technology' being a multi-disciplinary sector, the application of statistics has been very substantial. Large volumes of data have been generated in a wide range of applied scientific areas of fishing technology, fish processing, quality control, fishery economics, marketing and management. Apart from statistical data collected on various subjects in the technological research area from time to time, collection of data has been carried out in the area of production, export, socio-economics etc. for administrative and management decision making. An overview of the statistical systems in fishery technology with a background of its origin, development, present status etc. has been presented in this communication.

A large volume of statistical data is expected to be generated in the scientific areas, fishing and fish processing industry, export market and fishery management. Ensuring quality of the data and management of data for generation of valuable information are not going to be that easy. A complete restructuring of the fisheries statistical system in this background with an accessible common database and a central coordinating agency for fisheries to monitor, guide and improve the existing system is the need of the hour.

Central Institute of Fisheries Technology, Cochin

4. Inland Fisheries Statistics in India - Present Status, Problems and Perspective

R.A. Gupta

Development of human race has been intricately linked with the process of collecting information,

compiling, processing and drawing upon the information base for decision making. The races that managed information well prospered and those which did not, perished. This proves the point beyond doubt that statistical data is necessary for proper planning and development of a particular sector. India has also committed large resources for collection of data in different sectors of economy and continues to make efforts to improve the tools and techniques for information collection and management. Fishery statistics has also not remained untouched from this development but due to complexity in inland fisheries and more particularly in inland capture fisheries, it had not yielded desirable results. The type and quality of statistics require is still not available and the collection process is beset with problems in obtaining them. Inland fisheries being one of the major activities in India after agriculture, its progress and development also depends on the availability of sound and reliable data/ information with regard to policy planning, marketing and distribution and hence the problems associated in dealing with the collection system needs to be reviewed and improved.

Inland fishery is characterized by diversity in the use of gears, crafts, types of environments in which they are used and the socially and culturally complex societies within which they operate. Due to multi-species and multi-gear nature of fishery exploited by large number of fishers, licensed and unlicensed, with no fixed landing centres and no identified selling points along with lack of expertise and trained man power pose serious problems in collection of reliable data. Recent developments in fisheries research and management have also warrants a robust statistics collection system and level of attention to various sub-sectors. The complex system of inland fisheries has been a causality of this process. The present statistics tend to ignore the differing characteristics of this sub-sector.

This paper reviews the existing statistics collection system in India and discusses issues with regard to its origin, growth, current scenario and future challenges.

Some of the important sources of error are summarized as:

1. Errors in catch reporting
2. No importance is given to collection of statistics from small scale capture fisheries even though most of the catch arises from this sector
3. Mis-reporting by Govt. Officials
4. Estimates made without data collection
5. Inadequacies in recording the levels of participation in inland capture fisheries
6. Lack of description of the species composition of catches
7. Inability to monitor fishing effort
8. Inability to monitor recreational fisheries

The current statistics must be considered not only in terms of potential accuracy, but also in terms of the effort expended (cost) in obtaining them. Interestingly there does not appear to be a direct relationship between effort (cost) expended on information collection and the accuracy and relevance of the information produced. This has very significant implications for those thinking of investing heavily in improved inland fishery statistics based upon existing models.

Inadequate infrastructure facilities, poor communications, lack of trained manpower are further limiting the access and dissemination of fisheries information to the users.

Future Challenges

The resource base for inland fisheries is quite vast and varied. To cover this resource base for building estimates on various facets of activities also need large financial and human support even if it is done on sampling basis. Looking into the contribution of Inland fisheries in the GDP large scale investment in data collection may not be possible in view of benefits accrued to the society. What we need is a system of statistical data collection which is cost effective and sustainable.

More recently there have been significant shift in policy emphasis towards poverty issues and livelihood approaches, the environment and promotion of co-management systems for inland fisheries. However, existing system is incapable of addressing information needs for these policy areas and are not particularly compatible with them.

Classification of inland fisheries resources has also attracted the attention of experts but no definite and universally acceptable criteria for Indian inland waters have been evolved. This also poses problems in organizing statistical collection of data suitable to make comparisons between different areas and different states.

There is total lack of uniformity in the concepts followed for reporting area statistics vis-à-vis production. For example, some states give production at mean water level, while others give at full storage level or dead storage level. A significant challenge for the future is to respond rapidly to deal with these serious anomalies. A shift in policy and emphasis is needed by adjusting information generation and dissemination activities based on real data to cater the needs of inland fisheries.

To move towards co-management approaches for inland fisheries may also give significant opportunities to improve information generation. Effective co-management should improve confidence and trust between fishers and Govt. staff together with the willingness to divulge more accurate information and more cheaply. It is largely because most of the current information systems are extractive by nature by that they are inherently unreliable.

Suggestions

A scientific review is required for estimation procedures and the degree of participation, the extent of dependency etc. in inland capture fisheries and explanation of where there are inadequacies in current statistics.

It is widely and openly acknowledged that most of the existing statistics are not useful for monitoring trends in inland fisheries because of their poor quality. Need to explore options for obtaining better information using low cost and sustainable methods should be emphasised.

Establishment of a network of information, efficient document delivery system, effective retrieval of information, preserving information for posterity, facilities for information data analysis, condensation and repackaging of fisheries information to meet variety of farmers and rural demands etc. should be thought of. The creation of information highways to synergise the combined capabilities of cyberspace technologies along with optimizing informatics on the use of land and water resources for taking a quantum leap in agricultural research and production may be stressed.

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