

**Monsoon Season Post-harvest
Fish Losses in India**
Desk Review of Secondary Source Data and
Suggestions for Research Themes

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Abbreviations

AP	Andhra Pradesh
BOBP	Bay of Bengal Programme
CAT	Centre for Appropriate Technology, Nagercoil
CDS	Centre for Development Studies, Trivandrum
IMM	Institute of Marine Management
ITDG	Intermediate Technology Development Group
MARG	Marketing and Research Group Pvt. Ltd.
NRI	Natural Resources Institute
ODA	Overseas Development Administration
PHFP	Post Harvest Fisheries Programme
SIFFS	South Indian Federation of Fishermen Societies
SIFR	Strategy for International Fisheries Research

Summary

- Stagnant or declining fish catches in India necessitate an increase in the percentage utilisation of the catch in order to maintain levels of fish available for human consumption at current levels.
- Reducing losses in the processing sector during the monsoon season is one method by which this may be achieved. This may also improve the economic status of the fish processors involved.
- Post-harvest fish losses in India tend to be financial, where the fish does not earn its full potential revenue, as a result of poor handling, preservation and storage.
- Research needs to be clear on the type of loss referred to and on those involved in the sector who are affected by losses. Identification of stakeholders in the fish processing sector is important for helping to identify who will be the gainers and losers from interventions in the sector.
- A full understanding of the reasons why losses are occurring in the processing sector is needed.
- Identification of market opportunities for increased production and improved quality of processed fish is important if such improvements are to be one result of the project.
- The long term future of the fish processing sector needs to be considered in the light of declining fish catches, increasing exports of fresh fish and a shrinking residual market of fish available for processing.
- Possible interventions in the sector will not be considered until Year 3 of the project. Effects of intervention on the price of the final product should then be taken into account.
- Proposals for technical interventions should be subject to cost benefit analysis, and socio-economic factors such as availability of credit for purchase of the new technology, economies of scale in operation, seasonality of usage of the technology and labour availability need to be considered.

1. Introduction

The first Activity of the Project, “Understanding Wet Season Post-harvest Fish Losses in the Traditional Marine Fish Processing Sector in India”, is the completion of a desk study which collates secondary data on losses and the socio-economic aspects of Indian fisheries. A literature search on post-harvest fish losses in the monsoon season by Dr Sudhakara and Dr Srikar of the College of Fisheries, Mangalore in 1996 was used as the starting point for this study.

Secondary data sources in the UK on fish losses were few, with most research concentrated on the “dangers” of intervening in the post-harvest sector. The information found was used to complete a paper for presentation at a Workshop in Madras (26 - 28 February 1997) where representatives of various organisations involved in the fish sector in India were brought together to discuss the objectives and methodology for the research study. At this Workshop, a request was made for further secondary data suggestions, but none were forthcoming.

During the two weeks 3 - 15 March 1997, visits were made to potential research sites in Orissa and Kanyakumari, and institutions and individuals consulted regarding further secondary data sources on post-harvest fish losses. A list of these institutions and individuals is given as Appendix 1.

The additional information gained during the visit to India has been added to the Workshop paper and it is that which is presented here as a desk study. References used in the text are given at the end of the paper, and additional material consulted is listed as Appendix 2.

The study has two objectives; to review secondary sources of data on post-harvest fish losses in the monsoon season, and to act as a guide to data collection in subsequent stages of the project. After an outline of the Research Problem, the first section of the paper considers the type of fish loss suffered in the processing sector, the persons affected by that loss and the reasons why losses may be occurring. The second section looks at the market for fish, particularly processed products, as the market needs to be able to absorb any production improvements as a result of the project. Lastly, the question of interventions in the sector is considered and some suggestions made for research considerations in Year 3 of the project.

2. The Research Problem

According to the 1995 Strategy for Post-harvest Fisheries Research in Asia report (NRI/SIFR 1995) “fish catches are stable or declining and therefore losses must be reduced and the utilisation of landings must be increased, primarily in order to increase the consumption of fish protein by the populations of the countries concerned”. A declining fish catch in Kanyakumari district, southern India, was frequently referred to by local fisherfolk during the recent NRI/Mangalore visit, and this phenomena has previously been referred to by J Kurien (1982), when writing about the state of Kerala, “In 1973, Kerala had the highest recorded fish catch ever - 448 000 tonnes. From that peak there has been a secular decline until 1980 when the landing reached a trough of 279 000 tonnes, the lowest since 1961”, and “93% of the fishermen interviewed in an all-Kerala sample survey indicate “declining fish catch” to be the most disturbing trend in the fisheries sector”.

In order to maintain the quantity of fish available for human consumption at present levels despite a stagnant or declining supply, it becomes necessary to increase the percentage of the current catch which can be made available for consumption purposes. One way to do this is to reduce the losses occurring in the fish processing sector, especially during the monsoon season when fish drying is particularly difficult. By doing this, the consequences of a declining fish catch can be tackled, as well as improvements made to the economic status of those persons involved in drying activities.

If the problem of fish loss is to be addressed, a full understanding of the current situation is needed detailing the size and nature of the losses, the reasons for losses and the perceptions of those affected by losses. This information will form Outputs 1 and 2 of the current project. If this research demonstrates that post-harvest losses during the monsoon season are a significant problem in some areas, interventions to alleviate these losses will be defined and tested as Output 3.

3. Fish Loss and the Processing Sector

Defining “Fish Losses”

The starting point for a project which seeks to understand “Wet Season Post-harvest Fish Losses in the Traditional Marine Fish Processing Sector in India” should be to define the type of loss which might be occurring in the processing sector. It was reported (John Kurien, CDS, pers. comm.) in India that very rarely does any fish actually get thrown away (physical loss). In a society with large numbers of poor urban consumers, all qualities of fish can find a market if offered at the right price. Fish which does not find a market with consumers can be sold for fish meal processing.

T Bostock (1987) referring to the situation in Gujarat writes, “In Gujarat itself, net physical losses caused by poor handling, processing and spoilage are not considered to be of great significance in fish which is destined for human consumption..... Nutritional losses are also unlikely to be significant in fish for human consumption....”, but “As a result of a combination of handling and socio-economic factors, fish tend to be downgraded into lower value categories. This results in economic losses throughout the industry and at all levels of operation which are likely to be extremely important”.

Thus rather than physical loss, it is the financial loss, where the catch does not earn the revenue which it could as a result of poor handling and a lack of effective means of preservation and storage, which is significant for this research project. T Bostock (1991) writes, for example, “high value fresh fish such as seer landed in poor condition fetching on average 20% less than their top quality iced brothers; stored dried fish which is infested with dermestid beetles and larvae may attain only 25% of the value of best quality dried fish”.

In undertaking fieldwork for the study, the term “loss” needs to be used with caution. While the researcher may define a loss as the difference between the maximum potential revenue and revenue actually received, the processor may not recognise that a “loss” has been made so long as the fish has been sold and some revenue has been received.

During fieldwork, it needs to also be recognised that what is a “loss” to one person may be a gain to someone else. Identification of stakeholders in the fish processing sector is important. This may be done through defining the distribution chain either side of the processor during the exploratory research so that in the later fieldwork, case studies of interested parties may be used to highlight the gains and losses to be made through changes in the processing sector.

While the obvious gainers from a reduction in losses during processing may be the processors themselves, the losers may be the poorer consumers who previously purchased lower quality dried fish, and the fish meal processing plants which were able to purchase that dried fish which was not fit for human consumption. A detailed description of the loss to these stakeholders, gained through case study analysis, should be weighed against the potential gains to processors.

Quantifying Losses

NRI has recently developed methodologies for quantifying post-harvest fish losses and these methods are to be used in the current project to gain a good understanding of loss levels. The methodologies were recently used by Ward et al (1996) researching the marketing chain for fish between Visakhapatnam and Madras. They found, for example, that approximately 90% of fish arriving at the Visakhapatnam auction market is of good quality. The remaining 10% is of poorer quality. Of the seer fish arriving at the market, 30% is in poor condition and is sold for between 45 and 75% of the price of good quality fish. This is salted and sundried.

In Chatrapathi Shivaji Maharaja market in Bombay they were informed that out of the total amount of fish brought to the market, 5 - 6% is downgraded for salting. In general terms, the fish that is downgraded for salting is sold for 50% of the best quality price. The degree of downgrading varies according to season, with a higher percentage of downgrading occurring in the summer months.

Research for the current project needs to provide season-specific data in order to demonstrate the significance of losses during the monsoon season. Processors should be able to give information on losses at different times of the year.

Reasons for Loss

It will be important during the exploratory survey to identify the reasons why losses are occurring in the monsoon season in the individual research sites. This understanding is needed to judge whether anything can in fact be done to help alleviate the losses.

One reason for losses is the case of the small-scale processor who purchases fish which she is then unable to sun dry because of the rain. Some estimate of the frequency of this event should be made during the exploratory research. It could be that loss on some days is a part of the coping strategy during the monsoon season, and that this loss is compensated for on days when the weather is suitable for drying.

Another reason for losses during the monsoon season, referred to during a visit to SIFFS and in personal communication with Paul Calvert, is the case of bulk landings of anchovy. When this happens, landed quantities are so large that there is neither the market for fresh consumption nor the capacity for processing before the fish begins to deteriorate. The fishermen are adversely affected if they are unable to sell everything that is landed and a physical loss may result if some of the fish has to be discarded.

Although a serious problem when it happens, bulk landings of anchovy may only occur three or four times during the monsoon season. Any proposal for intervention to alleviate the problem would need to compare the costs of intervening with the expected gain from processing a larger quantity of fish three or four times in the season. If a technical intervention was being considered, the sheer size of a bulk catch would necessitate a large throughput capacity, and it is unlikely that it would be

economically efficient to invest in a large piece of equipment which can only be used to full capacity on a very limited number of days in the year¹.

This demonstrates the importance of gaining a full understanding of the reasons why losses are occurring, the frequency with which they are occurring, and an estimate of the size and financial value of losses in the exploratory and case study stages of the research project. Without complete knowledge about the nature and extent of the problem, it becomes impossible to suggest practical and economic solutions.

Species and Quality of Fish Used for Processing

As background information, the exploratory study should investigate which species and qualities of fish are processed in the research sites. Work on this to date is very location specific: Gordon (1990) states that dried anchovy and ribbon fish are the most important cured fish in Kanyakumari in terms of volume, whereas in certain areas there are markets for speciality products, such as brined ray in the hilly regions of inland Kerala. In Gujarat, Poulter and Walker (1986) refer to Bombay duck and ribbon fish making up a large proportion of the cured total, with Elasmobranch fish also making up a significant proportion. For Andhra Pradesh and Orissa, ODA-BOBP (1995) list the following fish as being processed by different techniques:

Salt drying	Ribbon fish, cluepid, mackerel, sardine, croaker Other economically valuable varieties when spoiled
Drying	Anchovy, bombay duck, by-catch
Wet salting	Ribbon fish, cluepid, sardine, mackerel, croaker
Smoking	Mullet, mudskipper, eel, shrimp

¹ This issue is discussed further in the section on “Experiences with Technical Interventions in India”, later in the paper.

4. Markets for Fish Products

Identification of the current markets for fish products coming from the sites selected for the current research project is important, as these could be the target markets for any quality or quantity improvements as a result of the project. If these markets are already saturated with products of an acceptable quality, it may be necessary to look elsewhere to ensure sales. There is little point in increasing output or improving quality if there is no end market for the product.

During discussions at SIFFS in Trivandrum during the recent visit to India, an interesting pyramid structure to the demand for fish in India was referred to. At the top of the pyramid high value fish such as seer used to be found, mainly consumed by the higher income sectors of the Indian community. Now much of this higher value fish is exported, so there has been an upward shift in species demand. Those species which used to be consumed by middle income consumers are now increasingly consumed by those at the top of the income scale, and are thus fetching a higher price in the markets.

This means that at the bottom end of the market, even species not previously used for human consumption, or not consumed fresh, are finding a market in the fresh form. Hence, there is less fish available for processing. Those poorer consumers who formed the main market for dried fish, are increasingly turning to the consumption of chicken, production of which is rapidly increasing in India.

Hence, when speaking to processors during fieldwork for the exploratory studies, it is necessary to gain an understanding of the trend in recent years in fish availability for processing. Proposals to intervene in the processing sector would need to take account of any decline in fish availability because of changes in the structure of the fresh fish market. Certain interventions may not be economically viable in the long run.

Information on current markets for processed fish in India can be collated from different literature sources. Mangaly (1983), gives an idea of the general distribution of demand for different dried fish species through India; “the market for salted shark is prominent in the hilly regions of Kottayam, Idukki and Ernakulam districts, while dry anchovies and ribbonfish are consumed mainly in Trivandrum and Quilon districts. Sardines and mackerels in the dry form enjoy extensive markets in Wynad district and in and around Gudalar in West Tamil Nadu”.

ODA-BOBP (1995) found that “salt-dried fish and dried fish are mainly consumed by tribals in the hinterland of AP and North Orissa. These markets accept lower quality products, and provide profitable outlets for produce that cannot be sold elsewhereSmoked fish is mainly consumed in the Godavari areas of AP, and wet salted fish in South Orissa (tribal markets) where it is considered a substitute for fresh fish”.

The major wholesale markets for processed fish in AP and Orissa are (ODA-BOBP 1995):

AP	Salt-dried, wet salted and dried fish	Nakkapalli, Kakinada, Davaleshwaram, Tadepalligudam, Renigunta
	Smoked fish	Amalapuram, Ambajipeta
Orissa	Wet salted, salt dried and dried	Humma, Rajshunakalla, Bhadrak, Remuna

Gordon, working in Kanyakumari district (1990), found that, “In terms of volume, dried anchovy and ribbon fish are the most important cured fish. These long shelf life products are distributed through complicated networks of dried fish merchants, to the most remote inland parts of India, finding a large dispersed market among low income groups in urban and rural areas. In certain areas, there are markets for speciality products: for instance brined ray finds a market in the hilly regions of inland Kerala.

Prices paid for dried fish products depend on fish type, sand content, and quality of drying. Whilst traders will discount for excessive sand, anchovy dried on the sand is said to have a desirable mildly cured flavour. Anchovy caught with shore seines are preferred to gill net anchovy, which tend to lose their heads”.

For Orissa, the ODA-BOBP IMM Post Harvest Overview states that, “Sardines, small prawns and ribbon fish are particularly popular as a dried product. There is demand for dried fish products amongst local consumers and those in other states. Good quality dried fish is not considered readily available and often contains varying quantities of salt, sand and dust”.

Regarding fish meal, “Dried fish is normally utilised by fishmeal production plants. Within Orissa there is a capacity of 9 mt per day. The species utilised include the lower value species from shrimp by-catch and any other spoiled fish”.

The same report for Tamil Nadu states that, “There is a large demand for small, low value dried fish such as anchovy, whitebait and small sardines. The quality of dried fish is variable and often contains varying quantities of salt, sand and dust”.

In 1987 Coulter (Tropical Development Research Institute) made a visit to India to evaluate markets for improved quality dried fish products, to be made using improved technology. Market information showed that consumption of dried fish in the domestic market was declining as improvements in transport and handling allowed larger quantities of chilled fish to be marketed in inland locations. Consumers of cured fish tended to be poorer people living in areas where chilled fish was not accessible. They were not upper income people such as are likely to spend on improved quality products.

Coulter found that dried fish was consumed in all coastal states other than Gujarat. Kerala was the most important consuming state, where consumption mainly took place in hilly rural areas such as Kottayam. The north east states such as Assam, Nagaland and Meghalaya formed important markets for dried fish.

The report concludes that no opportunities existed for improved quality dried fish products, mainly because of the overall lack of demand for dried fish, the low income

profile of the typical consumer and the reasonably efficient operation of the dried fish industry as it then operated.

On a similar theme, research commissioned by NRI (Ann Gordon, Head, marketing systems economics), on the markets for quality dried fish products in the north eastern states of India has recently been undertaken by Catalyst Management Services in Bangalore. The results of this study should prove interesting for the current research project; size of the market in the north eastern states, potential for market expansion and current supply sources would be useful information if the current project seeks to increase dried fish output in the coastal zones.

5. Interventions

Discussion

The third Output of the research project is “Appropriate technical and/or non technical interventions for loss reduction defined and tested”. Although these will not be investigated until the third year of the research project, a few broad generalisations can be made at this stage on the “dangers” of intervening in a process, as stated in the literature. Methodology for investigating these issues should be developed in Year 3.

An intervention to reduce losses will function by either improving the quality of current output, and/or increasing the quantity produced. A quality improvement is normally associated with a price increase and perhaps the most significant question is that of who is ultimately going to bear this price increase. “Quality of fish is a highly subjective concept and there are not absolute measures. If fish does not represent a public health risk and is eaten by consumers it is surely of acceptable quality. The question therefore remains as to what extent development projects should become involved in upgrading the quality of fish thereby pricing them out of the market for the low income consumer”, (Poulter et al, 1988). Any intervention must consider what the price increase will be to the final consumer and whether this increase is affordable by the poorest consumers. Necessary price increases can be estimated from the expected costs of the intervention and market research can be used to show to what extent consumers will be willing to pay a higher price for a higher quality product.

If the intervention leads to increased volumes produced, then it is necessary that a market exists for this. It also requires the producer/processor to have up-to-date market information regarding latent demand so that production is directed to where it is most likely to sell.

Regarding potential market expansion, the evidence is not wholly encouraging. Gray (1996) writes that it seems to be the case that where fresh fish is available, dried and salted fish is not appreciated by consumers. Because of this, there is a possibility that demand for fresh fish will increase at the expense of dried fish, as infrastructure improves and its availability increases. Also, dried fish is seen in India as a low value product and is consumed by low income households. Higher income groups are not generally interested in dried fish.

Wood (1984), also comments that “There is a general preference for wet fish rather than cured products among the fish-eating communities of India.....fish which would in the past have been cured is now distributed in the wet form leading to a decline in curing activity in some of the traditional centres like Calicut”. However, he does go on to give support to the cured fish sector: “This change does not imply any decreased consumer demand for cured fish; in fact demand seems to be high in the areas where these products are traditionally popular.....cured fish is, and is likely to remain, a popular and inexpensive source of dietary animal protein in India”.

This illustrates the importance of locating those areas where dried fish is popular with consumers. “Dried fish does not meet with any appreciation in West Bengal” (BOBP/ODA 1992).

Technical Interventions: Socio-Economic Considerations

i) Cost benefit analysis

Any proposed intervention in the production of processed fish through the introduction of new technology must take account of whether or not processors will be interested in technology uptake. Cost benefit analysis should provide a financial forecast for the proposed technology over, say, a ten year period, taking into account the cost of the new technology, any change in product throughput and changes in price due to quality improvements. “In the absence of state compulsion or subsidy, demand for technology comes from operators who expect to profit by using it.....If the apparatus would not profit its potential users, artisanal fish processors, then it would not be adopted” (Fegan, 1994). Cost benefit analysis should be undertaken at the start of technology development to avoid wasting time and money on equipment which is not likely to be taken up for financial reasons. Costs of technology can be estimated at the design stage, likely throughput and costs of any inputs given, and potential revenue estimated.

ii) Market conditions

Market conditions have to be sufficiently favourable to allow the up-take of a new technology, in particular if the latter is going to be capital intensive and comparatively large-scale. Hence an assessment of the market should include points such as, prices and how they will be affected by the new technology, and the size of the market segment potentially benefitting from reduced post-harvest losses. If prices for processed fish products were to go up, it would be important to establish to what extent consumers were prepared to spend more money on a better quality product.

iii) Availability of credit

Financial analysis in itself is not enough to predict the likely uptake amongst intended beneficiaries. Research should also look at the availability of credit for small scale processors, firstly for the initial capital investment, but also if the technology allows a greater throughput, for purchase of a greater quantity of fresh fish for processing. If credit is not available to small processors, it is more likely that they will lose out to larger processors who are able to afford the new technology and through buying fish in bulk, universally push up the raw material price. BOBP published a study on credit availability for marine artisanal fisherfolk in Andhra Pradesh and Orissa in 1995, and this work, particularly the references to current sources of credit, should form a basis for any further research specific to the area of credit for purchase of processing technology.

iv) Economies of Scale

Another area for research would be whether a certain size of operation is required in order to make uptake of the new technology viable. Small-scale processors are, by definition, small businesses and they may not wish to become involved in processing larger quantities of fish in order to justify technology purchase.

Alternatively, in theory, new technology may be adopted by groups purchasing together and then enjoying shared usage. It would be worth investigating whether there have been any successful attempts at purchase co-operation between fish processors in India.

v) Seasonality of intervention

More specific to this Project is the length of time each year when any interventions considered may be effective. If the intervention takes the form of improved technology, it is questionable whether the limited usage period during the monsoon will justify its purchase and economic annual use. It might be that the technology could be used to reduce losses in processing throughout the year, which could make its uptake financially more attractive.

vi) Labour input

Labour input to operate any new technology also needs to be considered. If the intervention is more labour intensive than current production systems, it is necessary to look at whether the processors are able and willing to spend more time on this activity or whether competing labour demands take precedence. Research in the first two years of the project should identify exactly who in the household is responsible for fish processing and the length of time spent on this activity.

Experiences with Technical Interventions in India

i) ODA-BOBP has had some success with the development of drying racks for anchovy in southern India. These were developed in response to the problems suffered by the Kanyakumari fishing communities as a result of large anchovy landings during the south west monsoon which could not be dried easily. While the cost of the improved technology would probably not be acceptable to local consumers in terms of higher prices for the dried product, there was potentially a market in Sri Lanka for increased exports of a higher quality product.

ii) ITDG / CAT unsuccessfully attempted to develop a tray dryer for anchovy in the Kanyakumari village of Manakudy in 1987/88. This would really only be useful if a glut landing on one day coincided with a rainy day the next day so that the fish could not be sun dried. However, if this did happen, the dryer was not large enough to cope with the size of the landings, and to develop a larger dryer which could cope would not be feasible given its usage would be limited to the three or four times a year when these glut landings occurred (Paul Calvert, personal communication). In addition to this, at the time the dryer was developed, landings of anchovy off the west coast of India seemed to be in decline anyway.

iii) Discussions at SIFFS, Trivandrum, suggested that the south eastern coast of India currently has large landings of sardine but as these are relative newcomers to these waters, there is no tradition of processing in the south eastern villages. Thus while not an “experience” with technical interventions as such, it was suggested that the processing techniques of the west coast, where there has been a tradition of large sardine landings, should be transferred to the east coast. An example could be the production of sardine oil - there is a market for this in India, and the by-products from production could be used by the fish meal plants along the east coast.

Marketing interventions

Marketing interventions could be used either instead of or alongside technical interventions in order to improve the overall percentage of the fish catch delivered to the consumer.

i) Improvements to the marketing infrastructure

Improvements to the marketing infrastructure may enable a greater proportion of fresh fish to reach consumers in more distant locations, thereby reducing the need for fish processing. This however, would have a negative impact on fish processors who would find less fresh raw material available for purchase. However, an adequate marketing infrastructure would also be necessary for delivering increased supplies of processed fish to consumers.

ii) Expanding markets for processed fish

The proposed research could investigate the potential for expanding markets for dried fish. Market research by a company MARG for BOBP/ODA in 1991 suggested that while consumers like the taste and convenience of dried fish, they may be embarrassed about admitting this. This was attributed to the poor status value associated with its consumption and partly because of its negative properties, such as its strong, often unpleasant smell, excessive salt content and poor quality. The MARG report identifies a need to make available good quality dried fish which may then be marketed by putting particular stress on the more expensive varieties of dried fish. This may then become more attractive to higher income consumers.

6. Conclusions

The paucity of secondary data on the problem of post-harvest fish losses in India during the wet season highlights the need for a thorough exploratory survey to be carried out in the first phase of the project in order to identify and describe the nature of the problem, the persons affected by the event, and the main locations where post-harvest monsoon losses are significant.

Possible interventions in the sector are not to be considered until the third year of the project and researchers must keep an open mind about the direction and future of the research in these next three years. It is important not to raise hopes in the study sites for outcomes which the project will not deliver. A complete comprehension of the current situation is needed before deciding on the best way forward.

While research in the exploratory stage is to focus on the processing sector, the importance of the market as the means of exchanging goods for cash must not be neglected. A product for which there is no market has very little value.

Although the main outcome of the exploratory stage will be primary data collected from key informants in the study sites, researchers should not ignore the value of secondary data identified while these studies are being undertaken for supporting the fieldwork research findings.

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Appendix 1 Organisations Visited and Individuals Consulted

Libraries visited

Centre for Development Studies (CDS), Trivandrum
South Indian Federation of Fishermen Societies (SIFFS), Trivandrum
Programme for Community Organisation (PCO), Trivandrum

Individuals Consulted

Satish Babu, SIFFS, Trivandrum
Paul Calvert, consultant engineer, working for ITDG, Trivandrum
Ms Kalavathy, consultant socio-economist, Madras
John Kurien, Associate Professor, CDS, Trivandrum
Mrs Vijayan, consultant socio-economist, Trivandrum

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