UNDERSTANDING AND REDUCING LOSSES IN TRADITIONAL FISH PROCESSING IN INDIA

A BRIEF SUMMARY OF WORK CARRIED OUT IN KERALA, TAMIL NADU, ANDHRA PRADESH AND ORISSA DURING 1997-2000 AS PART OF A COLLABORATIVE RESEARCH PROJECT BETWEEN THE NATURAL RESOURCES INSTITUTE, UNITED KINGDOM AND THE COLLEGE OF FISHERIES, MANGALORE, INDIA.

JUNE, 2000

CONTENTS

This report is an output of a research project funded by the United Kingdom Department for International Development (DFID). This report has been prepared by Dr. Mohan Joseph Modayil, Country Coordinator for distribution during the dissemination meetings with the Department of Fisheries and other governmental and non-governmental agencies during June 2000.

Summary

Using participatory and formal research methods, the DFID Post-harvest Fisheries Research Programme Project " Monsoon Season Post Harvest Losses in Traditional Fish Processing in India" has produced a comprehensive understanding of traditional fish processing in south India and the post-harvest losses incurred by small-scale fish processors during the monsoon.

The project found that 95% of small-scale processors in Andhra Pradesh and Orissa are women. And that 17% of processors are single woman who head the household. They are widowed or have been left by their husbands. Many processors employ working capital of Rs. 500 – 3000 with some employing less than Rs. 500. They typically salt dry and/or sun dry fish. And 99% produce fish for human consumption.

During the monsoon season processors incur both physical and quality (selling at reduced prices) losses. The three main reasons for loss are:

- Fish in brine becomes infested with maggots
- Fish being dried is drenched in rain and washed away/lost
- Fish is drenched in rain and cannot be re-dried and becomes infested with maggots

Most processors see these losses as a normal part of business.

Assuming all small-scale processors incur loss, it is estimated that the overall monetary loss to small-scale processors in Andhra Pradesh is between Rs 30,000,000 and Rs 187,000,000 per monsoon and in Orissa the figure is between Rs 570,000 and Rs 37,000,000.

State	Number of Processors	Loss Per Processor (Rs)	Macro Loss per Monsoon (Rs)
Andhra Pradesh	50,000	600 – 3750	Rs 30 – 187 million
Orissa	5,500	104 – 6750	Rs 0.5 – 37 million

The overall monetary loss represents a loss in potential income to small-scale processors as a whole. Some of this loss will be met by borrowing at high rates of interest.

Once a technical and socio-economic understanding of processors and processing and losses was established the project, in partnership with small-scale processors, field tested a number of interventions designed to reduce loss, improve income or reduce risk during processing. The following seven

interventions were identified as having positive benefits to processors. These appropriate technical ideas should be considered for wider promotion to small-scale fish processors in Orissa and Andhra Pradesh.

- Cleaning vats with bleaching powder to reduce contamination of brine and spoilage/infestation of fish
- Gutting and washing fish after gutting to reduce spoilage of fish and brine
- Testing brine concentration to optimise the use of salt and the brining process
- Keeping fish submerged in brine using frame to reduce maggot infestation
- Use of heavy lids for covering vats to reduce contamination of brine and maggot infestation
- Drying fish on mats, stackable racks to reduce drenching by rain
- Increasing drying speed to maximise limited available drying time

The research found that cleaning vats, submerging fish in brine and the lids for covering vats were found to be particularly beneficial by processors. Processors perceptions were that these ideas reduced maggot infestation and produced better quality products which sold more quickly in the market.

1. BACKGROUND

During 1995,the Overseas Development Administration (ODA) (now DFID) of the British Government conducted a workshop in Chennai under the leadership of Dr. John Ryder, ODA, to validate the findings of a participatory rural appraisal and needs assessment study carried out for ODA by Dr. Mohan Joseph of the College of Fisheries, Mangalore. The participants felt that the monsoon season losses of fish reported as a major problem for the fishers of south India must be further studied and suitable mitigation measures identified. A concept note was prepared and submitted to ODA for follow up action. Consequently, Mr. Ansen Ward, the Project Leader, of the Natural Resources Institute (NRI) , Chatham, U.K. visited India during June 1996 to discuss with the College of Fisheries, Mangalore and the Central Institute of Fisheries Technology, Cochin to chalk out a research project for carrying out a study on monsoon season losses in India. The project proposal was accepted for funding by the Department for International Development (DFID) of the British Government. The Project was termed " Monsoon Season Post Harvest Losses in Traditional Fish Processing in India" and the College of Fisheries, Mangalore officially signed in as the Indian collaborating institution. The collaborating Indian scientists are Prof. Mohan Joseph (Country coordinator), Mr. N.S.Sudhakar and Dr.L.N.Srikar, from College of Fisheries, Mangalore.

2. ABOUT THE PROJECT

The primary beneficiaries of the research are seen as small-scale processors (SSPs) – those processors who can afford to only use small amounts of working capital and who are seen as the more vulnerable of fishing communities. The project has tried to work with such processors and the data generated refers to this group. The Project has produced a comprehensive understanding of traditional fish processing in south India and the post-harvest losses incurred by small-scale fish processors during the monsoon. The second major output of the project has been the identification of appropriate interventions, which can assist small-scale processors reduce loss and risk during the monsoon season.

The project commenced during the south west monsoon season of 1997. The research methodology combined informal research techniques which yielded qualitative data, with a formal survey which provided key quantitative data.

There were four phasess: an initial exploratory phase, a focused case study phase, an intervention phase and a final dissemination phase. The exploratory study was carried out in two sites each in Kerala, Tamil Nadu, Andhra Pradesh and Orissa during June-August, 1997. The focused case studies were carried out in Kerala, Andhra Pradesh and Orissa during the monsoon of 1998. The field testing of selected interventions was carried out during the monsoon of 1999 at three sites each in Andhra Pradesh and Orissa. Table 1 shows the communities that were involved in the research. College of Fisheries Scientists formed the core of the fieldwork teams. They were supported by a number of independent consultants such as those from M/S. Catalyst Management Services, Bangalore and Integrated Marine Management of Kakinada. Table 2 shows the key people and organisations involved in field research.

Throughout the project a number of monitoring and evaluation workshops were held. These were attended by fisheries development specialists from both public and private organisations such as Central Institute of Fishery Technology, DFID Post-harvest Fisheries Project, Departments of Fisheries, consultancy companies and NGOs.

3. LOCATIONS

Table 1 Research Locations and Communities

STATE\ PHASE	EXPLORATORY	CASE STUDIES	INTERVENTIONS
KERALA	VIRUNDUKANDI PUTHIYAPPA	PUTHIYAPPA VIRUNDUKANDI	-
TAMIL NADU	KUTHENGULY COLACHEL	-	-
ANDHRA PRADESH	JAGGARAJPETA- SUBBAMPETTA DANAIPETA	JAGGARAJPETA SUBBAMPETA	MAYAPATINAM KONAPAPAPETA CHODIPILLIPETA
ORISSA		CHANDRABHAGA	CHANDRABHAGA BALI PANTAL NEW BAXIPALLI

4. TEAMS

Table 2. Research Teams and Organisations

PHASE\ TEAM	COLLABORATING SCIENTISTS	CONSULTANTS	OTHERS
EXPLORATORY	Dr. Mohan Joseph (CoF)	Mr. Shiv Kumar (CMS) Ms. Jyothi D'Cunha(SSW)	Mr. Binod Mohapatra Mr.Sreeramulu (DoF,AP)
CASE STUDIES	Mr. N.S.Sudhakar (CoF)	Mr.Shiv Kumar (CMS) Ms. Gomati (Consultant)	Mr. Sreeramulu (DoF,AP)) Mr.Narendranath
PARTICIPATORY PLANNING	Dr. Mohan Joseph (CoF)	-	-
FIELD TESTING INTERVENTION:	Mr.N.S.Sudhakar (CoF) Dr.L.N.Srikar (CoF)	Mr. Venkatesh Salagrama (ICM)	Mr. Sreeramulu(DoF,AP) Mr.Lachaman Nayak(CPDA) Mr. Binod Mohapatra Mr. Sreerama Murthy (FIRM) Mr.Prasad (ICM) Mr.Jayaraju
MONITORING	-	-	Mr. Sreeramulu (DoF,AP) Mr. Lachaman Nayak(CPDA) Mr. Binod Mohapatra
EVALUATION	-	Ms. Meera Sundararajan (Consultant)	

Key: CoF:College ofFisheries, Mangalore; ICM:Integrated Coastal Management, Kakinada; DoF,AP: Department of Fisheries, Andhra Pradesh; CPDA: Coastal People's Development Association, Konark; SSW:School of Social Work, Mangalore; FIRM: Forum for Integrated Rural Management)

5. TRADITIONAL FISH PROCESSING AND POST-HARVEST LOSS DURING THE MONSOON

The project found that 95% of small-scale processors in Andhra Pradesh and Orissa are women. And that 17% of processors belong to households with no adult male member; i.e. woman-headed households. These women are typically either deserted by their husband, widowed or the husband has neglected the family due to problems such as alcoholism. Without men to engage in fishing, women-headed households are cut off from the most important source of income and food available to their communities. Women-headed households are particularly vulnerable, and heavily dependent on fish processing and fresh fish trading.

The average length of time that processors have been processing is between 12 and 19 years.

Working capital employed by 72% Small Scale Processors (SSP) is in the range Rs. 500 – 3000 (1999 prices). Overall 22% , employ less than Rs. 500 as working capital (1999 prices). Only 6% use more than Rs. 3000.

Over half of all SSPs (55%) derive incomes from all three (fish-related) activities – fishing (through men) and processing & fresh fish trading (through women). See Table 3. Involvement in ***only fishing or trading alone*** is rare, 11% of SSPs are involved in ***only fish processing*** Fish processing and fresh fish trading are very important to all SSPs, and critical to SSPs from women headed households. (Fishing is open only to households with male members old enough to go to sea)

Table 3 Main Sources of SSP income

Fishing	Processing	Trading	Agricultural labourer	Other Labour	Own Agriculture	Count
Yes	Yes	Yes	Yes	No	Yes	2
Yes	Yes	Yes	Yes	No	No	40
Yes	Yes	Yes	No	Yes	No	1
Yes	Yes	Yes	No	No	Yes	3
Yes	Yes	Yes	No	No	No	88
Yes	Yes	No	Yes	Yes	Yes	1
Yes	Yes	No	Yes	No	No	3
Yes	Yes	No	No	No	No	23
Yes	No	Yes	No	No	No	1
Yes	No	No	No	No	No	1
No	Yes	Yes	Yes	No	No	8
No	Yes	Yes	No	Yes	Yes	1
No	Yes	Yes	No	Yes	No	8

No	Yes	Yes	No	No	Yes	1
No	Yes	Yes	No	No	No	31
No	Yes	No	Yes	No	No	3
No	Yes	No	No	Yes	No	1
No	Yes	No	No	No	Yes	1
No	Yes	No	No	No	No	25

24% of SSPs obtain some income from agricultural labour and 5% from other types of labour.

Processors in Andhra Pradesh had and overall annual household income range of from Rs 10,800 to Rs 51,000. Per capita income ranged from Rs 7000 to Rs 16,600. Processors in Orissa had a total annual household income of between Rs 8,800 and Rs 41,000. Per capita household income is between Rs 1,700 and Rs 23,000.
Monsoon is typically a deficit season. Four of the six SSP families interviewed in Andhra Pradesh face deficits in the monsoon, in spite of other incomes. Typically, these deficits are covered by savings (in other seasons) or loans.

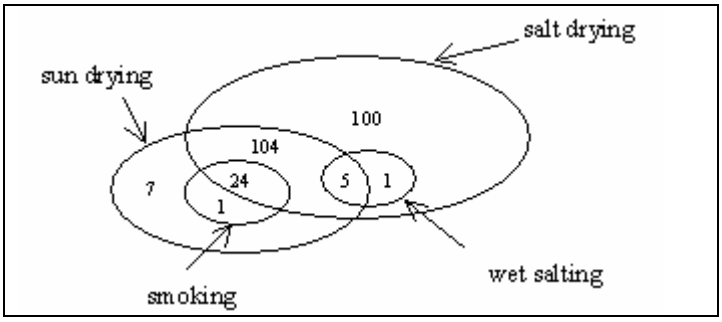
Of the five families interviewed in Orissa, three borrow from year to year, with interest mounting. They look for windfalls to make up for the loans. They regularly borrow to repay borrowings. All three were observed to be in a downward economic spiral.

Ways in which processors manage the deficits is to compromise on the food (quality and quantity), sending their children to orphanage, going on a long holiday to Andhra (home town) where they may have the support of other relatives and other earning sources.

Summer months tend to be financially difficult. Four out of five SSPs are deficit families during summer. Winter is the season for 'good' earning, repayment and saving. Monsoon months are in-between – some SSPs are just able to meet both ends and a few others earning in excess of expenditure. Some processors with surplus save using the daily saving route (Rs 10/day).

Small-Scale Fish Processing

Salt drying is the most common process, employed by 97% of SSPs, with 41% employing only salt drying. Sun drying is preferred next, employed by 58% of SSPs, with 3% employing only sun drying.Figure 1 shows the relationships between the four recorded methods for processing fish.

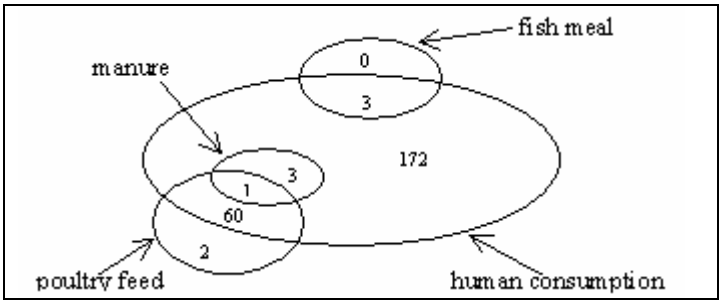


Sample size = 242

Figure1. Distribution of processing methods.

Smoking and wet salting are location-specific processes; employed where there is a demand for products of these processes. 10% and 2% of SSPs respectively reported using these processes.

The utilisation of the processed fish is described in Figure 2 .



Sample size = 241 (utilisation not recorded for one SSP)

Figure 2. Utilisation of processed fish.

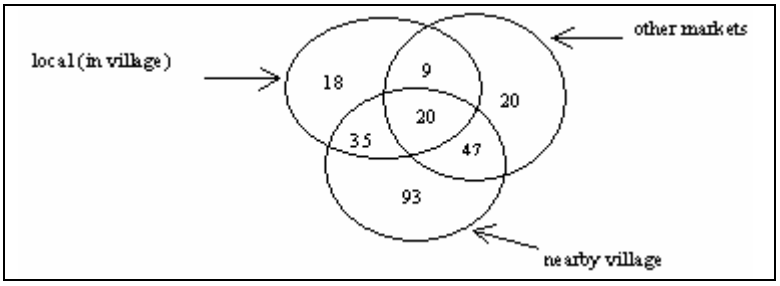
99% of processors process fish primarily for human consumption, 71% exclusively.

Fish is processed for poultry feed by 24% of SSPs, but only 3% use processed fish for fishmeal or manure. These three products are usually the result of lots gone bad or when raw material available/used is of poor quality.

Table 4 Frequency of processing amongst all the SSPs.

Frequency of processing	Number of households (241)
Daily	22
Once a week	46
Twice a week	55
Thrice a week	91
Less than once a week	27

Table 4 shows that 38% of processors process three times per week. 79% SSPs process between one and three times per week. All but 1 of the 242 SSPs interviewed processed fish during the last monsoon (1999).



Sample size is 242

Figure 3.Summary of SSPs Markets

Figure 3 shows that only 7% of SSPs sell ***all their*** produce within their own villages, but 34% sell at least ***some*** produce in their own villages. 93% of SSPs sell at least some produce outside their village, but 66% of processors do not sell produce in their village. 40% of SSPs sell in other markets (mostly in small towns), with about a fifth of these selling all their produce in such markets.

Types of Fish Loss

Small Scale Processors incur both physical and quality (selling at reduced prices) losses during the monsoon. Figure 4 shows the number of lots discarded and it is clear that most processors incur physical loss.

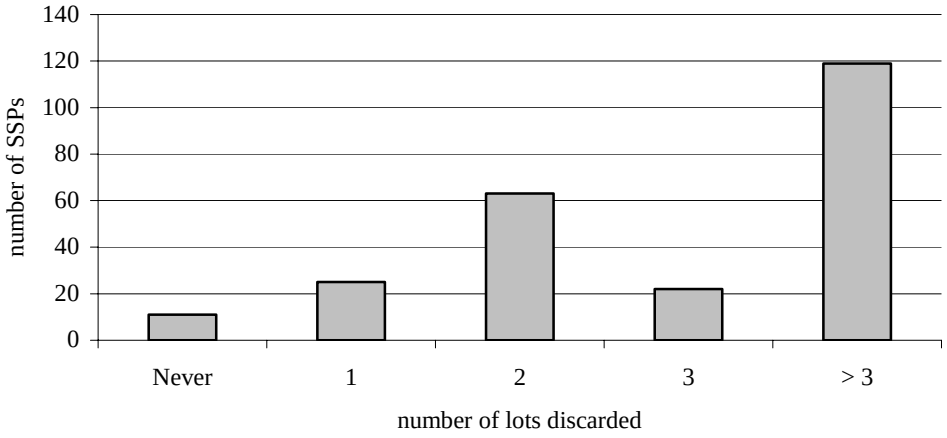


Figure 4.Number of lots discarded during monsoon

Table 5 summarises the types of loss, irrespective of processing method, which were identified by the project and which affect processors per se. The case

study data refers to small-scale processors only. The data clearly shows that physical as well as quality losses occurred at all sites during processing and/or afterwards, during storage.

Table 5. Types of Post-harvest Loss at Processing During the Monsoon

Site	Exploratory study		Case study	
	Quality	Physical	Quality	Physical
Virundukandi	Yes	Yes	Yes	Yes
Puthiyappa	Yes	Yes	-	-
Kuthenguly	Yes	No	-	-
Colachel	Yes	Yes	-	-
Danaipeta	Yes	Yes	-	-
Jaggarajpeta	Yes	Yes	Yes	Yes
Subbampeta	Yes	Yes	Yes	Yes
Chasndrabhaga	Yes	Yes	Yes	Yes
New Bakshipalli	Yes	Yes	-	-

Physical losses occur during processing, especially sun drying. Small pelagics which are usually sun dried are particularly susceptible to monsoon losses.

Rising demand for fish, stagnant/declining catches, better access to markets, availability of ice, increasing role of traders, especially large companies at the landing sites appear to have reduced physical loss over time.

All processors are aware of the fact that losses occur during the monsoon season. Most of them accept these as a normal part of business and think nothing much could be done to prevent losses.

Reasons For Loss

Seven causes of monsoon losses were recorded by the project and the combination of answers is summarised in Table 6.

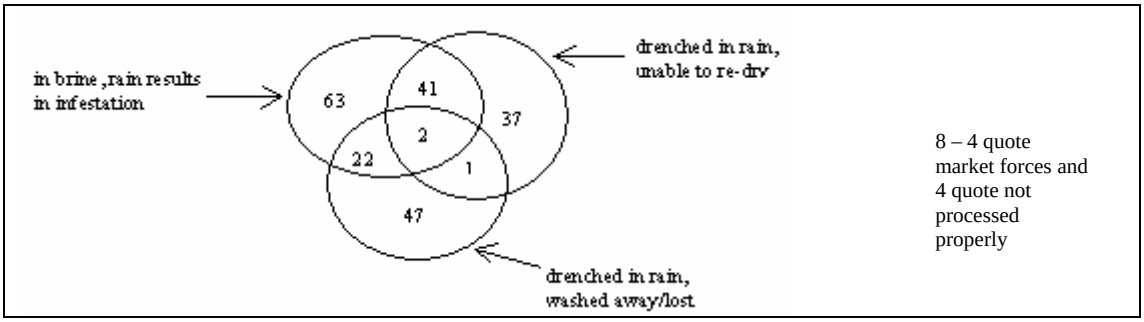
Table 6. Causes of monsoon losses

Material in brine, continuous rains resulted in	Material drying drenched in rain, washed	Material drenched in rain, unable to redry,	Material stored , infestation	Low quality material processed, infestation in brine	Market forces	Not processed properly	Count
Yes	Yes	Yes	No	No	Yes	No	1
Yes	Yes	Yes	No	No	No	No	1
Yes	Yes	No	No	No	No	No	22

Yes	No	Yes	No	No	No	No	41
Yes	No	No	Yes	No	No	No	1
Yes	No	No	No	Yes	No	No	1
Yes	No	No	No	No	No	Yes	1
Yes	No	No	No	No	No	No	60
No	Yes	Yes	No	No	No	No	1
No	Yes	No	No	No	No	No	47
No	No	Yes	Yes	No	Yes	No	1
No	No	Yes	Yes	No	No	No	1
No	No	Yes	No	No	No	No	35
No	No	No	No	No	Yes	No	4
No	No	No	No	No	No	Yes	4
No	No	No	No	No	No	No	21*
Yes = 128	Yes = 72	Yes = 81	Yes = 3	Yes =1	Yes = 6	Yes = 5	
No = 114	No = 170	No = 161	No = 239	No = 241	No = 236	No = 237	

* Note 13 of these SSPs did report monsoon losses, but gave no reason.

The highlighted rows give the most important combinations and the table can be summarised by considering a Venn diagram representation of the first three columns. (Figure 5)



Sample size is 221 (21 SSPs who came up with no reason are taken as non-respondents)

Figure 5. Venn diagram for combination of most important losses

Other, relatively minor causes of losses are:

- Adverse market forces
- Poor raw material leading to low-quality produce
- Insect infestation during storage

The implication of these findings for any intervention on the technical front is clear. Protection of material from rain and/or feasible alternatives to sunlight for drying could potentially reduce monsoon losses for 95% of the SSPs.

Frequency of Loss

The frequency with which processors reported sales at reduced prices is shown in Figure 6

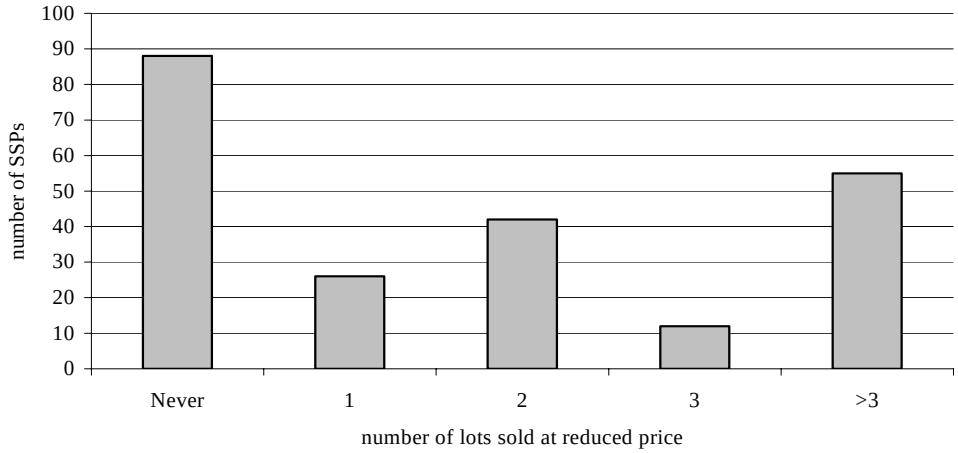


Figure 6 .Number of lots sold at reduced price during monsoon

During the case studies, it was found that ten out of thirteen processors interviewed had incurred post-harvest losses during the monsoon. The frequency of such losses were between 1 and 6 times during a season. Table 7 illustrates this point further.

Table 7. Loss frequency – Qualitative data

	Exploratory	Case studies
Site	Frequency of loss	Frequency of loss
Virundukandi	-	1-6
Puthiyappa	-	-
Kutheguly	-	-
Colachel	-	-
Danaipeta	3-4	-
Jaggarajpeta	4-5	2-6
Subbampeta	4-5	2-6
Chandrabhaga	1-2	-
New Bakshipalli	4-5	-

Variables That Affect Loss

The following is a list of the variables identified by the research, which influence the likelihood or level of losses.

Retail Door to Door

Processors who retail product door to door are more likely to discard material of the wrong quality in order not to sell poor quality product and risk losing customers.

Small Quantity

Processors incur lower losses when processing small quantities of fish. Handling small quantities is easier, especially moving them into shelter when it rains. Small quantities can be quickly disposed of if quality deterioration sets in.

Assistance in Processing

A woman processor has multiple roles. She is a mother, trader, processor, and takes care of household chores. The more help she has in processing or taking care of children, the more attention she can give to taking care of her fish and minimising the risk of loss. Therefore help from household members and/or neighbours can allow more attention to be devoted to processing and reduce the risk of loss.

Weather

The more sunny rain free days the less the chance of losses. If there is rain for more than 5–8 days loss is more likely. The greater the number of days of sunshine and clear skies, lesser the chances of losses.

Brining Time

Likewise the longer the fish remain in brine the more chance there will be quality deterioration and damage from maggot infestation.

Storage

The less time processed product spends in storage the less likely there will be losses. Shorter storage time reduces losses and risks. More the processor is inclined to check her stocks for quality deterioration (and take corrective action like adding more salt), lesser the chances of losses.

Raw Material

Poor quality raw material will increase the chances of loss.

Processing Method

Losses are associated with sundrying rather than wet salting, although losses occur in both processes. Sun dried varieties are more prone to losses than salt dried.

Processing for poultry feed and manure is less profitable, but also less risky.

Species

Specific species identified as loss-prone in monsoon processing are – sardines (41% of SSPs), ribbonfish (40%), mackerel (34%), anchovy (31%), croaker (24%) and mullet (23%).

Loss Levels

The loss levels incurred by small-scale processors showed variations. See Table 8 below.

Table 8. Loss levels – Individual Processors

Site	Product	Rs loss per Processor Per monsoon	% physical	% quality	% turnover
Virundukandi	Sundried Wet salted	230 - 2406	3	7	1-17
Puthiyappa	Sundried	211,000	10	50	20
Kuthenguly		Negligible			
Colachel	Sundried Wetsalted	2380	10		11
Danaipeta	Sundried	992			8.5
Jaggarajpeta	Sundried Wetsalted	600-3750	10		
Subbampeta	Sundried Wet salted	600-3750	20	50	
Chandrabhaga	Sundried Wet salted	104-4000	10	50	6-31
New Bakshipalli	Sundried Wetsalted	6750			

Extrapolation of Data from Micro to Macro Level

An analysis of quantitative survey data shows that for every 10 active fishermen in Andhra Pradesh and Orissa, there is one small-scale processor. Because no secondary data was available to the project on number of processors and number of marine fishing villages this ratio was used to calculate the number of small-scale processors in each State. Based on the ratio, the project estimates that there are approximately 50,000 small scale processors in Andhra Pradesh and approximately 5,500 in Orissa.

Using qualitative loss level data generated by the research (Table 8) it is estimated that the monetary loss to small-scale processors in Andhra Pradesh is between Rs 30,000,000 and Rs 187,000,000 per monsoon and in Orissa the figure is between Rs 570,000 and Rs 37,000,000. See table 9.

Table 9 . Extrapolated loss level data

State	Number of Processors	Micro Loss (Rs)	Macro Loss per Monsoon (Rs)
Andhra Pradesh	50,000	600 – 3750	Rs 30 – 188 million
Orissa	5,500	104 - 6750	Rs 0.5 – 37 million

The monetary macro loss represents a loss in potential income to small-scale processors as a whole because of post-harvest fish loss during the monsoon. The calculations assume that at all processors incur losses during the monsoon. Some of the loss will be covered by borrowing at high rates of interest or savings (see section on coping strategies below).

Coping Strategies

The research found that various coping strategies are used by the processors to minimise the losses as much as possible. These coping strategies are summarised in Table 10 , with the most important combinations highlighted.

Table 10. Coping strategies for monsoon losses.

	a	b	C	D	e	f	g	H	i	J	k	count
	Yes	Yes	Yes	No	No	No	No	No	No	No	No	6
	Yes	Yes	No	No	No	Yes	No	No	No	No	No	1
	Yes	Yes	No	No	No	No	No	No	No	Yes	No	1
	Yes	Yes	No	No	No	No	No	No	No	No	Yes	2
	Yes	Yes	No	No	No	No	No	No	No	No	No	61
	Yes	No	Yes	No	No	No	No	No	No	No	No	4
	Yes	No	No	Yes	No	No	No	No	No	No	No	6
	Yes	No	No	No	Yes	No	No	No	No	No	No	1
	Yes	No	No	No	No	Yes	No	No	No	No	No	2
	Yes	No	No	No	No	No	Yes	No	No	No	No	2
	Yes	No	No	No	No	No	No	Yes	No	No	No	5
	Yes	No	No	No	No	No	No	No	No	Yes	Yes	8
	Yes	No	No	No	No	No	No	No	No	Yes	No	5
	Yes	No	No	No	No	No	No	No	No	No	Yes	3
	Yes	No	No	No	No	No	No	No	No	No	No	52
	No	Yes	Yes	No	No	No	No	No	No	No	No	1
	No	Yes	No	Yes	No	No	No	No	No	No	No	1
	No	Yes	No	No	No	Yes	No	No	No	No	No	4
	No	Yes	No	No	No	No	No	Yes	No	No	No	2
	No	Yes	No	No	No	No	No	No	No	Yes	No	1
	No	Yes	No	No	No	No	No	No	No	No	No	34
	No	No	Yes	No	No	No	Yes	No	No	No	No	2
	No	No	Yes	No	No	No	No	No	No	No	No	2
	No	No	No	Yes	No	No	No	No	No	No	No	4
	No	No	No	No	Yes	No	Yes	No	No	No	No	1
	No	No	No	No	No	Yes	No	No	No	No	No	4
	No	No	No	No	No	No	Yes	No	No	No	No	3
	No	No	No	No	No	No	No	Yes	No	No	No	12
	No	No	No	No	No	No	No	No	Yes	No	No	1
	No	No	No	No	No	No	No	No	No	Yes	No	2
	No	No	No	No	No	No	No	No	No	No	Yes	2
	No	No	No	No	No	No	No	No	No	No	No	7*
Yes	159	114	15	11	2	11	8	19	1	17	15	
No	83	128	227	231	240	231	234	223	241	225	227	

* Only three of these SSPs reported no physical or quality loss

Key to columns

a	Made up in subsequent lots	G	Take up other work
b	Borrowed money	H	Brought in own money
c	Reduced turnover	I	Sold assets
d	Increased Turnover	J	Discount from fishermen
e	Stopped processing	K	Got credit facility
f	Pledged gold jewellery		

Making losses up in subsequent lots and borrowing money are the most common strategies. Of the 202 SSPs who use these two strategies, 88 make up loss in subsequent lots only, 43 borrow money only and 71 use a combination of the two. Nearly half (47%) of the sample report having to borrow to stay in business after suffering monsoon losses. 50% of the 42 SSPs from women headed households are also in the same situation. The cost of borrowing is high, and represents a heavy burden, especially on the poorest households.

6% reduce turnover and 1% cease processing, following losses. These are presumably households with no access to credit, very likely the poorest in the community.

5% are able to cope with losses by ***increasing*** turnover. 8% make up losses by infusing more capital from their cash reserves, 6% through institutional credit, 5% by pledging gold and other valuables, and 3% by taking up other work. Interestingly, some 7% report, being able to obtain discounts from fishermen from whom they buy fish.

Appropriate Technical and/or Non Technical Interventions for Loss Reduction Defined.

A project workshop in Chennai, March 1999 identified that simple interventions based on existing coping strategies and technical improvements to processors practices should be tested. The interventions should increase income to processors, reduce risk or reduce post-harvest losses during the monsoon.

Data showed that processors operate on low margins indicating that it will be difficult to successfully introduce expensive technical interventions.

An initial menu of possible intervention ideas was drawn up after the workshop (Table 11) based on:

- existing coping strategies
- processors socio-economic profile
- reasons for loss

Focus was on technical interventions rather than on socio-economic. This was a reflection of several issues. The historic focus of the DFID programme. The purpose of the project: to identify value addition and loss reduction measures. Also, the background and skills of the key researchers and the resources and time constraints of the project.

Table 11. Menu of Intervention Options

Physical Loss	Physical & Quality Loss	Quality Loss	Others
Hang fish in baskets to protect during storage	Correct quantity of salt	Improve aeration of fish during drying	Cut costs of production ie buy salt in bulk (groups)
	Use of mats to move fish out of rain quickly	submerge fish in bring	Pickles, cutlets
Improving fish collection during drying ie cot	Reduce drying time		Awareness of Govt savings schemes
	Low cost folding drying rack.		Appropriate packaging
Covering with nets (crows)	Changing brine more often		Sorting out valuable species (acetus/anchovies)
	Vigilance when drying		
	Plastic sheet to cover fish		
	Palm leaf f or drying		
	Adding extra salt		
	Covering vat with plastic sheet		

This initial menu was circulated to workshop participants for feedback.

Whilst the project had also worked in Kerala and Tamil Nadu it decided to focus the intervention phase in Andhra Pradesh and Orissa. Primarily because of the relative underdevelopment of communities surveyed in those states.

6. PARTICIPATORY INTERVENTION PLANNING

A Participatory Intervention Planning (PIP) exercise was carried out at with processing communities in Andhra Pradesh and Orissa. Meetings were held with small-scale processors in five villages in Orissa and in eleven fishing villages in Andhra Pradesh during April-May, 1999. During this exercise, the menu of intervention options was discussed with the community and their perceptions and views sought.

Table 12 shows the menu of internvetions used in the PIP exercise.

Table 12. PIP Menu

Intervention menu	Yes/ No	Reasons	Constraints	Appropriate, but do not appeal	Remarks
TECHNICAL					
Quantity of salt/ Brine concentration					
Improving drying speed by increased aeration					
Preventing maggot infestation					
Covering with plastic sheets, old nettings					
Storing near fire place					
Changing brine after 2 cycles					
Use of folding racks, mats, palm leaves					
Reduce time lag between capture and processing					
Improved shelf life by producing better dried fish					
Use of non insecticidal methods to prevent insect infestation					
Value addition through preparation of pickles, other items					
SKILL DEVELOPMENT					
Better handling practices					
Better hygiene and sanitation					
Entrepreneurship, skill development, group work culture					
Skill for preparation of organic manure					
SOCIO-ECONOMIC					
Group ventures(Buying and selling in bulk)					
Awareness of government schemes					
Alternate income options					
OTHERS					
Sharing transportation					
Supply of potable water					
Construction of drying platform					
Use of old nets for preventing animals/ pests					
Awareness of safe and natural insect					

repellents					
Waste disposal and environmental sanitation					

While some of the proposed interventions were attractive to the communities, others were rejected for various reasons. At the end of this exercise, a short listed menu was ready for each of the sites selected based on the willingness of the community to field test these interventions during the ensuing monsoon.

7. FIELD TESTING OF INTERVENTIONS

The shortlisted menu was field tested at three sites in Andhra Pradesh and three sites in Orissa . See Table 13.

Given the short period of time in which the trials were to be conducted, it was agreed that it would be difficult to generate reliable data on physical and monetary losses prevented – and for this reason the "willingness to adopt" would be used as an indicator of livelihood improvement. The improvement might be in aggregate income, or reduced risk, or less variable income, or in some other quality of life aspect (working conditions etc).

The objective of intervention field testing was:

"In partnership with small-scale processors field test appropriate interventions. Determine the willingness of processors to adopt the interventions. Assess the effect of the interventions on income, losses and risk alleviation. Identify lessons learnt and constraints to adoption at the micro and macro levels."

Table 13. Shortlisted Interventions For Field Trials

Intervention	Chand	Bali	NewBak	Mayapa	Konap	Chodi
Brine Concentration						
New Processing Methods						
Improved Drying Speed						
Prevention of Maggot infestation by keeping fish submerged in brine						
Covering fish/vats						
Changing brine						
Portable/stackable racks & mats						
Value addition						
Better handling practices						

Fieldwork to demonstrate and train processors in the nine intervention ideas at the six sites was undertaken during July 1999.

The team spent four to five days with processors in each of the six communities.

Whilst eight of the intervention ideas were specific, one intervention was less so – "better handling practices". In order to establish the improved practices, which may benefit small-scale processors, the team analysed the existing processing practices at each site and identified 'critical control points', at which

improved practices may lead to a reduction in loss, reduced risk or an increase in income. In addition to the other eight intervention ideas the following practices were also introduced by the team where appropriate:

- **cleaning vats using bleaching powder before starting a new processing operation**
- **treat seawater using bleaching powder and give adequate contact time for chlorination**
- **wash fish in treated water**
- **gut fish on plastic sheets**
- **wash gutted fish using treated water**

Once the team had left the site three processors continued to use the interventions, for two months. A monitoring procedure was established and regular visits to each site were made by one of the research team. These visits enabled follow-on support for processors and assessed whether interventions were being used.

8. **FIELD TRIAL EVALUATION**

During October, 1999 in Andhra Pradesh and January 2000 in Orissa, the Project carried out a n evaluation process through an independent consultant to find out the adoption of the interventions and to enlist the constraints, if any, for adoption of interventions. These results were discussed at a workshop held in March , 2000. The evaluation found that some of the interventions were immediately accepted and adopted by processors at the sites while other, although appealing, were not adopted for various reasons.

9. APPROPRIATE INTERVENTIONS

The Project has identified the following intervention ideas which could be promoted for uptake by the fisher communities in order to reduce losses and risks during the monsoon season in traditional fish processing.

Cleaning vats with bleaching powder

Most of the vats have heavy deposits of slime, bacteria and organic matter. The project tested the impact of thorough cleaning using bleaching powder. Processors found this very useful as it was a fast and effective way of cleaning and also resulted in keeping the brine clean without discoloration and foul smell reducing risk and quality loss.

Gutting and washing fish

Fish were gutted in order to avoid internal decay and further spoilage. The prevented fish from floating in the processing vats. Although most processors agreed on the advantages of gutting all fish, they felt that it is not practical to gut small varieties, especially when there are large quantities to handle. Larger fishes were gutted and washed afterwards to remove blood and other unwanted matter. They found this practice useful as it helped in keeping the brine clean for a second cycle, thus reducing the cost of salt used.

Testing brine concentration

The Project designed a simple field tool for testing brine concentration. A wooden egg (of the same specific gravity as that of concentrated brine) was made and provided to the processors. This egg sinks in dilute brine while it floats in concentrated brine. Many processors found this useful as it offered them a simple and fast method for checking brine concentration, helping reduce the risk of loss and optimise the use of salt.

Submerging fish in brine

Maggot infestation can be prevented if fish is kept submerged in brine. Full submerging of fish can be achieved by using a weighted frame made of locally available materials. This idea was widely accepted by the processors as they found this extremely simple and useful. Some processors started making their own versions of the frame using locally available materials in various sizes and shapes to suit their processing vats.

Use of lids for covering vats

Due to heavy winds, traditional covering for vats is blown off, rain water seeps in resulting in lowering brine concentration and spoilage of fish due to maggot infestation or decay. Seepage can be prevented by using an appropriate lid for the vats. The project designed a two piece cement lid with interlocking edge so that these could be used for covering the vats. The lids could be easily removed for access to the vat's interior. The

processors found this very effective in maintaining brine concentration thus reducing the risk of loss. Some processors felt that the lids should be made lighter.

Drying fish on mats, stackable racks

Sudden and unexpected rains are characteristics of the monsoon and when these happen, the processors have to rush in to the rain to prevent the partially dried fish from getting wet. Quite often, such efforts result in getting the fish wet and spoiled. This can be prevented by using a stackable rack or mats which could be easily carried indoors in case of sudden rains. The Project designed small easy to transport racks which could be stacked one over the other in case of rains and kept either covered by plastic sheets or carried indoors. Many processors felt that these are handy, but not very useful when dealing with large quantities of fish. The cost involved in making these racks also was an item of concern to many processors.

Increasing drying speed

Sunlight is imited during the rainy season and therefore it is important to make use of whatever sunshine is available for drying fish quickly. This can be achieved by two methods. One is by turning around fish as often as possible so that both sides of the fish dry equally well. Although this involves additional labour, the results are worth the trouble. The other method is to dry fish on bamboo screens so that air passes below the drying fish resulting in drying of the lower surface of the fish. Mats made of split bamboo have the added advantage that these could be rolled along with fish and carried inside the house in case of sudden rains.

10. FUTURE WORK

The Project has worked with a limited number of processors in six villages and has found that certain simple interventions can provide real benefits to them. Some of the interventions are relevant during the rest of the year also.

There is scope for wide scale promotion and dissemination of information on these interventions via training programmes and appropriate media. This would raise awareness amongst small-scale processors of simple appropriate ways of reducing loss and risk associated with traditional processing.

Some of the intervention ideas could be developed further. Work could be done to develop lighter versions of the vat lids, which would be easier for processors to use.

The project has generated a great deal of technical and socio-eonomic data on small-scale processors and processing. This could be used to inform planning and decision making for the benefit of small-scale processors.

The participatory intervention process used identified appropriate interventions. The method should be made available for others to use and adapt.

11. FURTHER INFORMATION

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