

Fisheries Marketing Systems and Consumer Preferences in Puttalam District Sri-Lanka

**Working Paper SL1.4
Project R7064
2000**

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Preface & Acknowledgements

These working papers are interim components of a UK Department for International Development (DFID) funded natural resources research program R7064, currently operational in Sri Lanka and Southern India. The project is of 3 years duration from 1999-2002 and aims to investigate the potential for integrated aquaculture options within small-scale farmer managed irrigation systems to bring benefits to marginal groups within diverse, risk-prone semi-arid and water-stressed regions of the world. Benefits are expected to be increased opportunities for livelihood diversification and more efficient and sustainable use of dwindling per capita water supplies.

Principle collaborators are the Institute of Aquaculture, Stirling University, UK, and in Sri Lanka the Agribusiness Centre of Peradeniya University and CARE international. The latter have also provided generous in-country financial support.

Acknowledgement also goes to the following dedicated research staff: Mr I.M Gunewardene, Yasanthe Naveratne, Harsha Balsooria, Bandara Samarakoon and Priantha Jayakodi.

All statements of fact or opinion in this document should be taken as interim statements. The work is continuing and matters covered in this report may be revised in the light of future information received. The document has been prepared to provide information exchange within the research team and with counterparts elsewhere. Comments or requests for further information are invited and should be sent to the project leaders in UK or Sri Lanka listed below:

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Project background

Arid and semi-arid regions of Southern India and the lowland Dry-zone of Sri Lanka's are representative of water-stressed areas experiencing erratic seasonal water availability, high rates of land degradation and chronic poverty. It is estimated that almost half the world's poorest people, nearly 500 million, live in such drought prone-areas and depend on irrigated agriculture to provide them with much of their food supply (UNDP 1997). This will rise to 20% of the world's population by 2050 (Engelman and Leroy 1993). Increasing frequency of drought and competition for water with industrial and domestic users will combine to make water a dwindling per capita resource in these areas. It has been predicted that both India and Sri Lanka will face a fresh-water crisis in the near future (Nigam et al, 1998). Much water is currently wasted due to inadequate management and conservation practices. World-wide irrigation efficiency¹ may be as low as 37% (Postel 1996) and there is a need for more integrated approaches to water management which take into account its multiple uses for purposes besides irrigation (Gowing 1998, Redding 1990). Since agriculture is responsible for some 70% of global water use (FAO 1995), the potential for water savings through multiple use, including aquatic production is enormous.

An emerging development priority has emerged following a paradigm shift where irrigation systems are being reassessed as components of the whole water basin. It is now realized that water and land management practices at the wider watershed level can lead to increased options for on-farm water management at the individual level (Pretty 1995). Watershed development is a huge development initiative in Sub-Saharan Africa, India and other semi-arid areas of the world and often involves the construction of large numbers of small community or farmer-managed water bodies for rainfall harvesting, groundwater recharge and the prevention of soil erosion. In Sri Lanka, as in many parts of India, traditional watershed management exists in the form of the ancient community-managed cascade tank systems. Large-scale rehabilitation of tank systems has taken place over recent decades in both countries.

Two thirds of the predicted shortfall in world fish production (20-30 million tonnes by the year 2000) will occur in the semi-arid tropics (FAO 1995), further underlining the need for such research effort. Despite this potential, attempts to integrate fish production into these water bodies have been rare and usually based on conventional commercial semi-intensive pond aquaculture. Whilst the resource-rich have been able to adopt such an approach, it has proved inappropriate for poorer marginalised groups. By investigating aquaculture options for both traditional and modern watershed development structures, the research results are likely to have broad applicability.

Although large-scale irrigation systems supply the greatest area of farmland, the greatest numbers of farmers still cultivate in rain-fed dry lands, where they rely on small-scale systems. Furthermore the scope for further expansion of large-scale systems is limited, whilst great potential exists to increase the availability of smaller systems through the adoption of watershed development programmes, which include water-harvesting components.

The project aims are to identify social and bio-economic constraints to the integration of aquaculture into farmer-managed irrigation systems and to develop and promote effective approaches to aquaculture for farmers in diverse risk prone dry-land regions of India and Sri Lanka. Intended beneficiaries are the rural poor. Within this group, opportunities for landless, lower caste unemployed youth and women's groups, all of whom have traditionally derived least, benefit from irrigation developments, will be given special consideration. The project has sought to promote a participatory approach to the design and implementation of targeted research. Research outputs include technical guidelines to engineers, policy guidelines to

¹ The percentage of irrigation water actually consumed by crops during their growth.

planners and donors, research guidelines to scientists and extension guidelines to field-level implementers. The closely linked DFID KAR² engineering programme (R7123) is investigating the potential for integrating aquaculture into larger formally managed irrigation systems of semi-arid areas in contiguous research areas.

This series of working papers is based on field research that took place during December and January 1998. The social, economic and technical feasibility of fish production in such systems were investigated and some preliminary constraints to the uptake of poverty focused aquaculture identified. Research included a 'Rapid Rural Appraisal' of two cascade systems in Puttalam and Kurunegala districts (incorporating a total of 21 tanks and 9 villages), and semi-structured interviews with representatives of Government fisheries departments, fisherman's co-operatives, marketing agents and other relevant institutional organisations throughout the country.

Field work was undertaken in collaboration with the, field staff of the NGO's CARE³ IFAD⁴ the Government 'Samurdhi' welfare programme and the Agricultural Economics department and Agribusiness Centre (AbC) of Peradeniya University.

List of working papers in the series:

SL1.1 The Lowland Dry Zone of Sri Lanka; Site for Study of Aquaculture Development within Farmer-managed Irrigation Systems and Methodology for Participatory Situation Appraisal.

SL1.2 Inland Fisheries Resources and The Current Status of Aquaculture in Sri Lanka and North West Province.

SL1.3 The Nature of Small-Scale Farmer Managed Water Resources in North West Province, Sri Lanka and Their Potential for Aquaculture.

SL1.4 Fisheries Marketing Systems and Consumer Preferences in Regional and Sub-Regional Markets of Sri-Lanka.

² Knowledge And Research

³ Caring About Relief Everywhere

⁴ International Fund for Agricultural Development

Glossary

ARP	Aquaculture Research Programme (DFID)
CARE	Cooperative Assistance Relief for Everyone (US NGO)
CFC	Ceylon Fisheries Corporation
CPUE	Catch per Unit Effort
CWE	Cooperative Wholesale Executive
DFID	Department For International Development
DoF	Department of Fisheries
KAR	Knowledge and Research (DFID development branch)
<i>Kawara</i>	Fishing Caste
<i>Maha</i>	Main cultivation season (October – March)
<i>Modalali</i>	Small wholesale/retail businessman
mt	Metric ton
NARA	National Aquatic Research Agency
NGO	Non Governmental Organisation
NPA	Non Plantation Agriculture
NWP	North West Province
<i>Pola</i>	Weekly town market
<i>Poya</i>	Buddhist full-moon festival day
RRA	Rapid Rural Appraisal
Rs	Rupees (Sri Lankan unit of currency; \$1 = Rs 65)
<i>Samurdhi</i>	Government rural welfare programme
SSI	Semi Structured Interview
<i>Warakan</i>	Seasonal winds (end of April to early July)
Yala	Secondary cultivation season (April – June)

Executive Summary

Increasing production from an under exploited seasonal tank resource has long been mooted as a means of poverty alleviation Sri Lanka, yet development efforts over the last few decades have achieved no sustainable results. These efforts have shared a bio-technical, production-orientated approach, ignoring critical socio-economic constraints and opportunities. Elsewhere many aquaculture interventions have failed due to poor consideration of market realities and this remains one of the most neglected areas of inland fisheries research in Sri Lanka.

The aim of this study was to understand the current and historic market situation for inland fish and its substitutes in order to identify which of the various production opportunities presented by the seasonal tank resource might have greatest relevance for marginal communities in the Dry-zone. Regional and sub-regional market networks for fish and meat products were investigated, ranking and scoring exercises used to characterise consumer demand in rain-fed areas of North West Province and secondary data sources were used to assess historic patterns of demand and supply.

The 2.7% contribution of the fisheries sector to GNP belies its socio-economic and nutritional importance to the nation. In rural areas up to 85% of mean per capita protein intake consists of fish products whilst in many coastal areas more than 10% of the population derive their primary source of income from fisheries. Demand for inland and marine products is highly demarcated. More costly marine fish is mostly consumed in urban areas, whilst the consumption of inland fish is almost entirely restricted to the rural hinterland. In both sectors, rising demand is being met through increased imports of dried marine produce, currently accounting for some 30% of total consumption by volume.

Ninety percent of reported commercial production in the inland sector comes from only 74 of the largest major irrigation systems. Highly seasonal production from village tanks is effectively excluded from these markets due to off-flavours, which have the greatest adverse effect on the smaller tilapias that constitute the bulk of harvests. This production is instead used for local household consumption, with most villagers relying on purchased product from the perennial fishery for much of the year.

A politically inspired withdrawal of government patronage to the inland sector in 1989 has led to an unregulated increase in the number of entrants and intensification of the fishery. Concomitantly there has been a decline in the larger indigenous species once important in the fishery, and a reduction in the mean size of tilapias harvested which now constitute some 90% of total yield. Nevertheless this harvest appears highly attuned to local demand, in particular that of lower wealth groups. This is due both to the low price of the smaller tilapias (<150g) that dominate harvests and seasonal production patterns that are highly complimentary to the rural livelihood calendar. However unfulfilled niche markets for more costly larger fish are also identified. These include a variety of fast-growing exotic carps stocked in seasonal tanks, which though less popular amongst consumers than tilapia have demonstrated good growth potential. The smaller mean size of fish likely to be produced by such stocking programmes relative to the very large size that carps attain in perennial tank fisheries, is also likely to be more compatible with local demand. Whether this demand level is sufficient for the seasonal production volumes that might accompany widespread adoption of this strategy requires further research.

Shortfalls in supply are greatest between April and June when seasonal winds make fishing difficult. Interventions that aim to increase outputs of aquatic organisms from seasonal tanks should ideally target this window. Conversely the lowest margins and poorest consumer acceptance related to off-flavours can be expected for conventional harvests during the traditional dry-season window (July-Sept) when supply reaches a seasonal high and water levels are lowest.

By-catches of highly popular, though costly, snakehead from seasonal tanks have again regained commercial acceptance following adverse consumer reaction associated with severe disease outbreaks that occurred over the last 15 year. Strategies aimed at increasing the output of this species may have good potential for income generation.

There appear to be few perfect substitutes for inland fish, due to socio-cultural perceptions and the relatively high cost of other meat and marine fish products. The price of inland fish has remained extremely stable over the last 10 yrs maintaining close parity with inflation. This suggests demand and supply remain fairly well matched. Marine fish prices on the other hand are highly volatile both historically and seasonally due to the higher number of production variables and high overheads incurred in this sector. In rural areas adverse quality perceptions relating to the freshness of marine fish, which must be transported for long distances using ice, also reduce demand.

Marketing networks for fresh inland fish are contrasted with those for marine fish and agricultural produce. The highly dispersed and local nature of the rural consumer and production base and small though relatively stable daily production volumes, means that there are few of the scale-economies exploited by middlemen in the other sectors, which often results in producers becoming compelled to accept low margins as 'price-takers'. Instead, a highly equitable marketing system has evolved based, around large numbers of small-scale actors in an artisanal gill-net fishery and networks of '2-wheeler (bicycle and motorbike) vendors' who transport a fresh, low cost product on a door to door basis to even the remotest villages with negligible wastage. Mutually beneficial trading relationships exist between producers and vendors often on a one-on-one basis with both receiving fair margins. The low overheads required for entry, particularly into the 2-wheeler networks, means the profession represents an ideal opportunity for income diversification, thereby reducing the vulnerability of poor households. Many traditional cultivators now participate in fishing or fish marketing on a full-time or seasonal basis. After the introduction of tilapias, this system evolved with no appreciable external institutional involvement. Members of fisheries co-operatives from larger systems now identify a need for more effective external support in enforcing fishing regulations aimed at sustaining production, which the Department of Fisheries is encouraging them to adopt.

High demand for fresh fish means few opportunities exist for post-harvest processing. Margins are generally lower for dried fish, which, in the absence of cold chain facilities for lower value inland species, represents a salvage rather than a value addition mechanism. Consequently only the smallest most perishable varieties are dried locally. The preparation and retail of these species at weekly town markets (*polas*) represents the only opportunity identified for women's participation in a male dominated industry. Women from Tamil and Christian communities, both from coastal areas and illegally encroached around a local reservoir, are currently the main participants. Socio-cultural barriers represent a considerable constraint to the participation of women of Sinhalese Buddhist backgrounds, though there may be less reluctance from lower caste groups and single female-headed households. Male Buddhist farmers by contrast appear increasingly inclined to participate in the fishery despite traditional taboos.

Unlike the market for inland fish with its daily turnover of small volumes, the low periodic surpluses generated by the majority of small-scale cultivators leave them vulnerable to exploitation. For many the situation has become worse with rapid trade liberalisation and 'agricultural commercialisation' policies that aim to increase farm output growth at the national level with benefits to the poor envisaged through linkage effects. The pace of this change has increased the vulnerability of the most marginal groups who are locked in uneconomic paddy production on miniscule land holdings. At the same time these farmers have lost many of the subsidies they enjoyed under the centrally planned era and are consequently reverting back to subsistence strategies, combined with off-farm labour where available. Integrated rural development programmes that have treated farmers as passive

recipients of packages, have only served to disempower them further and there is a need for more participative and less ambitious projects addressing site-specific needs. With this in mind the subsistence orientated, adaptive low-input enhanced fishery system evolved from this situation analysis (Working Paper SL1.1) may have greatest relevance as a livelihood diversification strategy for marginal populations in the rain-fed areas to the North East and West, that have benefited least from recent structural developments in major irrigation and are likely to have poorer access to the commercial fish yields and off-farm labour opportunities which originate from them.

No private sector market for fish seed currently exists in Sri Lanka. This represents a considerable constraint to strategies, which rely on stocking non-self recruiting species, such as Chinese and Indian major carps. Development of such markets is constrained not only by the current lack of demand but significantly by an opportunity cost for more lucrative ornamental fish production destined for export markets (Working Paper SL1.2).

Finally a range of marketing issues that require follow-on research, are identified.

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1 Introduction

Increasing the yield from a large but under exploited seasonal tank resource has long been mooted as means of reducing Sri Lanka's malnutrition problem (Box 1). Over recent decades, many poverty focussed research programmes have dealt with the bio-technological potential of culture-based fisheries in these water bodies (Working Paper SL1.2), yet little research has been undertaken on socio-economic aspects which impact on the adoption of new technologies. Published knowledge of the marketing potential for the products of inland aquaculture is especially poor (Shirani 1999). Pillay (1990) notes that many production programmes in the past have failed due to poor consideration of marketing potential during programme planning. The quality, size, methods of processing, preservation, presentation and suitability of different production options all depend very much on the available markets. Marketing networks are in turn shaped by a wide range of physical and socioeconomic factors.

Physical factors include: the temporal and spatial distribution of productive resources, physical infrastructure, and the consumer base. Socioeconomic factors include seasonal livelihood patterns and income availability, cultural and behavioural norms, the nature of economic and personal relationships between network actors and most critically, the characteristics of consumer demand for the aquatic product in question and its range of perfect and imperfect substitutes. Consumer demand arises as both cause and effect of the interplay between many of these factors. Predicting the ability of the poor to benefit from different intervention

Box 1. The Problem – Malnutrition in Sri Lanka.

Protein malnutrition remains widespread in Sri Lanka, especially amongst the rural poor of the dry zone and the plantation sector in the hill country (Sinathamby and Noguchi 1997). Despite an upward trend in many development indicators over the last thirty years, nutritional indicators have remained consistently low. Average stunting level in under-five's (a good indicator of chronic malnutrition) averaged 24.5% in 1996 (Gunasekara 1996) whilst the level of underweight births recorded in the same year was the fourth highest in the world in (UNDP 1997). This is a consequence of government interventions, which have emphasized survival, through immunisation programmes and improvements in primary health care, without simultaneous improvements in the basic food security of resource poor communities. This project aims to investigate the potential for development of suitable low input aquatic production systems to improve the food and income security of marginal groups.

options depends in large part on understanding demand and the range of constraints and opportunities present by prevailing market conditions.

The range of options in a spectrum of production intensity ranging from on the one hand, highly extensive capture fisheries to intensive aquaculture on the other present very different marketing opportunities. A strong point of aquaculture is the ability to plan production cycles using multiple stocking and harvest strategies. This gives ability to target deficit species or supplies during off-seasons in capture fisheries i.e. to move away from a simple production orientation and become progressively more market orientated as farming effort is intensified.

In Working Paper SL1.1 a low input, culture-based system incorporating *in-situ* production of advanced tilapia fingerlings in village tanks accessible to marginal rural communities in the Sri Lankan dry zone is described. This could overcome major production constraints of highly seasonal water availability, poor seed availability and high predation levels and other environmental constraints. It can be defined as an enhanced fishery, incorporating stocking and environmental modifications, but no direct feeding, which lies midway between aquaculture and a capture fishery. As such it shares some of the benefits and constraints of both systems. The seasonality of the approach means that it is highly manageable with respect

to harvesting and stocking but also increases possibility of seasonal production gluts compared to perennial fisheries.

The concept of this system arose through an iterative process, which considered not only the bio-technological constraints, but also the socio-economic conditions of target communities, including the marketing analysis presented here. It is the purpose of this paper to consider the existing trading networks for food fish, and other protein substitutes, and assess the constraints and opportunities for vulnerable rural groups in upper watershed areas (Working Paper SL1.3) who may have potential to produce fish in seasonal tanks, to enter these markets.

2 Methodology

Markets operate at different scales of market space (Lewis et al 1996), which has consequences for their accessibility to lower income rural communities and groups (section 7). Networks at the regional level in and around the hill capital Kandy and sub-regional levels in the hinterland around the Dry zone market towns of Anamaduwa and Galgamuwa in North West Province were identified and investigated. In Sri Lanka the rural poor have greatest access to the smallest sub-regional markets for aquatic produce i.e. inland fish, which became the primary focus for this investigation. In addition to inland fish, the markets for substitutes including fresh and processed marine fish and other animal products are also investigated.

Multiple data sources were used for the study. Numerous secondary sources were used to establish context. Primary sources included interviews with producers at landing sites of perennial tanks and seasonal tanks, traders involved in marketing activities and consumers in rural villages and direct participant observation. A range of different traders, including assemblers and retailers at different network levels were interviewed at their respective marketing points, usually within towns and villages and on route to their markets where chance encounter permitted. Retailers included bicycle vendors, two wheeler vendor, van sellers, and market stall holders. Finally, ranking and scoring exercises were employed to identify consumer preferences for fish as part of RRA's in villages of two small-scale cascading tank systems in North West Province. Consumer responses were correlated with wealth rankings undertaken as part of the same RRA's. Examples of semi-structured interview (SSI) formats used at each of these different levels are shown in Appendix 2.

Cross-referencing of these sources and overlap in the interview design provided a means of data triangulation. The use of flexible interview techniques allowed participants greater latitude to discuss their own priorities, whilst a systematic attempt was made by the researchers to fully cover predefined areas of interest. These techniques facilitated greater interaction with actors and improved understanding of their perspectives and the motivations behind their behaviour, in addition to providing a record of their actions. More traditional formal questionnaire techniques, biased towards selective empirical outputs were also employed. Cross tabulation and analyses of these multiple data sources provided a means of estimating the relationships between different factors under study i.e. the function of wealth, gender, religion etc. By adopting this methodology a general overview of the marketing situation was constructed.

3 Fisheries production, demand and supply in Sri Lanka

The entire fisheries sector has contributed between 2.2.7% of GNP during the last decade (NARA 1997). However this low figure obscures the vital role it plays in meeting the basic nutritional and socio-economic livelihood requirements of the population. Some 120,000 people are employed directly in fishing and an additional 20,000 in ancillary services. In many coastal areas over 10% of the population rely directly on fisheries for their primary

source of income and greater numbers of entrants are moving into the inland fishery (Murray 1999).

Over 96% of Sri Lankans consume fresh or processed fish, which provides an estimated 65-70% of the mean annual animal protein intake (Sugunan 1999, Jinadasa 1997). Nathaniel (2000) reports that this figure rises to as much as 85% of animal protein intake in rural areas. Per capita consumption rose steadily during the 1980's to a peak of 18.6kg and has currently stabilised around 15-16kg per capita (Box 2). This is one of the highest levels in developing countries of the region, reflecting Sri Lanka's island status and a culture of low livestock holdings and consumption. Net fish production in Sri Lanka (i.e. local fish production – export production) is sufficient to meet approximately 78% of current demand. Much of the balance is imported in dried form of marine origin in addition to a smaller amount of canned produce (Jinadasa 1998). In 1996 a total of 283,000mt of fish were consumed in the country, consisting of 228,500mt local production and 62,900mt of imported products. Another 8,400mt of high value marine produce including tuna, shark fin and shellfish were exported during 1996 with a return of Rs 2,144 million in foreign exchange (NARA 1997). Export earnings have been increasing steadily over the last decade.

Capture fisheries: An increasing dependency on imports from the early 1980's (Box 2) can be attributed in part to reduced production in the North and East following the outbreak of civil war in 1983 which still rages today (Figure 3). The remaining coastal fisheries on the East, West and Southwest coasts are reportedly close to their maximum sustainable yields, whilst demand continues to increase (NARA 1997). The deficit is being filled by increased exploitation of offshore fisheries whilst deep-sea fisheries are being more slowly developed⁵. The high levels of technology and investment that are required to exploit deep sea fisheries represents a major constraint to local development, whilst reliance on foreign assistance would be likely to involve major access concessions. Furthermore benefits of such a fishery are likely to accrue to a much smaller number of individuals, than the coastal fishery, which is for the most part a highly labour intensive, small-scale artisanal and subsistence fishery.

The dominant role of the marine sector in meeting local demand is reflected in Figure 1. According to these figures coastal and marine fisheries contributed 90.2% of total catch in 1996. However this hides a marked spatial variation in consumer demand for products from the two sectors. Demand for marine fish is concentrated along the coastal zones and in the urban areas of the Southwest and the hill country and arterial routes between the same locations. These areas enjoy good communication networks or are in close proximity to marine resources. In poorer rural inland areas by contrast, demand is predominantly for cheaper fresh inland fish, supplemented with dried imported fish of marine origin and far smaller amounts of locally produced dried inland and marine fish. An estimated 90% of inland production currently comes from only 74 of the largest major irrigation systems, representing some 10% of the total reported fisheries production.

Box 2 Per capita fish consumption in Sri Lanka and regional States (kg).

State & Year	(1)	(2)	(3)
India ¹	3.7		
Bangladesh ¹	7.6		
Pakistan ¹	12.2		
Sri Lanka ² :			
1977	10.6	0.9	91.5
1985	16.4	5.7	65.2
1988	18.6	6.9	62.9
1990	15	5.5	63.3
1993	15.4	2.9	81.2
1996	15.6	3.5	77.6

Sources: ¹FAO (1993), ²NARA (1996).

(1) (Local Production + Import-Export) / total population.

(2) Import/Total Population.

(3) % Contribution of local supply

⁵ Sri Lanka has 1,585km of coastline and 26,00km² of continental shelf area within a 200 nautical mile exclusive economic zone.

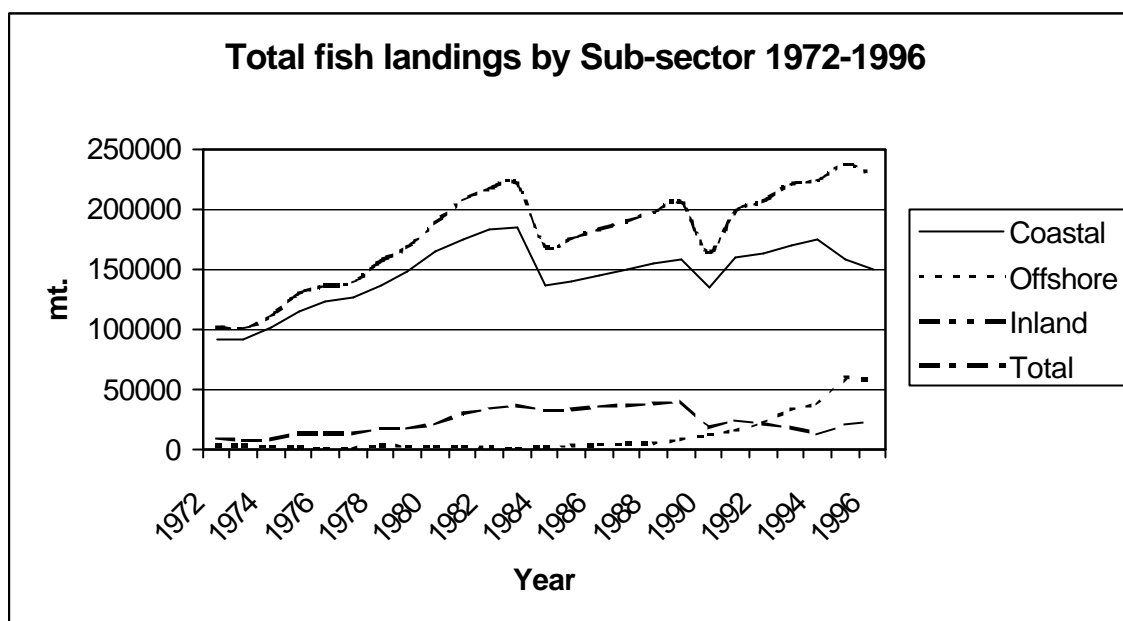


Figure 1. Historic trends in marine and inland fish landings 1972-1996
(Source: NARA 1997)

Aquaculture: No indigenous tradition of aquaculture exists in Sri Lanka and the sector remains poorly developed. Jinadasa (1997) estimates that aquaculture contributes only 2% of total production by volume, consisting primarily of intensive private-sector production of high value shrimp species destined for overseas markets. Some 95% of total production was exported in 1996. Poor regulation of the industry, with an ever-increasing number of small-scale entrants and a lack of any meaningful waste remediation strategy has resulted in serious environmental degradation accompanied by repeated devastating outbreaks of disease over the last decade. Marked fluctuation in production levels, clearance of mangrove areas and associated damage to highly productive lagoon capture fisheries on which many other livelihoods depend, has raised serious questions over the longer-term sustainability of the industry and its ability to benefit the poor. After the last major viral outbreak in 1999, some 20,000 employees were faced with redundancy.

Although marketing systems are complex and regional variations exist, internal trading in the Sri Lankan fisheries sector can be classified into three broad categories that occupy progressively smaller market spaces:

1. *Import and wholesale at national level:* State sector organisations i.e. the Cooperative Wholesale Executive (CWE) and private sector organisations including various multi-nationals undertake these functions. Private sector organisations enjoy the major share of the dried fish import and wholesale distribution market.
2. *Wholesalers and retailers at regional (provincial and district) level:* Wholesalers bid for catches at landing sites, which are consigned primarily to St. John's wholesale market in Colombo and ultimately sold to consumers through a chain of smaller retailers. St. John's is the largest wholesale market in the country; secondary regional wholesale markets exist in the towns of Galle, Kandy and Anuradhapura (see Figure 3.). These markets cater principally for marine fish production whilst very little inland production enters these networks.

3. *Sub-regional retailers and wholesalers:* Middlemen supply capital or credit to fishermen, informally contracting their entire catch. Marine fish may be consigned to Colombo and distributed directly or indirectly through small-scale retail networks including boutiques⁶, daily markets in larger towns, weekly fairs (*polas*) in smaller market towns and extensive networks of mobile 2-wheeler vendors. In contrast the bulk of the inland fish production is marketed in close proximity to the production base, principally by 2-wheeler vendors.

Research was focused primarily on markets in the third ‘sub-regional’ category (section 7), beyond which markets for inland fish inland fish rarely extend. A brief investigation of a regional market around the hill-capital of Kandy is reported in section 7.1.

4 Historic trends in prices of fish and meat substitutes.

Table 1 shows recent trends in the retail price of tilapia and substitutes, with percentage increases calculated between 1992 and 1998. During this period inflation averaged 12.4 %/year (Central bank 1998), the equivalent of a 98% absolute increase in price over the 6 year period. Increases in prices of most of these food sources have merely kept place with inflation and maintained approximate parity with each other. The only notable exceptions being sardines and paraw whose prices have dropped. This reflects a greater short-term instability in sea fish prices (the wholesale price of sardines halved over the last year). Sardines, herring anchovies and sharks are the cheapest marine fish. These and other small ‘trash’ marine fish were the most popular marine species amongst poor farmers within the study area, though quantities consumed were still very low compared to tilapia.

Table 1. Historic trends in retail prices for fish and protein substitutes in Colombo markets (Source ARTI 1989-98)

Protein Source	1989 ¹	1992 ¹	1995 ¹	1998 ²	% increase 92-98 ³
Meat					
Beef	48	74	92	120	102
Mutton	87	132	163	235	78
Pork	51	61	88	128	110
Chicken				120	
Venison				125	
Fresh Fish					
Sardine	21	53	60	50	-5
Paraw (carnax sp.)	72	134	171	135	-1
Tuna	40	89	104	180	102
Tilapia (>150g)		30	40	60	100
Dried Fish					
Sardine	34	56	74	45	32
Tilapia				70	

¹Source: Weekly retail Price, Colombo city, Department of Census and Statistics

²Source: Personal Observation (weekly fairs Puttalam district).

³No price figure available for tilapia in 1989.

Tilapia prices have increased steadily from Rs 35/kg in 1993 to Rs 45/kg in 1995 and currently average Rs 65-75/kg for larger fish (>150g⁷). However such prices are consistent with the general rate of inflation and by and large have remained in parity with other animal protein substitutes. Tilapia prices are reported to have dropped shortly after the withdrawal of Government patronage for the inland fisheries sector in 1989 (Working Paper SL1.2). This is

⁶ Boutiques are small single room shops, which generally sell a range of essential groceries and domestic supplies. They are widely distributed with concentrations along main communication routes or junctions, but are generally present even in remoter villages of a modest size (i.e. >25 households).

⁷ Negligible demand exists for smaller tilapias in urban markets. Such demand is confined to poorer rural areas.

consistent with increased production initially following de-regulation. Merchants reported no clear trend in individual sales volumes over the period, but indicated the number of retailers has increased. This is consistent with the relatively small number of fishermen and traders encountered who were active prior to the ban, whilst 78% of those interviewed (n = 28) had entered the industry within the previous 4 years. However, this could also be explained by a high replacement rate in what remains a low status occupation. Further research is required to resolve this question.

5 Government intervention in the marketplace

From the early 1960's up to the late 1970's Sri Lanka's socialist centrally planned economy became increasingly closed. Protectionist 'self-sufficiency' strategies designed to encourage import substitution with locally produced goods became the main focus of economic policy for the next two decades. As part of this policy the government began to play a more interventionist policy in internal trade through provision of input subsidies and attempts to regulate prices of basic commodities. In 1964 the Ceylon Fisheries Corporation (CFC) was formed to undertake this remit in the fisheries sector. It attempted to do this by purchasing and selling fish at publicised prices in the mass media, which were intended to act as 'floor' prices to producers and 'ceiling' prices to consumers, helping the former in times of glut and the latter during the lean season. However, the CFC never handled more than 2% of total fish production and was never able to perform its task effectively due to limited capital availability. Without sufficient cold storage, or cold chain facilities for longer-term buffer storage, stock had to be turned over on a day-to-day basis. Furthermore such storage capacity as existed was reserved primarily for high value marine species.

With the progressive introduction of open economic policies from 1977, restrictive practices including import quotas, licenses, food rationing and price controls on most commodities including fish were gradually removed. Price determination henceforth came to depend increasingly on market forces. Today, the private sector has emerged as the dominant importer, wholesaler and retailer and the state sectors role has become a more supervisory one. However as the free market is still young and operates in conditions of less than perfect competition, the state reserves the right to intervene directly to ensure supplies and maintain reasonable prices where supply-demand distortions occur. A number of the old government parastatal organisations therefore continue to exist, albeit with reduced capacity. Today the focus of the CFC is on fair price, profit sharing contracts with cooperatives, increasing the number of regulated retail outlets with cold storage facilities and encouraging value addition through post-harvest processing activities including drying, curing, filleting and freezing. However, its overall market share by volume continues to fall, reaching 1.2% of total production in 1996 (NARA 1997).

A second state organisation, the Co-operative Wholesale Executive imports a wide range of basic food commodities including dried fish, in order to adequately maintain supplies and help to stabilise prices when necessary.

It is the policy of the current government to encourage more persons and organisations to enter the fish marketing trade to strengthen competition. This includes encouraging formation of co-operative societies and providing assistance to co-operatives to undertake marketing activities. Whilst under state direction, the banking sector has also provided loans to traders to improve their facilities for fish marketing. The impact of such initiatives on the inland fisheries sector is considered in following sections.

6 The transport network

The quality of the transport network for fish products impacts on demand through the major market variables of product quality, price and market space. As already indicated, the bulk of production is comprised of marine species landed at 563 coastal sites (Figure 2.). These stocks are usually packed in ice, in wooden or plastic boxes and transported early in the morning by van and lorry for retail in the most populous areas. The greatest volumes are therefore destined for consumption in the South West (Figure 3). Numerous intermediaries including, wholesalers, handlers and commission agents exist to take advantage of scale-economies, which exist in these bulk translocations. Consequently although volumes are generally higher the margins earned by marine fisher folk are relatively low in comparison to the inland fishery, where bulking opportunities for intermediaries are few and trading networks much flatter.

The railway network has deteriorated extensively since independence, prior to which it was a highly efficient and cost effective means of servicing the estate sector. Today most rail services are concentrated in the Southwest, with no operational lines to the Southeast, the warring North and limited services to the East Coast. The majority of haulage now takes place on increasingly congested and poorly maintained road networks. Consequently the ability to transport large amounts of sea fish to dispersed inland markets is likely to be constrained by the increased costs, greater risks of spoilage incurred by protracted journey times and lack of cold chain facilities (section 6.1). Demand for marine fish was also found to remain low even in relatively accessible rural areas where fresh, low cost tilapias were available from the reservoir fishery. The market town of Anamaduwa enjoys a good road connection to the major fish the landing port of Puttulam, which was only 30km or 1/2 hour drive away. Here fresh fish is directly from the producer to consumers in surrounding villages via low cost 2-wheeler networks (section 7.2). Consequently, icing of fish is indicative of inferior quality to rural consumers. More expensive fresh marine fish therefore has little capacity to compete other than in the few months of the year when inland stocks are low and marine supplies relatively plentiful (Table 3).

Many small-scale rural traders use public transport to move small volumes of agricultural produce between local markets. However, due to risk of leakage, restrictions are placed on the transporting of fresh fish on buses⁸. No such restrictions exist for dried fish and many women who are also culturally far less inclined than men to use bicycles, use public transport to move small amounts of dried fish and vegetables for sale at village fairs (section 7.2).

⁸ Though one small-scale vendor encountered had circumvented this restriction by wrapping his stock in polythene and cardboard.

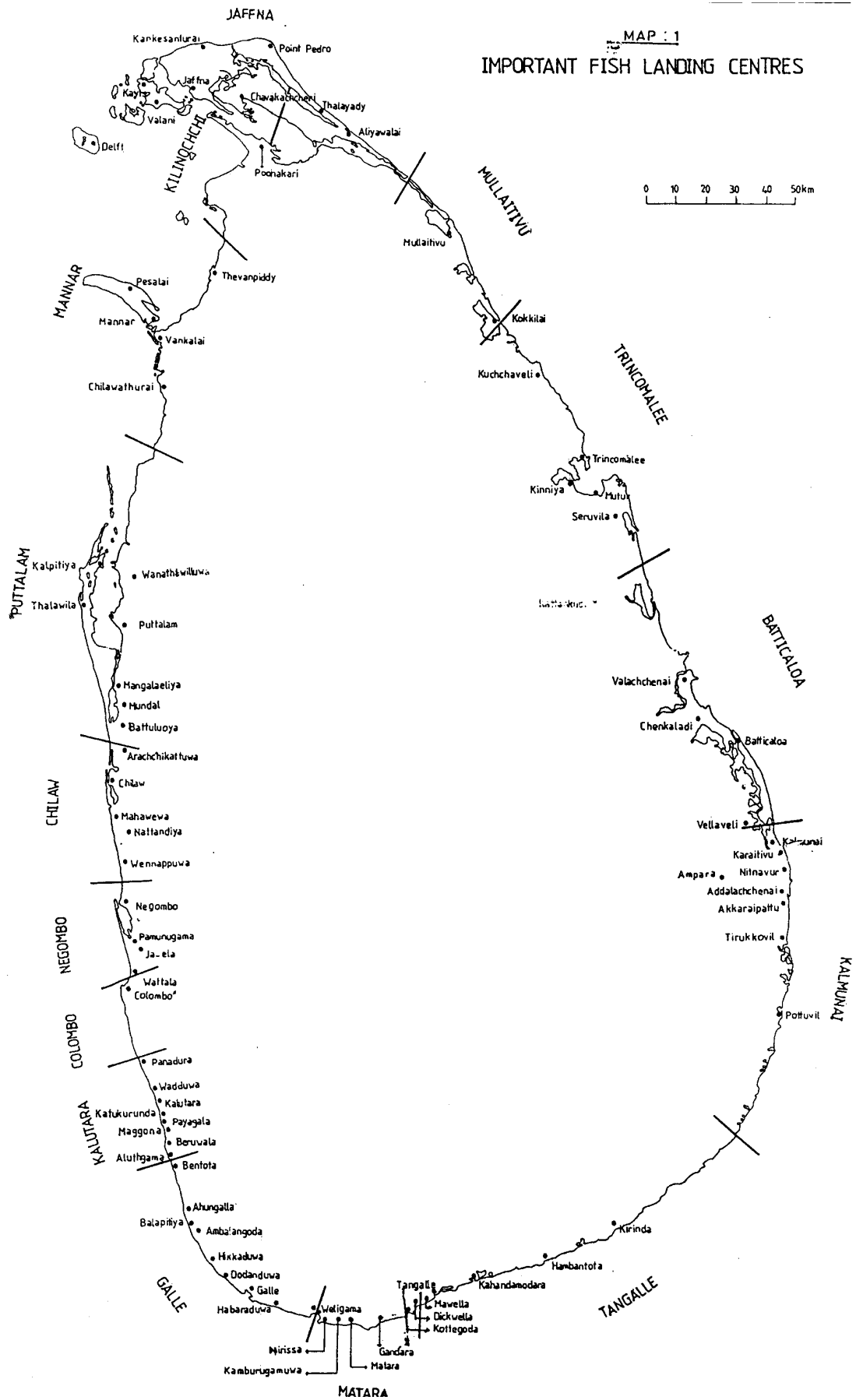


Figure 2. Principal marine fish landing sites in Sri Lanka (Source NARA 1997).

6.1 The cold chain

Jinadasa (1997) estimates that post harvest losses of marine stocks as high as 40% are not uncommon. This is mainly due to the inadequate cold storage and refrigeration capacity that is required for the movement of marine fish to urban areas. This can be contrasted with rural markets, where negligible wastage takes place due to the proximity of production and consumer bases (section 7.2). NARA (1997) report a total of 42 ice plants with 3 more under construction, having capacity to produce a total of 986mt of ice per day. In the early 1990's the previous government took a decision to lease out government ice plants to the private sector or fisheries co-operatives. Many of these plants were subsequently abandoned. However with the advent of commercial shrimp farming, an increase in the number of multi-day fishing boats, and a policy shift towards increased export earnings, several new plants were established on the West coast. Ninety six percent of total capacity is now in the private sector, however daily production still only averages 60-70% of total estimated capacity. Mechanical problems in older plant are cited as the main reasons for this shortfall. Eighty five percent of production takes place on the West Coast between Puttalam and Galle with 20% in Colombo alone. Little development has taken place elsewhere and such installations that are still operational on the East Coast are regularly targeted by terrorists (the Island 9/12/98). Consequently Colombo supplies a large quantity of ice to these districts and fish hauliers must purchase ice prior to arrival at most landing sites (Plate 1). On average, 56% of production costs goes on energy charges and the Ceylon Electricity Board has just introduced a low of peak rate to encourage greater production during these hours (Jinadasa, 1997). Prices range from Rs50-75 per 50kg of ice on the West Coast up to Rs 80 per 50kg in remoter areas.

As indicated above, much of the inland fish production within our study areas was distributed on a highly local basis by 2-wheeler vendors. Very little in the way of cold facilities are available, and generally stock must be sold and consumed on the day of catch. The durability and good handling characteristics of tilapia, the principal species marketed, are eminently suited to this distribution system.

Tilapias transported under a moist cloth were commonly observed reaching the consumer still living even after a 2-3 hour journey from the source of production. By contrast larger exotic carps, often upwards of 5kg may need to be butchered for retail to a number of individual consumers in which state they are much more perishable. For this reason and their relatively high cost they are less likely to enter the mobile markets. Instead they are sold mainly from roadside or junction selling points to more affluent consumers in rural market towns (section 12).

Any refrigeration capacity, which exists, is limited to boutiques on main routes or market towns with electricity supply. This is reserved for higher value marine fish and meat varieties. An exception was observed in Hambantota District, where one fisheries co-operative was profitably adding value to its tilapia harvest through processing; descaling, filleting, steaking, packaging and freezing the resulting products. However the capital requirements were subsidised by an external organisation in addition to which the village had the benefit of proximity to a main road and electricity supply.

Plate 7. Ice transported to Kandy market for marine fish wholesale purposes.



7 Market space: sub-regional and regional markets.

In a study undertaken in Bangladesh, Lewis et al (1996) noted that the scale of the market space is an important determinant of forms of interaction between actors within rural markets of developing countries. At one end of a continuum there exists the smallest sub-regional markets, often incorporating a group of neighbouring villages, whilst wider provincial, national or international markets exist at the other end⁹. Within the sub-regional markets actors operate in a closed system where personal non-economic ties are likely to be of greater consequence than in the wider market space where transacting parties are likely to be less intimate. Lewis *et al* found the following social and economic features to be characteristic of smaller market spaces in their study:

- Status, kinship and networks across villages become increasingly important.
- Non-economic sanctions can be used to enforce codes of behaviour between transacting parties, such as denial to the benefits accruing to some other collective sphere of community activity.
- Transactions are likely to be multi-dimensional (i.e. labour exchange in addition to monetary exchange) and multi-periodic (i.e. transactions are likely to recur between the same parties). Consequently the rationale for fair price is more likely to reflect other than monetary value of a commodity (i.e. goodwill in another sphere of trade).
- Informal credit is highly prevalent, reflecting the seasonality of income and represents a form of risk sharing in the absence of legally binding contracts.

This concept moves away from Western neo-classical economic models representative of wider open markets of industrialised countries, where price alone rations access and efficient resource use and actors are viewed as operating in a single economic sphere. Therefore instead of traditional marketing analyses techniques such as income and price elasticity's of demand, sub-regional systems may be more amenable to an analysis of the networks within which transactions occur and an assessment of the motivations and moralities of the different actors. In the Sri Lankan context where wide ranging agrarian structural adjustments have accompanied the move towards a free market economy over the last two decades (Working Paper 1), it is likely that rural populations will have to increasingly operate in the wider evolving economic space, but with a cultural experience derived from the smaller one.

7.1 Market organization at the regional level; the example of Kandy

Wholesalers in Kandy (n=2) and boutique owners within and along arterial routes (n=4) close to the town were interviewed to assess the contribution of inland fish to their sales. Within the town inland, fish, principally tilapias and smaller amounts of snakehead and carps contributed only a small portion of total fish sales amounting to more than 10% of wholesale turnover. Supplementary quantities of these fish are obtained from major reservoirs, which lie on route to Kandy, after the principal stock of marine fish has been obtained from coastal landing sites. These included the Kantale and Maduru Oya reservoirs 110km to the Northeast and 80km to the East respectively. These reservoirs were said to be too large to police effectively and could be fished throughout the year. Wholesalers/retailers located in the central markets of Kandy and the satellite town of Katugastota control much of the flow of fish to retail outlets and bicycle, motorbike and van vendors supplying outlying villages. The CFC also has a hygienic retail outlet with limited refrigeration capacity in the Kandy central market. Two wheeler vendors (section 7.2) who sold fish to villages within a 30-mile radius around Kandy

⁹ In the Sri Lankan context, sub-regional markets were found to operate no wider than the district level. This space is determined primarily by the distance that bicycle vendors can cover in a day. This extends to roughly a 35km radius around the production site during periods of seasonal glut in the dry season, reducing during other periods.

(n=3), included only 0-15% of inland fish in their sales. The highest relative volumes were reported in a plantation area 20km to the North of Kandy. Tamil labourers in these estates, who constitute some of poorest communities in the country, demand the lowest cost varieties including tilapia and small marine varieties. The deeper hill country reservoirs support relatively unproductive tilapia fisheries and much of this stock also comes iced with marine stocks. This impacts on one of the main competitive advantages of the tilapia, the caveat of high freshness enjoyed in lowland areas. In contrast to this situation in the hill country, within the lowland study areas of Northwest province, inland fish contributed close to 100% of village sales.

Prices of Marine fish in Kandy peak during May–August rising to between Rs 10-20/kg when annual supplies are at their lowest level due to seasonal winds which follow the SW monsoon. At the same time tilapia availability peaks as reservoir water levels retreat during the dry season, yet tilapia prices rise slightly in urban areas whilst falling elsewhere. This suggests that tilapia may act as a substitute for marine fish to some degree during the lean season and further effort should be aimed at investigating the potential to develop this market. Prices for tilapia were found to increase with progression up the retail network. Large tilapia, retailing for Rs 60/kg in Kandy were being sold for between Rs 80-90 /kg by motorcycle vendors in out-lying villages. Generally much greater homogeneity in retail price exists in rural areas, particularly in remoter villages where demand is greatest for smaller tilapias (<150g) which have the lowest cost and greatest year round availability. Only the largest specimens (250g-1kg) and occasionally intermediate sizes (>150g) are typically selected for the urban markets. Larger sizes also tend to be selectively sold in rural market towns when available.

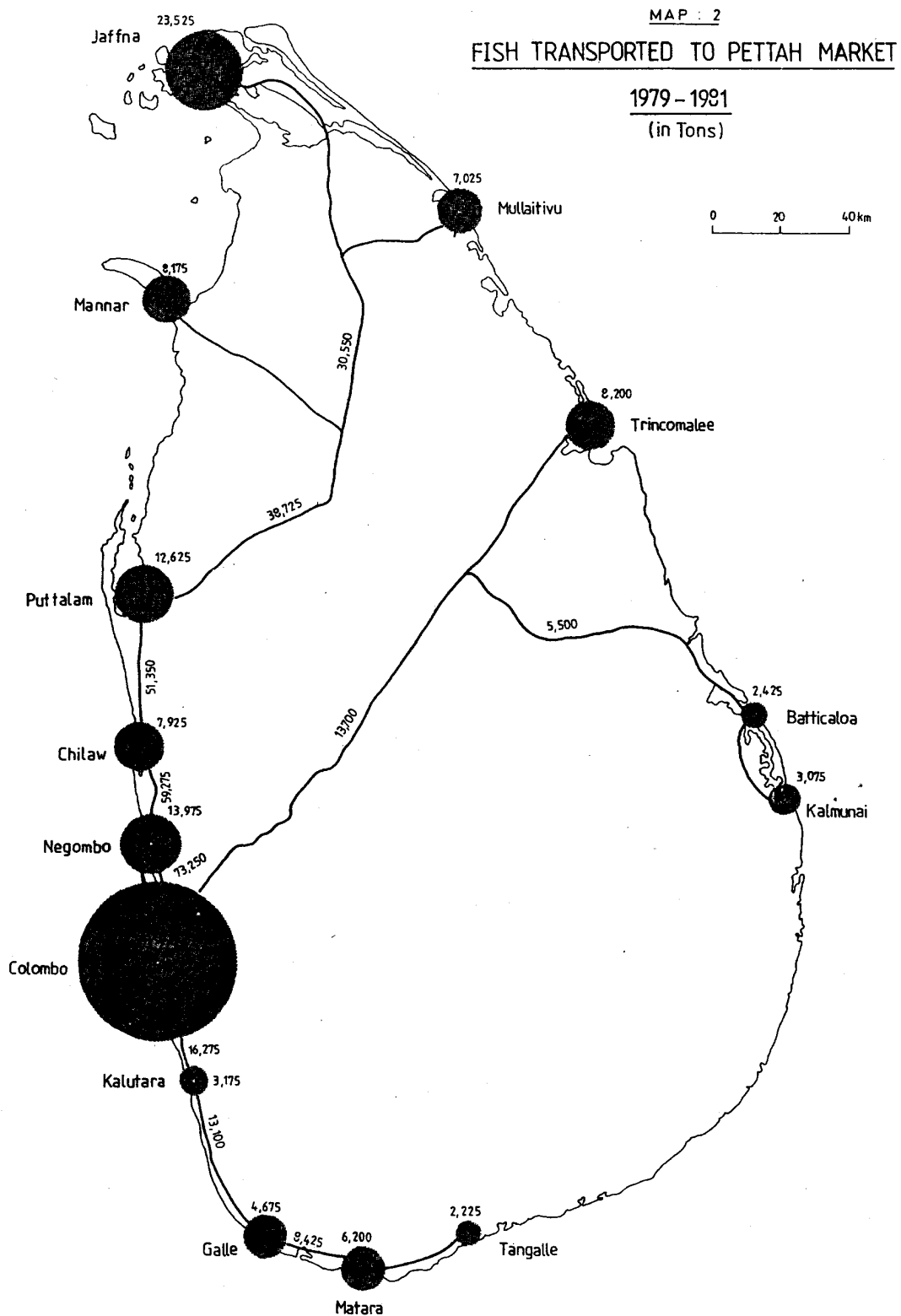


Figure 3. Main sources and volumes of marine fish transported to Pettah market, Colombo (source NARA 1997). Note the significant contribution to production from the Jaffna region prior to the onset of the civil war in 1983 which has all but ceased today.

7.2 The sub-regional marketing network for inland fish; Northwest Province

Figure 4 shows the sub-regional marketing network for inland fish constructed from interviews with local producers, traders and consumers around the market towns of Anamaduwa and Galgamuwa in North West Province¹⁰. Inter-connections with wider regional markets are indicated. The greatest volume of fish (thickest lines), flows through small-trader networks and relatively little production enters wholesale networks in sharp contrast to markets for marine fish. This is a consequence of the highly local, but widely dispersed nature of the inland production and marketing sites, which afford few scale-economies, such as product bulking, for middlemen to exploit (Box 3). A market dominated by large numbers of small-scale actors therefore arises which brings small though equitable benefits to producers, intermediaries and consumers alike, encompassing the lowest wealth strata.

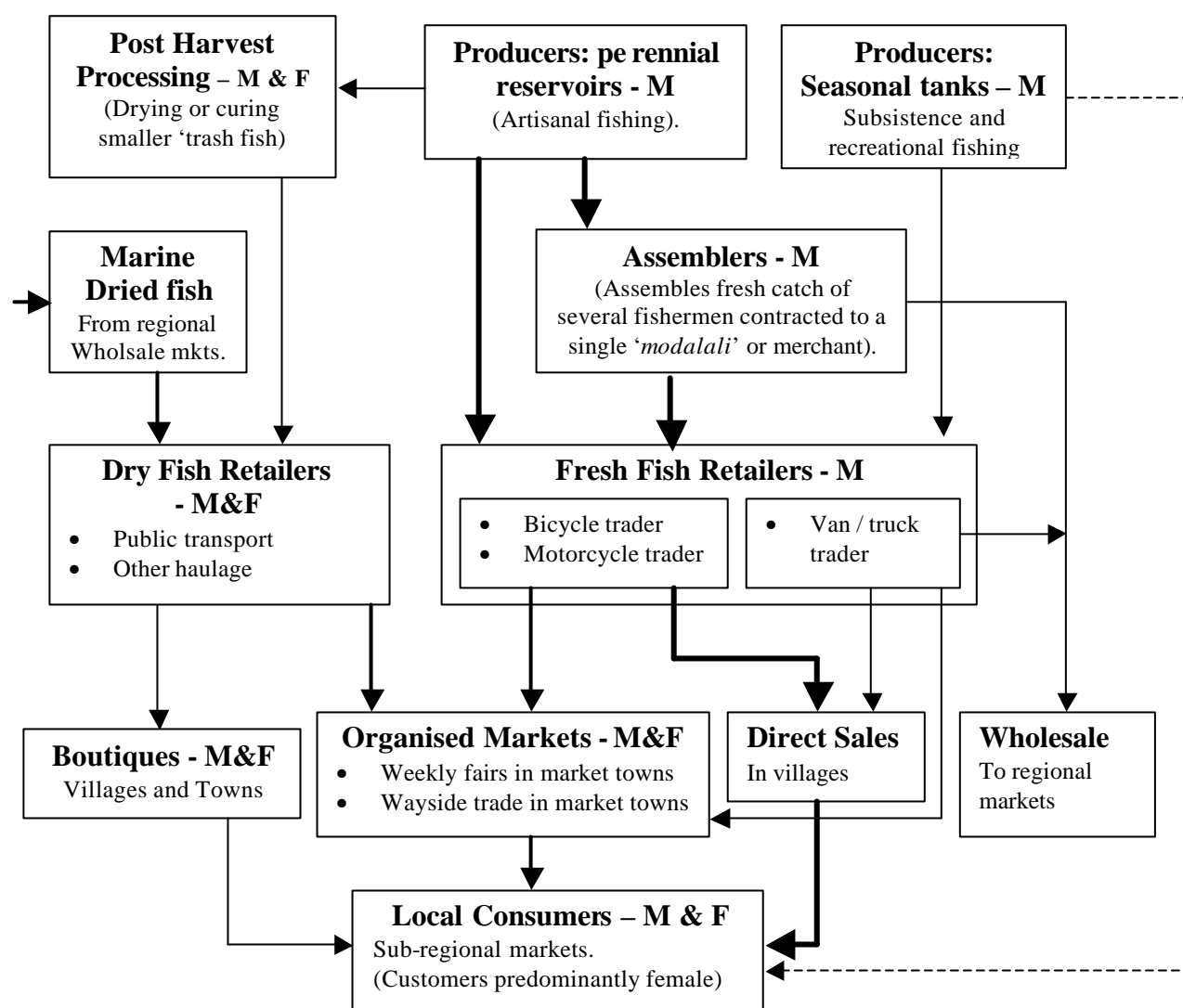


Figure 4. The freshwater fish-marketing network in Anamaduwa and Galgamuwa Divisional Secretariats (M = Male, F = Female, indicating likely participation). Note: Thickness of arrows indicates relative volume of fish moved within sub-components of the network.

¹⁰ Anamaduwa and Galgamuwa are the market towns/service centres, which are adjacent (<8km) to the research villages of Pahala Diulwewa and Danduwellawe respectively (Working Paper 1).

Most of the fish sold at weekly markets and surrounding villages emanated from a small number of major perennial reservoirs within a 15km radius of each study area. The largest and most important in terms of fisheries yields were, Rajangane (1646ha) and Inginimitya reservoirs (2042ha) adjacent to Danduwella and Pahala Diulwewa research villages respectively. Both these fisheries support more than 200 boats (section 8). A number of smaller perennial systems with full-time fishing communities (10-50 boats) supplement the catches from these systems (section 8). Although not contributing directly to markets in the research areas, the largest fishery in the region based on the Kalawewa reservoir (2858ha) located in the Mahaweli H system to the NW, was also investigated for comparative purposes.

Box 7 Case studies on fish marketing practices in Anamaduwa and Galgamuwa Divisional Secretariats.

1.1 Marketing in small rural towns

The town of Galgamuwa located in the middle of a triangle formed by 3 of the largest reservoirs in the district; Ranjangane, Usgala Siyambalangamuwa and Inginimitya is an important marketing point for inland fish. A cartel of 7 bicycle vendors controls the retailing of inland fish at the main junction here, paying a nominal annual levy to the town council for this privilege. These vendors are highly tuned to local demand, selling small volumes (<30kg) all of which is generally sold by mid-morning to avoid spoilage in the absence of any ice or refrigeration capacity. Very rarely do these vendors resort to taking fish into villages themselves or drying surplus stocks as a salvage mechanism as observed in larger urban markets. During the high season motorcycle vendors also use the junction to wholesale fish to the secondary networks of 2-wheeler vendors responsible for retailing fish in surrounding villages (Plate 2.). The pattern was different in Anamaduwa. This is a smaller town and less important as a distribution centre. Unlike Galgamuwa small amounts of fresh fish are sold at the weekly fair but little 'wayside' vending takes place within the town.

1.2 Large-scale intermediaries in the marketing network

During the high season 'Tuti' who began his career as a 2-wheeler vendor, purchases the entire catch from, one of the landing sites on Ranjangane reservoir, contracting between 20-30 fishermen for the purpose. This catch is iced, transported by truck and sold to retailers at a range of local fairs early in the morning. During the marine low season, the balance is transported to larger towns including Kurunegala and Anuradhapura (over 50km away) and occasionally even to the coastal fishing town of Puttalam during the marine low season (May-July). In Kalawewa to the Northeast of the research area, the position of large-scale intermediaries is one of greater permanence. Whereas most of the participants in the other reservoirs visited were Buddhist Sinhalese, or occasionally Christian Sinhalese migrants from the coast, in this instance nearly all of the producers and intermediaries were Muslim. Most of the fishermen here sell their produce to one of three Muslim assemblers or fish '*modalali*'. Although the fishermen receive a slightly smaller margin for their stock, they considered this was worth the reduced risk of defaults, which are incurred in relationships with smaller vendors and the assured availability of credit also provided by these *modalalis*.

Most professional fishing takes place from un-motorised canoes, typically with 2-3 men per crew. Most prefer to work through the night when fish are more susceptible to gillnetting, keeping their catch alive in their partially flooded canoes or wire mesh keep nets till they can be sold the following morning. This also benefits vendors who can begin selling their stock during the coolest part of the day, potentially returning for a second, smaller batch during favourable times of the year. Relatively little fishing effort takes place during the day when most fishermen sleep.

Fishermen sell only small quantities of their catch directly to consumers. Very occasionally this role would be assigned to a family member not directly involved in fishing though this is not the norm. Instead, fish are landed at a widely disseminated number of landing sites around the reservoirs where bicycle vendors and a smaller number of motorised vendors arrive from

first light to purchase the catch (Plate 5.). During the low season, most producers and mobile vendors adopt tied relationships. The vendor must guarantee to uplift catches on a daily basis and will sometimes offer medium term credit to the producer with his higher gear overheads and in return is assured a guaranteed supply of fish and 24hr credit on his stock. Such relationships are relaxed during the dry season when surplus production results in a buyers market attracting many casual seasonal entrants.

Plate 8. Bicycle vendor with 'typical' morning stock of small tilapias (Danduwella Village NWP)



vendors operating at greater distances from production sites and the two networks are demarcated by a small price differential (Box 1). Many farmers will visit their the nearest market town once a week on the occasion of the weekly fair, at which time in Anamaduwa at least, fresh fish can be purchased at slightly lower rate.

Most farmers reported that other than brief periods of the year, production from their own seasonal tanks contributed relatively little to their annual consumption compared to commercially available stocks (Plate 3.). Little of this harvest enters the commercial networks described above, due to a widely held perception amongst consumers that tank fish are inferior to perennial reservoir fish due to muddy/soapy off-flavours¹¹ (Working Paper SL1.3). Larger snakehead that represent an important by-catch to tilapia from seasonal tanks, appear to be less susceptible to such off-flavours, but in recent years this species

The 2-wheeler bicycle vendors then transport the fresh fish in wooden boxes on a door-to-door basis, reaching even the remotest villages furthest away from permanent roads usually on a daily basis. The great majority of fresh fish consumed by village communities is retailed in this manner (Plate 2.). Very few instances were observed where credit was extended to consumers. Volumes marketed and distances travelled range from between 5-30kg and 5-35km respectively, the highest levels occurring during the dry season when availability is highest. A smaller number of motorcycle vendors' transport up to 80kg of fish per day usually within a 60km radius. The more valuable species and sizes are generally marketed to more affluent populaces in larger rural towns, by the roadside or from stalls, boutiques or *polas*. Strategic junction locations in and around towns are also used to both retail and relay fish to secondary networks of 2-wheeler

Plate 9. Villager with share of seasonal harvest from village tank July 1999. (Nr. Dambulla North West Province).



¹¹ These stocks are harvested on a collective basis when catch effort is lowest during periods of lowest waterspread. Harvests are used for immediate household basis, distributed amongst friends and kinship groups. Additional surpluses are dried or smoked for later household consumption (see Working Paper SL1.2).

has also suffered from adverse consumer perceptions due to their susceptibility to a recently introduced fungal disease; Epizootic Ulcerative Syndrome (EUS). The first outbreaks occurred during the late 1980's and 1990's, affecting seasonal tanks particularly severely (Working Paper SL1.3). Consequently these fisheries are exploited mainly on a subsistence basis by poorer often low-caste youth or on a more recreational basis by youth in other better-off communities. Commercial vendors may be invited to purchase stock from some of the larger village tanks during collective harvesting in the dry season, though advance information regarding these often poorly managed, *ad hoc* events is difficult to come by¹². Potential for conflicts between different water users means that many communities are reluctant to share such information even on the rare occasions when the event is formally planned in advance.

Because bottom dwelling predators like snakehead are relatively immune to the gillnet fishery their contribution to the catch is greatest during the dry-season when water levels are low. At other times of the year, specialist fishermen catch small volumes of snakehead and other high value predators including eels (*Anguilla bicolor* and *A. nebulosa*) using hook and line. These are typically sold from a roadside vantage, close to the point of harvest by the fishermen themselves (Plate 4).

Larger retailer/wholesalers tend to enter the market erratically and on a seasonal basis. They will buy inland fish mainly during the dry season (June-September) when availability and price reach their seasonal highs and lows respectively. This corresponds with a reciprocal situation in the marine market due to the negative impact of seasonal winds on this fishery. It therefore becomes profitable at this time to bulk transport inland fish on ice by van or lorry too more distant markets. The differences observed in the wholesale marketing patterns between two of the largest commercial fisheries investigated, Rajangane (1646ha) and Kalawewa (2858ha) reservoirs¹³ are a consequence of several factors:

- The larger area and size of the Kalawewa fishery means that high volume supplies are more likely to be assured. Most landings also take place on only three principal landing sites close to the bund, whereas landings in Rajangane are widely disseminated around the littoral area, accessible mainly through jungle tracks.
- Kalawewa reservoir lies close to an arterial road between the East Coast fishing centre of Trincomalee and the principal cities of Kandy and Colombo, affording superior transport opportunities.
- Cultural differences between the largely Sinhalese and Muslim communities exploiting Rajangane and Kalawewa respectively.

Plate 10. High value predators such as eels and snakehead are caught and sold by specialist fishermen (Kala Oya, Rajangane, NWP).



¹² As many of those who participate in collective fishing do so only occasional, they very often borrow gears from out-with the immediate community. This then becomes a *de facto* means of information spread, leading to additional unsolicited external participation. A sizeable proportion of the catch also leaves the village as 'shares for the net-holders'.

¹³ Located in the Mahaweli H system, Anuradhapura District, this is the largest reservoir in the area, though the spatial separation of this and the other two major systems described above, means there is very little overlap in the market range for their fisheries products.



Plate 11. Professional fisherman selling the results of a nights fishing effort to 2-wheeler vendors at first light (Rajangane reservoir, North West Province).



Plate 12 Cartel of wayside bicycle vendors selling fish at Galgamuwa junction early in the morning. Rare surpluses are taken for sale in villages later in the day.

However the prevailing market characteristics described above and the very low overheads required to enter the network; particularly as mobile vendors, ensure the dominance of local small-scale actors, sales and consumption in the sector. Farmers in these areas are increasingly likely diversify their livelihoods through participation in the inland fisheries sector during the dry season when alternative opportunities and agricultural labour requirements are low (Table 2). Farmer/fisherman or farmer/vendor livelihood combinations are becoming increasingly prevalent despite traditional taboos on participation in fishing related activities (section 10).

The various levels of the marketing network are examined in greater detail in the following sections, based on the results of fieldwork in North West Province.

8 Activities of fisherman's co-operatives

Co-operative members, unaligned fishermen and fish vendors were interviewed regarding the current and historic patterns of co-operative activity during visits to *major* (>2000ha irrigable command area), *medium* (<2,000ha and >200ha) and *minor* (<200ha and >80ha) reservoirs in the vicinity of the two study areas, this being the range of tank sizes, supporting full-time professional fishing communities¹⁴.

Principle reservoirs in Galgamuwa District include Ranjangane (1646ha¹⁵, >200 boats) and Usgala Siyambalangamuwa (788ha, >45 boats) whilst in the Anamaduwa area there are Inginimitya (2042ha, >200 boats), Mahauswewa (360ha, >25 boats), Tabowewas (729ha, >40 boats) and Uriawewa (119ha, 10 boats). Uriawewa is minor tank, a base tank immediately adjacent to the Pahala Diulwewa cascade. According to our operational definition, all of these water bodies are perennial '*system*' tanks, that is, they receive assured water supplies either by virtue of their location as impoundments on perennial river systems (typically the case for the larger systems) and or via trans-basin canal diversions in the case of the smaller systems¹⁶.

Deregulation accompanying government withdrawal of patronage to the sector in 1989 resulted in extensive loss of any earlier institutional capacity. Since the repeal of the 'ban' in 1994 the government has encouraged the establishment of new co-operatives. Four of the five co-operative societies investigated, had been re-established during the previous 34 months, with the encouragement of a local fisheries inspection officer. Envisaged activities include savings and credit schemes, negotiation with other water users and institutions, regulation of the fishery (including enforcement of sustainable fishing practices and anti-poaching measures) and marketing initiatives. However, membership in each case membership was low and any of these co-operative activities as yet negligible. In 1987 some 5,000 canoes and gears were distributed to co-operative societies under a loan scheme, which proved unsustainable due to high default rates. Many of those interviewed had joined in anticipation of receiving such benefits again. Although government policy is to move away from encouragement of this kind of dependency culture, in reality the situation is perpetuated by patronage handouts, which accompany frequent local, regional and national political elections. Government institutional capacity also remains very weak with only one fisheries inspector relying on public transport, encompassing the whole of the research area.

One co-operative member in Ranjangane stated that the 'number of fishermen were increasing daily, with the younger generation competing with the old'. He estimated that nearly 500 fishermen were active to various degrees of which only 14 had joined the one state registered organisation at this time, whilst two other organisations were still awaiting registration. A similar picture was painted in other reservoirs, indicating that despite these initiatives the fisheries remain essentially open access with few real restrictions on individual fishing activity. In Rajangane the resulting cycle of exploitation with progressively decreasing mesh sizes was reported to have lead to conflicts as competition intensifies. This includes destruction of competitors fishing gears and the poaching of their catches.

Subsequent visits to meetings of two of these organisations (hosted by local fisheries staff) some months later revealed some interesting progress. In Rajangane co-operative membership appeared to have increased substantially. In both Usgala Siyambalangamuwa and Rajangane fishermen who were very aware of the potential damage being done to their livelihoods under the current access systems had voted for self-imposed bans on what they perceived as destructive fishing practices. The included staggered enforcement of the 3.5" official

¹⁴ The government classification of irrigation systems is based on the size of their command areas.

¹⁵ These figures indicate area at maximum waterspread of the impoundment

¹⁶ 'System tanks' can contrasted with the 'rain fed tanks' that are the main focus of this project. These tanks harvest rainfall from their own micro-catchments or receive drainage and spill waters from superior tanks in cascading systems of rainfed tanks and tend to be characterised by greater seasonality in water availability (Working Paper SL1.3).

minimum mesh size and a total ban on monofilament and trammel nets¹⁷. Subsidised deals on legal net sizes were offered by fisheries officers to facilitate change over. In Usgala Siyambalangamuwa, a ban on nighttime fishing was also imposed by a majority decision, both to conserve stocks and more importantly to reduce the incidence of fishermen interfering/poaching from each other's gears. Such co-ordination is far more difficult to impose on larger reservoirs such as Rajangane, where there are 3 co-operatives representing 3 different communities with a wide range of social status¹⁸. There also exists a great deal of irregular fishing by so called 'outsiders' who do not live immediately adjacent to the reservoir and are not members of any co-operative society. Fishermen repeatedly identified a requirement for external assistance in enforcing regulations under these circumstances. The lack of such capacity and the lack of political will required to change the situation¹⁹ are perhaps the greatest constraint to sustainable management of the largest and highest yielding systems such as Rajangane.

Only one co-operative organisation interviewed, Weerawilya co-op based around a minor tank in Southern Province, was involved in any collective marketing activity. Here female members undertook value enhancing processing activities and products were directly marketed in local villages and fairs by 2-wheelers acquired by the co-operative. This was a model organisation, which had benefited from a good deal of external government and NGO support.

9 Seasonal fluctuations in supply and demand

Table 2 shows seasonal patterns of supply and demand for fresh inland fish and its principle substitutes (fresh marine fish, dried fish and vegetables) compiled from interviews with traders, fishermen and consumers in the two research areas. Two peaks in production are reported during the inter-monsoon periods from February to March and July to September when waterspread areas reach seasonal lows and stocks become most susceptible to the gill net fishery. Most production from seasonal tanks is reported during the second period (July to September), the driest months of the year when many smaller tanks dry up completely. This serves to depress demand for commercial stocks for short periods in villages immediately where collective harvests have taken place²⁰. Strong seasonal winds serve to depress yields from late April to July, whilst catches between October to January are highly erratic as intense rains cause fish to rise and/or migrate in spill events but increasing water spreads make them steadily more difficult to catch²¹.

Consistent with the trends reported above, is the reduction in the number of inland fish vendors visiting villages during the Nov-Dec off-season; the frequency of visits falling from almost daily to 1-3x per week²². Consequently visits by sea fish vendors increase particularly in the Anamaduwa area with its greater accessibility to the coast. During August to September when the availability of inland fish is greatest average prices drop by 15-25% of their seasonal highs (April) for large and small species respectively.

¹⁷ A highly efficient sandwich system of various sized gillnets, selective for a wide range of fish sizes and species.

¹⁸ These range from a illegally encroached village of Low Caste Christian fishermen, who migrated from the coast during the 1970's, to high caste Govigama communities who became involved in the fishery more recently. Such social differences represent formidable barriers to achieving meaningful collective co-operation in the management of natural resources.

¹⁹ Lower caste fishermen indicated that their complaints regarding illegal fishing practices to local police were routinely ignored, whilst random acts of largesse are showered on groups with different political allegiances during election times.

²⁰ Surplus catches that cannot be consumed on the day of harvest are either gifted to friends and family or dried for later household consumption.

²¹ It should be noted that like cultivation calendars, these patterns vary slightly with locality due regional variations in weather conditions.

²² Heavy rainfall also makes travel along dirt tracks more difficult at this time.

Table 2. Supply and Demand for inland fish in study areas of Puttalam and Kurunegala districts (Source: interviews with farmers, fishermen and vendors).

Month	Demand	Supply
Jan	Steady increase: <ul style="list-style-type: none"> Farmers earn main income from sale of <i>maha</i> crops or agricultural labour (February to April) Farm labourers traditionally fed fish by their employees during <i>maha</i> harvest. 	Erratic: (5-80kg/boat/day) – <ul style="list-style-type: none"> Brief ‘windfall’ harvests from fish migrations associated with erratic spill events (Dec-Jan). Otherwise low CPUE as reservoirs reach maximal water spreads.
Feb		Moderate: (10-20kg/boat/day) <ul style="list-style-type: none"> Calm days with little wind Maha irrigation releases result in rapid reduction in water levels and increased CPUE¹.
Mar		
Apr	Highest: New Year celebrations	Moderate to high: (10-30kg/boat/day)
May	Steady decrease <ul style="list-style-type: none"> Little cash available after New Year celebrations High cash requirements for festive season credit repayments. 	Lowest: (2 –10kg/boat/day) <ul style="list-style-type: none"> Seasonal <i>warakan</i> winds send fish deep and inaccessible to gillnet fishery.
Jun		
Jul		
Aug	High <ul style="list-style-type: none"> Some secondary income potential from <i>yala</i> harvest. Fish fetching lowest seasonal prices substituted for vegetables that reach their seasonally highest price levels². 	Highest: (20-60kg/boat/day) <ul style="list-style-type: none"> Highest CPUE as water spreads fall to lowest levels during driest period of year Many casual seasonal entrants to fishery Seasonal tank stocks including snakeheads harvested for home consumption.
Sep		Decreasing to median levels (10-25kg/day) <ul style="list-style-type: none"> Risk of over exploitation during drier years with lowest water spreads Fishermen revert to smaller net sizes.
Oct	Moderate to low <ul style="list-style-type: none"> Highest seasonal credit requirements for agricultural inputs. Modest income potential from agricultural labour (preparing fields for cropping) and sale of chenna crops. Availability of marine varieties at seasonally low prices. 	Moderate to low (5-20kg/boat/day) <ul style="list-style-type: none"> Falling CPUE as water spreads increase with onset of NW monsoon. Larger carps appear in catch, rising to surface immediately after intense rainfall events.
Nov		
Dec		

¹ CPUE: Catch Per Unit Effort.

² Vegetable supplies reach maximum and minimum levels during April and (the driest month of) August respectively.

Supply patterns for fresh marine substitutes: The South West and North East monsoons bring adverse weather and fishing conditions to the East and West Coasts during the months of May to September and December to February respectively. Production along the East Coast and the North has also been adversely affected by the continuing ethnic crises. The net result is a minimum availability of marine fish between July and August when prices increase on average between Rs20-30 per kg. Table 2 shows that inland fish production is highly complimentary, reaching a seasonal peak during the marine low season.

Supply patterns for dried fish: Supply follows the availability of inland and freshwater fish with a slight lag. Lowest availability for dried fish was reported during December to February possibly because these are the months following the marine low season. Also dried fish is most difficult to prepare and conserve during the concurrent rainy season. As is the case for

fresh fish, demand for dried fish is also greatest during the April new-year celebrations by which time supply levels have increased once more.

Supply patterns for fresh vegetables: Supplies of fresh vegetables are lowest and prices highest during the dry season, when many poorer farmers wives reported that they substituted small tilapias, highly available and cheap at the same time.

The striking conclusion regarding these supply patterns for inland fish is how highly compatible they are with seasonal patterns of rural consumer demand and income availability (Table 2.) and substitute availability. The relatively stable pattern of year round supply by comparison to the marine fishery is also noteworthy. The greatest mismatch between availability and demand occurs from the end of April to the end of June. It is recommended that this should be the primary seasonal production window targeted by aquaculture interventions.

10 Middlemen/producer margins

In a context, where demand is greater than supply for much of the year, and good competition exists through a large network of highly mobile small-scale traders, fishermen are in a relatively strong position with respect to marketing their produce. Although in this instance, it was not possible to calculate producer overheads and hence margins with any accuracy²³, Table 4 shows that on average fisherman receive over 50% of the final consumer price, a favourable rate considering the higher risk of spoilage losses born by mobile vendors. Conversely, the lower overheads (i.e. bicycle and scales) born by the vendors indicate that wholesale and retail margins ranging from 19-34% are relatively equitable. It is also noteworthy that small tilapia (<150g) which constitutes the bulk of produce entering rural villages attracts the most favourable retail margins (20-34%). Because of the highly local nature of the market, most actors have good knowledge of margins at all levels of the network and were generally content with these rates. One fisherman went so far as to state 'that it is good that two families can make a living from one catch'!

Fishermen in Ranjangane reservoir were landing an average of 10-15kg of fish per day during the current low season (November). This can rise to as much as 60-80kg/day during the dry season. For a typical crew of 2 men with an extra share going to the boat owner, and with most boats fishing 28days per month (no fishing takes place on full moon days), the current yield represents a gross income of between Rs2,800 -4,200 per month (£24 - £36) or over twice the official poverty line of Rs1,500.

Despite these apparently favourable returns, a community of full-time professional Christian fisherman around Rajangane reservoir inhabited one of the poorest villages encountered during the study. Remaining illegally encroached around the reservoir after over 25 years in residence²⁴, this low caste village had no permanent housing or access roads, no access to productive land and high levels of alcoholism and gambling were reported²⁵. Therefore income levels alone cannot be used as an accurate indicator of poverty. Elsewhere around the reservoir many Singhalese cultivators have commenced fishing more recently as a means of livelihood diversification (section 7.2).

²³ Overheads are essentially restricted to the costs of locally produced fibreglass or dugout canoes and gill-net replacements. This highly artisanal fishery can be contrasted with the increasingly mechanised marine fleet, subject to fluctuating costs of important fuel and motor spares.

²⁴ Since migrating from the coast at time when the tilapia reservoir was just beginning to be exploited.

²⁵ Never the less the villagers felt that their lot had improved and that they now enjoyed greater self-determination compared to the exploitation they faced at the hands of fish 'modalalis' on the coast.

**Table 3. Price margins (Rs / kg) between landing site and consumer December 1998.
(Source professional fishermen (n=9) and traders (n=12) in Anamaduwa and
Galgamuwa districts).**

	Landing price	Wholesale	Wholesale margin (%)	Retail	Retail margin (%)
Large Tilapia (>150g)	35-40	45-50	20-23	60-70	19-25
Small tilapia (50-150g)	15-30	20-40	25	30-50	20-34
Common Carp	40-50	-	-	60-80 ¹	-
Snakehead	50	60-70	17-29	80	12.5-25
<i>L. dussemeri</i> <500g	-	-	-	40-50	-
Minor cyprinids ²	15-20			25-30	

Note: Large tilapia retail for as little as Rs 40/kg when supply is greatest during the dry season.

¹ Large carps are generally portioned before sale and a surcharge added to cover processing losses.

² Consisting largely of *A. melettinus* also known as *wewas salaya* or 'tank sardines'.

As indicated above much of the catch from the most seasonal tanks is retained for home consumption, with collective harvest surpluses occurring between the driest months of July to September. Due to the seasonal gluts in supply which prevail at this time and the negative consumer quality perceptions associated with seasonal tank fish (section 7.2) these surpluses have low marketable values. This is a result of off-flavours, which appears to become progressively worse with a reduction in tank size. Most severely affected are the small tilapias, which represent the principle harvest from these tanks. The source of these fish is immediately apparent due their dark and 'slimy' appearance. In extreme cases even post-harvest processing (skin, removal, curing and smoking) can not remove these off-flavours. Off-flavours appear to be less of a problem in larger exotic carps. However the seasonality of the harvest still results in a depression of prevailing market price and reduced margins to producers. Villagers near Dambulla whose tank had been stocked on several occasions in the past had recently marketed large rohu to motorised vendors for only Rs 20-25 after a collective harvest in August, compared to a concurrent retail price of Rs 60-80 (Table 3.).

A parallel study in Raichur District of Karnataka province in India, found that markets were monopolised by a small number of wholesale traders and severe exploitation of fishermen through tied credit relations was common. Fishermen received as little as one seventh of the final retail price (Murray and Felsing 1998b), compared to margins of 50% found in the current study. In this semi-arid district with extremely poor infrastructure, little demand currently exists for fresh fish and most of the production which comes from rivers and reservoirs is exported by rail to urban wholesale markets out-with the state. Because of their scant knowledge of these distant markets small-scale producers have a poor perception of the subtle exploitation they face from traders. Kinship linkages and the provision of a range of informal services including informal credit (such services are often unavailable to poor producers through conventional channels) further blur the distinction between synergy and exploitation in these relationships. Similar though far less exploitative trends were found by Chandrasiri (1986) who reported high levels of trader monopolisation and poorer margins accruing to fishermen around coastal freshwater tanks in Southern Province of Sri Lanka. This is attributed to relatively low levels of demand for inland fish where population density is low and fresh marine fish readily available. Instead, middlemen transported much of the production to more distant inland markets and producers typically receive only 40% of the final retail price. In marine markets, where producers must quickly sell large volumes of product, often by auction at the land site, exploitative relationships are also very common. Attapatu, (1994) for example, reports occurrences of organised bidding by middlemen at marine landing sites. However the higher volumes typically landed by marine fishermen offsets the effects of such exploitation to some degree.

In both countries unfulfilled demand exists for fresh fish, which therefore commands higher margins than dried fish. The drying of fish therefore represents a 'salvage' rather than a

‘value addition’ mechanism and is most commonly practiced on the smallest most perishable species (section 12.).

In section 13 this unique, highly accessible, equitable and unregulated marketing system for inland fish that has evolved in Sri Lanka, largely in the absence of government intervention, is contrasted with agricultural markets which continue to suffer from years of policy-induced stagnation.

11 Weekly *polas* and dried fish marketing

Weekly fairs in the market towns of Galgamuwa and Anamaduwa (Box 4) were visited to assess their contribution to the wider local markets for aquatic produce and to investigate the ease with which new entrants could operate in this market area.

Relatively little fresh fish is sold at these venues for which other daily outlets are more important. Instead, they serve as important retail points for cash crops and dried fish. As previously indicated dried fish varieties, both inland and marine varieties constitute a dietary staple for much of the population both rural and urban. In frequency terms, dried fish is the most commonly consumed animal product. In the study villages it is eaten almost on a daily basis throughout most of the year, whilst fresh fish is likely to be consumed no more than 2-3x per week during periods of peak availability.

Box 8. *Polas*; periodic food markets in market towns.

A total of 580 of weekly town markets (*polas*) are held in Sri Lanka (Dheerasinghe 1998). They are held on alternative days in neighbouring towns so traders can work on a circuit basis. In Anamaduwa and Galgamuwa fresh produce is sold on a permanent site at the edge of town, whilst clothes and other fancy goods are sold on stalls lining the side of the road leading into town. These food markets are either privately or council owned. Larger vendors hold traditional sites in covered areas, whilst the smallest vendors trade from the ground in peripheral areas. Wholesale activities take place early in the morning from 6.8AM. Many of the smaller ‘ground vendors’ will arrive empty handed, purchasing stocks from professional wholesale suppliers or local farmers who visit the *pola* early in the morning for this purpose. Local farmers were rarely found to retail their own produce at these venues. These markets are also important opportunities for social exchange for both men and women from local villages, who dress for the occasion.

Jinadasa 1997 estimated that approximately 5% of locally produced marine fish is dried and this supply is augmented by substantial imports of dried marine fish. Box 1 shows that over the last decade the contribution of imported fish (which is mostly in dried form) ranged from 19-34% of mean per capita consumption over the last decade. As the crude protein levels are likely to be almost twice those of fresh fish, this indicates that quantitatively, if not qualitatively, dried fish is at least as important as fresh produce in terms of protein consumption. This is especially the case for the poor for whom dried fish represents the most cost-effective animal protein source.

In the absence of refrigeration, fresh fish must be sold within one or two days of capture, whilst dried fish can be stored for weeks or months depending on the season (storage times are dramatically reduced during the rainy season²⁶). As is the case in other Asian cultures, dried fish is generally marketed alongside vegetables for which it

is almost an inter-changeable accompaniment to be consumed with rice. Fresh and dried fish are therefore distinct commodities that should be clearly distinguished when investigating consumer preferences.

²⁶Vendors report that dried fish can only be stored for 1 month without repeated drying during the rainy season and for up to 3 months during the dry season.

In addition to drying/curing of fish, smaller amounts are also smoked locally. This can extend storage potential significantly, particularly when combined with curing²⁷, which is the usual practice. Smoked produce is highly popular with consumers, commanding a premium price, more than 50% higher than the dried variety in the case of snakehead (retailing for over Rs300/kg). However the extra labour involved in preparation and the higher processing losses involved means that relatively little commercial production takes place²⁸. Farmers in villages are likely to home smoke small surplus quantities of fish during the rainy season when curing is more difficult. This is integrated into the cooking process, reducing the requirement for additional wood fuel.

Little of the dried fish available in the study areas came from the immediate area. As producer margins for fresh inland fish exceed those for dried fish and demand in the study area invariably exceeds supply, local fishermen rarely have any excess 'table size' stock to process or dry. The only exceptions are the smallest (<150g) 'trash' fish: mostly tilapias and small indigenous minor cyprinids including *Amblypharyngodon melettinus*, *Rasbora dandonicus* and *Puntius* spp. which are highly perishable and command particularly low farm-gate prices in their fresh form (Table 3.). When dried they can be readily stored or sold through local rural boutiques or *polas*. These species, which have the rare ability to breed within the reservoir environment, have been reported to constitute a largely unexploited biomass greater than that of the tilapia fishery (Pet 1995, Working Paper SL1.2).

Whilst most commercially available dried fish is imported, the bulk of locally produce dried inland fish that appears on the market comes from the North and East, particularly from Padavia and Wahalakare tanks in the troubled Wannu region and Maduru Oya to the East. Poor roads, lack of cold chain facilities and transport restrictions make it difficult to transport fresh fish from these areas to more populous markets in the West. Consequently larger fish from these areas, principally snakeheads and tilapias are dried as a salvage mechanism. For the same reason no dried exotic carps were observed in any market as it is highly unlikely that any seed for stocking such species is available in the remoter areas. Locally, the drying of all these larger varieties would result in an unnecessary drop in value likely to be borne by the producer.



Plate 7. Drying small indigenous varieties, undertaken by the wives of Christian fisherman wives (Rajangane reservoir, NWP).

²⁷ Locally produced salt is readily available for this purpose, costing only Rs 6/kg.

²⁸ Whereas sun drying takes 1 day (within a 3 day window after processed fish have been covered in salt), smoking requires 2-3 days.

Surprisingly, only two female vendors at Galgamuwa *pola* had purchased dried inland fish from the nearby Rajangane reservoir, where the wives of Christian fishermen process significant quantities of small inland fish varieties (Plate 7). Instead motorised traders from the coast visit the reservoir intermittently to bulk purchase this produce which then enters the wholesale network along with locally produced dried marine varieties. Woman's participation in this processing activity and the enduring market connections observed date back to the coastal origin of these fishing communities. Few Buddhist women around the reservoir were involved.

Some 70% of customers observed buying dried fish were female (n = 21). Poorer consumers²⁹ were most likely to purchase smaller, cheaper varieties of dried fish regardless of marine or inland origin. *A. melettinus*, tilapias, sardines and two other unidentified marine species, were the most prevalent of these species. All vendors agreed that demand for dried tilapia was good and that demand often outstripped supply. Demand for dried fish, regardless of species, is at a maximum during March and April, the time of the New Year celebrations and the 'maha' harvest. Seasonal lows occur from October to December during the main rainy season (section 9) with a mean seasonal price fluctuation of Rs10-20 between these extremes. Historic prices were reported to have remained relatively constant over the previous 6-7 years with respect to other food commodities, whilst dried fish sales were reported to have increased substantially over the same period.

11.1 Gender and dried fish marketing:

Substantial numbers of vendors were involved in retailing dried fish at the weekly markets visited in Galgamuwa and Anamaduwa. Two scales of marketing were observed which varied in volume and species composition, gender, spatial and temporal aspects. These are considered below.

1. Large-scale/male dried fish vendors: A total 12 and 15 stalls selling large volumes (>100kg/stall) of predominantly imported marine varieties were observed at Galgamuwa and Danduwellawe *polas* respectively. These stalls tended to be strategically located within permanent covered areas of markets and were operated exclusively by male traders who bring fish by lorry from distant wholesale markets, predominantly in Colombo.

These traders are full-time, year round professionals who operate from a regular weekly circuit of fairs within the region. Often they will work collectively to reduce transport costs. In Anamaduwa several traders were part of such a co-operative incorporating over 40 members. These traders, having usually been established for many years, exercise greater collective influence than smaller independent peers. They intimated that they would be intolerant of direct competition i.e. from new stallholders from members outside their peer or kinship groups.

In addition to large volumes of marine fish, these traders also retail larger tilapias and snakehead from the troubled areas to the North and East as well as lesser amounts of smaller 'trash' inland and marine species.

2. Small-scale/female vendors: A second tier of independent small-scale traders, mostly women, operated from stalls on the ground in uncovered areas in the markets. Stock holdings were small at around 10-30kg varying with the season. The source of this stock tended to be much more local, consisting predominantly of the smallest and cheapest species both marine and freshwater. Many of these women came from nearby coastal areas (i.e. Putullam) and were selling the smallest dried 'trash' component of their husband's catch, which they processed themselves (Plates 8 and 9.).

²⁹ Consumers were questioned regarding the status of their house, school leaving age and household dependency ratio as proxy indicators of wealth.

An alternative strategy adopted by many women involved the purchasing of some or all of their stocks from wholesale traders who attend the markets early in the morning. This was especially the case where women were retailing higher volume vegetables, the primary commodity for sale in these markets. Some vendors, husband and wife teams in several instances were selling a combination of vegetables and dried fish (Plate 7.). Margins for these vendors selling vegetables vary between 10-25% decreasing over the course of the day. At the end of the day any remaining produce is sold below cost to reduce losses. This is in contrast to the good keeping qualities and low risk attached to the retailing of dried fish, underlining the complementarities of this product mix



Plate 8. Tamil woman selling husbands by-catch of small marine varieties (Anamaduwa Wkly Market, NWP).

from a major coastal landing site (70km, whilst Anamaduwa is only 30km) had no female traders from coastal areas and consequently fewer small-scale/female dried fish traders overall. Unsurprisingly the few female vendors present were selling substantially more inland fish than in Anamaduwa (section 11).

Whilst it was not possible to question women about their caste backgrounds, their names suggested that few belonged to the higher *Govigama* (farmer) caste. Furthermore, of 11 women traders interviewed only two came from households where agricultural production provided the primary source of income. This reflected the cultural norm observed in

For most of the women interviewed marketing was a part-time occupation and also highly seasonal. Most attended no more than 2-3 markets per week within a 30-mile radius of their hometowns and ceased to trade between during the maha and yala field preparation and harvest periods when they were involved in agricultural labour. These women occupied the same locations in the market every week and although every available space appeared to be occupied, they suggested that it was relatively straightforward for new entrants to come into the market at this level. New entrants are likely to be offered the most marginal sites at the periphery of the market in the first instance.

Although the ethnic backgrounds of women at the peripheral market areas were mixed including Buddhist and Tamils and Catholics from coastal areas, their social backgrounds were uniformly low. Participants included wives from local fishing communities, the wives of landless labourers and women from single-female headed households. Whilst many vendors involved in the 'large-scale' marketing of dried fish were Muslims, no Muslim women traders were encountered. Galgamuwa which is much further

Box 9. Retail and wholesale margins (Rs/Kg) for dried fish at Anamaduwa and Galgamuwa weekly fairs

Species	Wholesale	Retail
<i>Tilapia</i> sp.	50-80	65-100
Mixed indigenous sp.	40	60
<i>A. melettinus</i>	25	40
Snakehead		100
Sardines	30-35	40-60
Sprats		130
Large seafood		80-240

Note: Price ranges reflect variation in fish size.

villages where farmers reported that it was considered an indication of poverty to have their wives involved in such work. Further investigation indicated that such trade is likely to be adopted only by women from lower caste groups or those from female-headed households. In this respect it is also noteworthy that only amongst the Christian fishing community of Rajangane, were women observed participating in fishing activity. These were women from single-female headed households, using small mesh sizes to fish for smaller-species in littoral areas, which they were then able to process and sell themselves.

Despite such constraints the economic incentives for women's participation appear good. Box 5 shows the margins between wholesale and retail prices for dried fish, whilst Box 6 shows the main overheads involved in selling produce at local *polas*. For small-scale/ female vendors (section 11.1) assuming sales of 20kg per day, transport of 30km using public transport a small site rental of Rs40/day and a margin between Rs15-20 on the sale of small dried tilapia, one could expect a return of between Rs250 – Rs350 per day. For the women involved this is a substantial amount compared to the average daily casual off-farm labour rate of Rs100-125.

In conclusion, because of the constraints women face culturally and physically in transporting fresh produce to markets (section 6) and in the absence of existing male domination, the processing and retailing of low volume and high value sun-dried fish would appear to offer the greatest opportunity for their participation. This potential may extend to women from resource poor low-caste communities around seasonal tanks in upper watersheds, likely to yield smaller sizes of fish. In India, the cultural exclusion of higher caste groups is often interpreted as a benefit for aquaculture options that aim to target the poor. However under the feudal caste system that prevails in Sri Lanka, over 50% of the population fall within the highest *Govigame* group, many communities amongst which also experience high levels of poverty. Therefore in this case, such cultural barriers may represent more of a constraint than incentive to poverty-focused adoption.

Box 10 Overhead marketing costs at weekly fairs.

Transport Costs:

Note: For transport purposes, A gunny (rice) bag is the basic unit for charging. This volumetric unit is equivalent to approximately 20kg of dried fish.

By Lorry: Transport of dried fish from Colombo to Anamaduwa (130km) is charged at Rs 20 per Gunny (20kg) to co-operative members (lorry capacity 2mt).

Local transport by van or lorry: Vendors sharing a 1 mt lorry pay Rs 20-27 per 20kg to transport vegetables in a 30 mile radius.

Public transport: A gunny bag is typically charged at 50% of a passenger ticket. i.e. to transport 20kg of dried fish 30km from Puttalam to Anamaduwa costs Rs 10.

Site Rental:

Rental costs from Rs 25 to Rs60 per day were reported. Smaller traders' occupying 2x2m pitches reported paying Rs40 per day. Curiously, larger traders in the covered market reported paying an average of Rs25 per day.



Plate 9. Female vendor selling vegetables, dried marine and inland fish alongside her husband at Galgamuwa fair.

12 Fish Preferences in study villages of Puttalam and Kurunegala Districts

Information on consumer preferences was collected and triangulated using the following data sources:

- Villagers in Dandulawellawe and Pahaladiulwewa small tank cascade-systems were asked to rank and score their preferences for fish consumption (marine, dried and inland) and meat substitutes.
- Villagers were asked to explain their consumption preferences, patterns and frequency of consumption.
- Mobile fish vendors within and around study villages were questioned about consumer patterns of demand.

12.1 Religious and cultural perceptions towards fish and meat consumption

The ethno-religious composition in both cascade systems was almost 100% Sinhalese/Buddhist. A wide variation in attitudes to the culture and consumption of fish reflected a pragmatic ambiguity in Buddhist teachings. Traditionally, this even extended to passing on a hidden portion of the economic benefits of fisheries to the clergy, a practice known as ‘doing the right thing’ (Siriweera 1986)! A 12th century rock inscription observed at Paramakanda temple in the Pahaladiulwewa cascade, claimed half of the proceeds of fishing on temple lands for the local monastery, whilst ancient images showing the harvest of aquatic produce from village tanks are a common site on the walls of cave temples. The following religious attitudes to fish and meat consumption were identified during RRAs:

Of 82 villagers interviewed, 33 and 49 in DDW and PDW respectively, only 7% abstained entirely from any form of fish or meat consumption, whilst an additional 25% abstained only from meat consumption. Such behaviour is largely attributable to religious factors. Generally, the oldest and more affluent members of the community were most conservative in their religious beliefs, several intimating that the subject of catching fish was not only a sin but also unpleasant to discuss. However further questioning revealed that many of these respondents had in fact participated in fishing activity when they were younger as had their parents before them. This suggests that this conservatism is an intergenerational feature of age, rather than a result of changing attitudes amongst the youth of the current generation.

Many respondents cited a religious distinction between the acceptability of killing of animals and fish, though no coherent explanation was offered and the likely explanation may lie with the traditionally higher cost and lower availability of meat products. Interestingly, wild game

is highly popular with many respondents. Whereas very few of these farmers undertook regular fishing activity, most were happy to consume fish caught and killed by others. Commercial fishing is often described as 'pity work' and is typically the preserve of poorer groups. Similarly farmers who kept livestock rarely slaughtered their own animals. Aged or non-milking stocks are instead sold to Muslim-owned slaughter businesses in neighbouring towns and villages. By contrast, the practice of recreational fishing in seasonal tanks is widespread, though essentially restricted to male youth who often combine the activity with other recreational activities including the consumption of locally distilled liquor. No instances of women fishing in seasonal tanks were observed or reported. Because of these adverse perceptions most parents frown on their children fishing and a perennial game of cat and mouse ensues as children resort to fishing secretly usually with hook and line after school.

The majority of inland fishermen and vendors in the area were Buddhist who had various perspectives on their trade. One fisherman felt it was less of a sin to catch fewer larger fish and would only use larger mesh sizes. Other fishermen felt that it was acceptable to catch fish using nets but not with hook and line. On *poya* days (Buddhist religious occasions held at every full moon) most villagers respect a traditional restriction on hunting and fishing and even children will not fish on these days.

Elsewhere in the South Asian region, a cultural perception that fish is a 'hot' food has a considerable impact on seasonal demand³⁰. Similar perceptions were found amongst local villagers. Whereas sea fish was considered to be hot (especially tuna), freshwater fish such as tilapia, snakehead and eels were considered to be cool. However such perceptions had no apparent effect on the consumption patterns of any of the respondents. Various medicinal and nutritional properties were also ascribed to different species, including the benefits of snakehead consumption to lactating mothers. Tilapia in turn was attributed with the ability to produce phlegm, a positive attribute in Sri Lankan society, and 'being good for small children as it purified the blood and gave them strong bones!'

12.2 Consumption patterns for fresh fish and animal protein substitutes

Similar patterns of fish and meat consumption were found in both cascade systems. Inland fish represented the most important fresh animal protein source consumed by villagers, with over 60% of respondents consuming fish 2-3 times per week and over 80% at least once per week (Figures 5 and 6.).

A large proportion of respondents ignored religious objections to meat consumption (section 12.1), though chicken, beef and pork are consumed much less frequently, on average once per month or less because of their high costs. These items are mainly purchased from boutiques in nearby market towns although vendors also occasionally brought meat products into villages.

Butchers interviewed in Anamaduwa said that over recent years, demand for meat had decreased as farmers increasingly struggle to make ends meet. In Dandulawawellawe wild game such as venison, rabbits, and wild boar is consumed more frequently

Plate 10. Village hunter loading home made gun.



³⁰ Where by the effects of inland fish consumption are associated with the debilitating effects of hot weather. This may be correlated with high endogenous histamine levels and the incidence of scromboid disease, particularly in red meat varieties such as Tuna.

than livestock (Figure 5.) due to its lower cost³¹. However, here too availability has recently fallen, due to noise emanating from a new quarry scaring game away. This meat is supplied, often illegally, by a small number of village hunters who butcher and distribute the meat primarily within kinship groups. Two households where the men regularly hunted with home-made guns were interviewed (Plate 10.). Both came from the lowest wealth rankings, one being landless, reflecting cultural taboos similar to those prescribing entry to inland fisheries. Both hunters also participated in occasional fishing in seasonal tanks, but only for their own household consumption rather than resale.

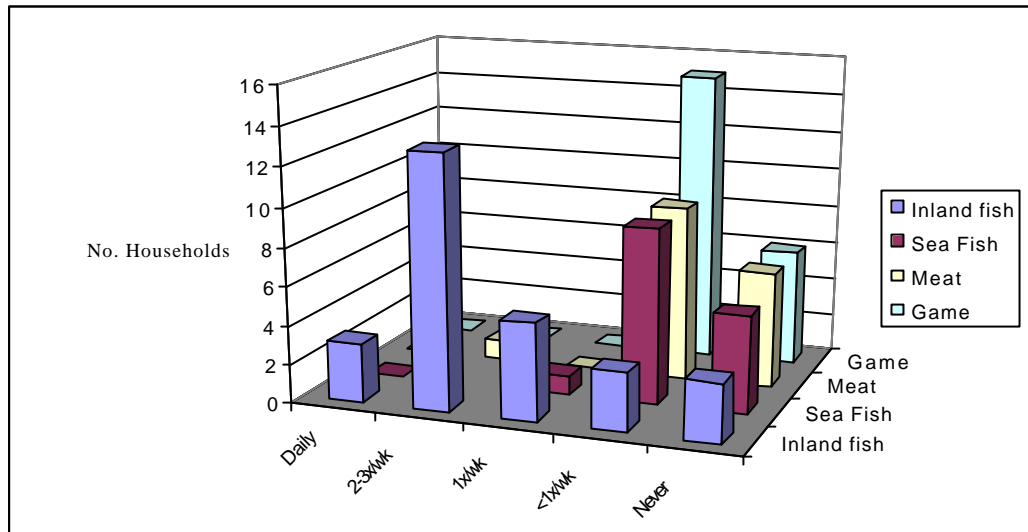


Figure 5. Household consumption frequencies of fish and meat substitutes in Danduwellawe village (n = 27).

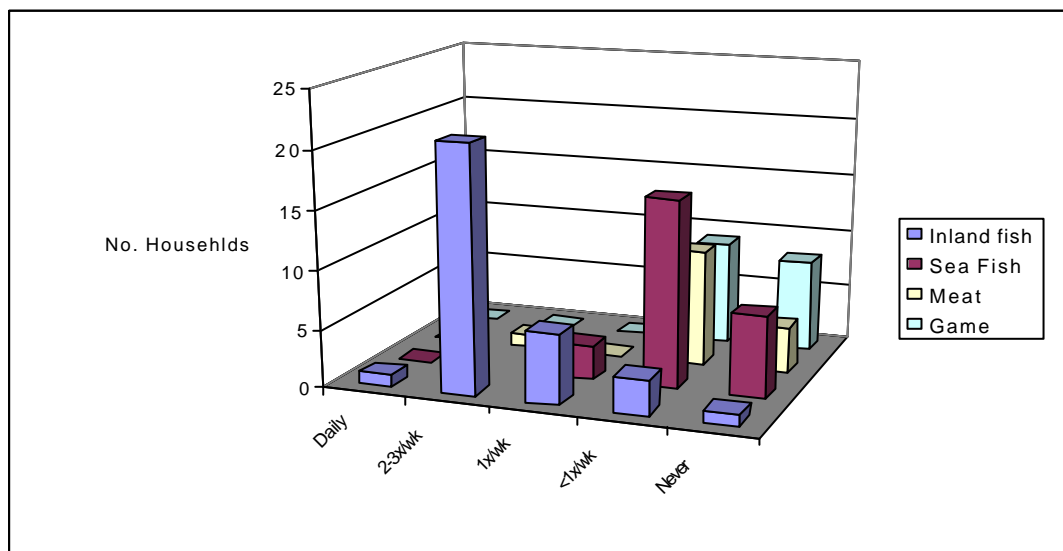


Figure 6. Household consumption frequencies of fish and meat substitutes in Pahala Diulwewa village (n=38).

³¹ Danduwellawe benefits from its proximity to pristine forest areas still well supplied with wild game, whilst only secondary forests remain in the Anamaduwa area to the South.

Less wild game was consumed in Pahala Diulwewa, due to the lack of natural forest habitat for wild game in this area. Here, approximately 50% of respondents occasionally consumed fresh sea fish (once per month or less) whilst 29% of respondents never consumed seafood at all. Most respondents complained sea-fish was too expensive and often of dubious quality compared to inland fish.

Only farmers within medium and better-off wealth ranks were frequent consumers of marine fish. Most of these respondents purchased these varieties to add diversity to their diet, but still expressed a high preference for fresh water fish because of its highly fresh quality. Only one resident, a teacher in the Pahala Diulwewa system consumed sea fish exclusively, having recently migrated from the district capital, Kurunegala.

Most respondents consumed dried/cured fish at least as frequently as fresh fish and the frequency of consumption relative to fresh fish was higher for the poor who consume on average between 2-5 meals per week. One 'poor' farmer reported that 250g of dried fish would be sufficient for 3 meals, whereas for the same price, enough fresh tilapia for only one meal could be purchased. Dried marine and inland fish and fresh inland fish are therefore the staple animal protein sources that complement the rice-carbohydrate staple in these villages.

12.3 Inland fish preferences

Villagers indicated that between 75-85% of fresh fish consumed in villages consisted of tilapias reflecting the species composition of stocks brought into villages by 2-wheeler vendors. Snakehead (*Channa striata*) made the next highest contribution by volume, followed by *Etilapia suratensis*³² and occasional exotic carps. Smaller amounts of indigenous species including; climbing perch (*Anabas testudineus*), small catfish (*Mystus sp*, *Heteropneustes sp.*) and a variety of minor cyprinids including *Amblypharyngodon mellaenus*, and *Puntius sp.* tend to become available, towards the end of the dry season.

1. Preference criteria: Farmers were asked to rank and score the preference criteria they applied when purchasing fish. Identical criteria, cost, quality, size and taste were identified in both cascade systems. A non-parametric 2-way analysis of variance (Friedman's test) was used to establish whether significant concordance existed amongst different groups of farmers. Results are summarised in Table 4. These results stress the importance of cost to poorer wealth groups in both villages. For better-off respondents, cost becomes the lowest priority although the difference does not quite reach statistical significance at the $P>0.05$ level. Taste was universally considered of low importance, perhaps because fish is more often curried than fried. This suggests that the textural qualities of exotic carps are likely to have greater impact on demand than their taste qualities *per se* (see below).

³² The green chromide (*Etilapia suratensis*), another locally introduced minor cichlid is commonly sold together with the smallest tilapias, so similar are their appearance and eating qualities.

Table 4. ‘What do you look for when you purchase fish?’ Results of Friedman’s test on results of preference scoring for fish purchasing criteria adopted by farmers in project villages (see Appendix 1). Median ranks are indicated in order of priority, Rank 1 is of greatest importance.

Location	Median Rank	All Ranks	Poor	Medium	Rich
Danduwelawe	1	Size	Cost	Size	
	2	Quality	Size	Quality	
	3	Cost	Quality	Cost	
	4	Taste	Taste	Taste	
No. of respondents		22	12	10	
Probability		0.011	0.112	0.021	
Pahala Diulwewa	1	Quality	Cost	Cost	
	2	Cost	Quality	Quality	
	3	Size	Size	Size	
	4	Taste	Taste	Taste	
No. of respondents		14	7	5	
Probability		0.01	0.021	0.019	
Both villages	1				Quality
	2				Size
	3				Taste
	4				Cost
No. of respondents					5
Probability					0.06*

Note: Where $P < 0.05$ significant difference is between scoring criteria is inferred at the 95% confidence level. An asterisk indicates insignificant results. See Working Paper SL1.1.

Plate 11 Selling carp steaks in Pahala Diulwewa village



It soon became apparent that the criteria of size and cost are closely inter-related. Tilapia of 150g or more, typically cost approximately 15% more per unit weight than smaller specimens. In the poorer of the two villages, Dandulawelawe, size was consistently ranked a highest priority criterion for this reason. Of 11 and 17 respondents in lower wealth groups questioned in Dandulawelawe and Pahaladiulwewa respectively, 7 and 12 expressed a preference for smaller fish for this reason. This was despite the relatively low ranking of size as purchasing criteria in Pahala Diulwewa, though here too cost was ranked highly amongst medium and poor groups.

Whereas one farmers wife (medium wealth) stated that she bought larger fish because there is less wastage, many poorer farmers (male and female in both villages) opined that ‘small fish are more nourishing’ (as they are often prepared whole) and some farmers suggested that bones were tasty, but conceded that children today rarely shared this opinion.

2. *Species preferences:* In a parallel study in India snakehead was considered to be the superior inland fish species (Murray and Felsing 1998a). Opinion in Sri Lankan villages was

divided over whether tilapia or snakehead was the most preferred species demonstrating the wide acceptance tilapia has gained amongst rural consumers since it's introduction nearly 50 years ago.

Wide consensus existed amongst villagers as to the lesser status of introduced carp species. The low consumption frequencies recorded in both villages (Figure 7.), are consequence of this perception and also their lower availability. Several villagers reported that they would be prepared to purchase more carp, but remarked that bicycle vendors were often unwilling to portion large carps fish due to fears of rapid spoilage (Plate 11). However such portioning is generally only necessary for the largest specimens as vendors indicated there is an unfulfilled demand for whole larger fish up to approx. 5kg. In several instances large carps close to this size were observed being purchased whole by villagers (Plate 12.). These fish were destined for extended family get-togethers or festival meals as they involved significantly lower processing effort than the comparable volume of smaller fish required for such a large meal. Demand in this niche market is currently both by larger carps and tilapias which command similar margins for vendors³³. Furthermore the lower mean size of carps likely to be yielded from seasonal tank fisheries may be more attuned to local demand. However whether sufficient demand currently exists for the seasonal volumes of carp that would enter the market assuming widespread adoption of village tank stocking programmes requires further investigation.

Common carp, known locally as golden carp, which appear to have become established locally (Working Paper SL1.2), is the most widely available species, along with smaller numbers of catla and rohu. No villagers made any distinction between these species in terms of consumption characteristics with respondents alternatively described them as too fatty, slimy, oily or having a watery taste (n = 7). In a separate study Creech (2,000) reported a particularly adverse consumer reaction to bighead carp due to excessive oiliness, but good marketing potential for other varieties including rohu and catla utilised in a seasonal tank-stocking programme. This is unsurprising considering the high esteem with which *Labeo dussemiri* an indigenous carp fast disappearing from the fishery is still held by many villagers.

Figure 8 shows carp consumption frequency versus mean wealth ranking for all respondents in each frequency group. These figures indicate that there is a tendency for the higher wealth groupings to consume slightly more carp than poorer groups, carps being on average 15-20% more expensive than larger tilapia and double the price of small tilapia. Amongst poorer farmers, the preference for smaller fish has implications for the selection of suitable species for stocking programmes. *O. mossambicus* may be more suited to local market conditions than *O. niloticus* which tends to mature at a larger size, where self-recruiting species are to be stocked.

Plate 12. Villager with 5kg common carp purchased for extended family gathering (Danduwella village, NWP)



³³ A surcharge of Rs10 is payable by consumers who purchase carp steaks, thus passing on the cost of the processing losses.

These observations are somewhat at odds with an institutional view gleaned from key informant interviews with fisheries institutions and NGO's that remains firmly focussed on stocking programmes using fast growing large exotic carps (Working Paper SL1.2). This view does little to acknowledge the importance of smaller low cost varieties to the livelihoods of the rural poor in Sri Lanka. Conversely our results also indicate that good niche markets for larger carps do also exist, a fact rarely acknowledged by tilapia proponents. This increasingly polarised debate between advocates of carp and tilapias serves only to obscure real development constraints and opportunities based on farmer, defined needs, priorities, capabilities and marketing potential.

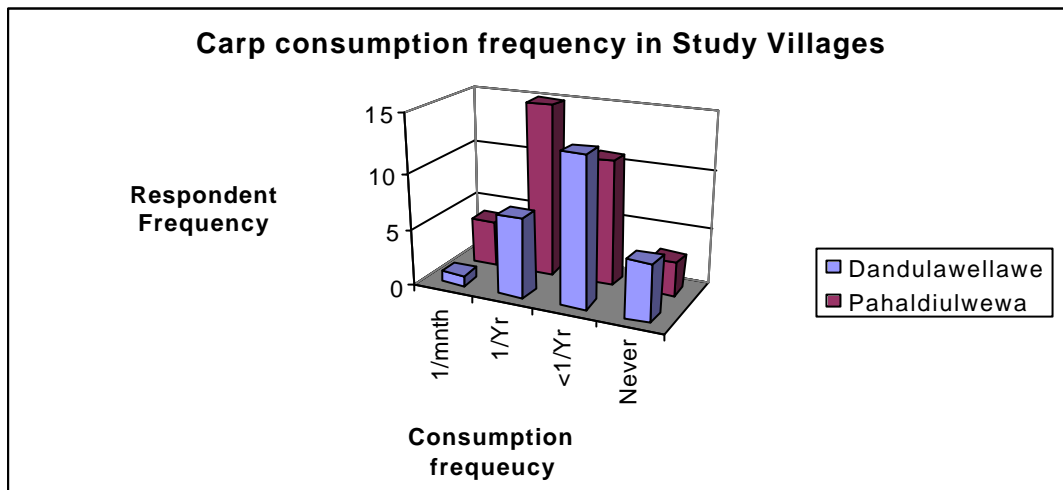


Figure 7. Consumption frequency of exotic carps (all varieties) in Dandulawellawe (n=26) and Pahala Diulwewa villages (n=33).

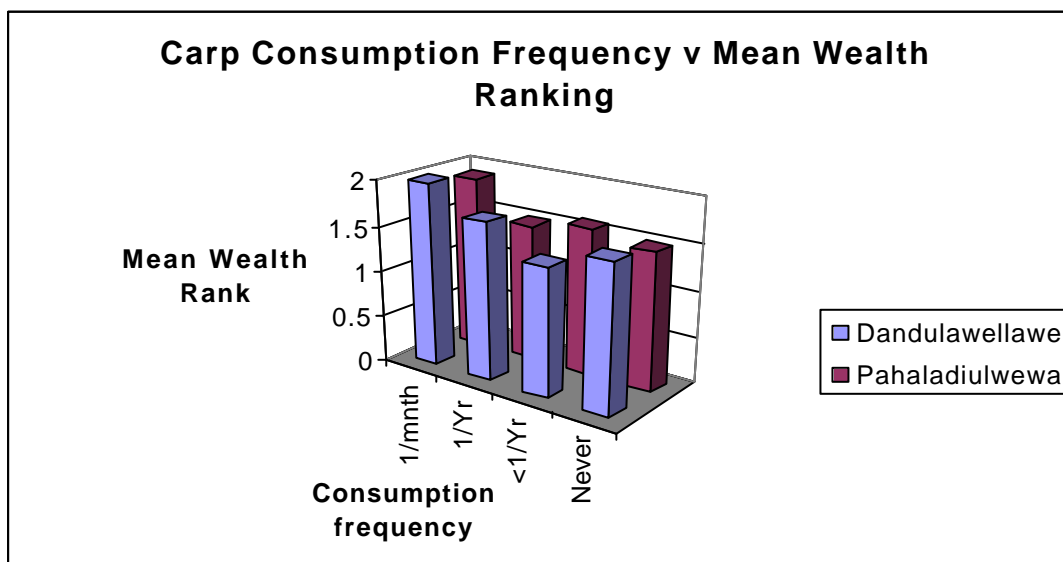


Figure 8. Consumption frequency of exotic carp species (all varieties) by mean wealth ranking in Dandulawellawe (n=26) and Pahala Diulwewa villages (n=33). Mean wealth rank is calculated by attributing a score of 1-3 for poor, medium and rich ranks respectively and averaging ranks for respondents in each frequency group.

13 Market orientation amongst farmers

During PRAs farmers were asked to explain the reasoning behind their cropping systems and production decisions. Farmers overwhelmingly responded in terms of resource availability (water, land, pasture, credit etc.) rather than any consideration of market requirements i.e. most farmers in these resource-poor villages can be considered as production rather than market orientated. As such, these farmers display very little evidence of successful adaptation to rapidly changing market and environmental conditions. Instead they adhere to or have reverted to subsistence forms of agriculture emphasising direct food security (i.e. paddy production³⁴ - Table 5.) above income generation. Following are some of the prevailing trends giving rise to this situation.

- *Small and decreasing land size* (Table 5.) Most farmers are locked in uneconomical paddy cultivation in miniscule and progressively unproductive holdings (Working Paper SL1.3). Some argue this is a major reason for poverty in Sri Lanka, whilst others argue that the relatively distribution of land resources is one reason why rural poverty in Sri Lanka is not as extreme as in other countries (Tudor Silva *et al* 1999)
- *Trade liberalisation and policy induced stagnation.* Present trends are likely to lead to a further opening of markets for agricultural imports. Where agro-ecological conditions are favourable to certain crops, improved infrastructure and accessibility to market centres has been found to coincide with increased commercialisation. Yet broadly speaking, years of politically inspired public delivery (i.e. input subsidies and guaranteed markets) have created an enduring dependency culture resulting in the persistence of inefficient farming methods. Under such conditions, small-scale farmers can be expected to be at even greater risk as a result of this commercial exposure.
- *Erratic trade policies:* The prevailing low market prices for many agricultural products, including rice, maize and milk act as a disincentive to domestic food production. Despite this fact and with the price of rice languishing at historic lows, government policy is still characterised by a bias towards paddy. Meanwhile volatile trade policies towards alternative cash-crops including frequent reversals on subsidies and tariffs have led even dynamic farmers, to a reversal from commercial back to subsistence farming practices and off-farm employment (Tudor Silva *et al* 1999).
- *Structural adjustments:* The massive investment in major irrigation and associated infrastructure represents the main structural change in the project area over recent decades. This has a profound impact on farmers in 'Purana' communities of rainfed areas (Working Paper SL1.3) traditionally practicing low yielding supplementary irrigation. The rapid shift to agricultural labouring, leasing or share cropping of land under large-scale systems, in combination with increased frequency of drought has lead to many seasonal tank resources becoming under utilised or abandoned entirely for irrigation. Many farmers had relegated such irrigated cultivation to a part-time basis with further reductions in efficiency
- *Cultural attachments:* There exists a strong cultural attachment to rice production. It is considered a matter of honour for farmers to be able to provide enough for their household needs from their own land. This means farmers are unlikely to entirely give up cultivation even when economic returns are low. Furthermore current levels of production have been achieved through years of research and extension and heavy public investment in major irrigation development, which may not readily be utilised for production of alternative crops or farming systems. However the question still remains,

³⁴ Whilst rice can be stored for up to 3 years, whilst farmers must find buyers for cash crops such as vegetables immediately, bringing increased risk of exploitation by middlemen.

how best or whether to bring an under-utilised seasonal tank resource back into agricultural production?

Table 5. Frequency of respondents retaining >50% of agricultural produce for on-farm consumption during 97-98 maha season - an average rainfall year, (Numbers in brackets = total respondents).

	Consume >50% Paddy produce	Consume > 50% Upland produce	Consume > 50% home garden	On-farm livestock consumption ²
Danduwellawe	14 (16)	18 (24)	21 (27)	7 (9)
Poor Wealth Rank	4 (4)	10 (13) ^o	13 (15)	2 (2)
Average resource holdings (ac) ¹	0.3	1.9	0.8	5.5 cattle
Pahala Diulwewa	24 (28)	12 (16)	26 (37)	14 (17)
Poor Wealth Rank	12 (13)	7 (10)	9 (13)	4 (5)
Average resource holdings (ac) ¹	0.8	1.1	1.8	5.4 cattle

¹ Mean responses for lower wealth rank respondents (11 in Danduwellawe and 17 in Pahala Diulwewa).

² The number of farmers retaining cattle and goats primarily for home consumption (milk, manure, work), income generating sales being restricted to household emergencies.

³ Minimal chenna production took place in Danduwellawe at this time due to wild animal damage.

Upland cultivation: Although for the reasons outlined above, paddy cultivation under seasonal tanks is becoming increasingly erratic, most farmers in rainfed areas continue to regularly practice dry upland cultivation, either fixed or shifting - slash and burn (*chenna*). This too is a traditional low risk subsistence production strategy. The cropped area is typically a function of the household labour available to clear land, usually extending to no more than 2ac. Cash requirements for inputs are very low, many farmers use their own save-seed, no inorganic fertilisers and only occasional pesticide applications. A range of low-yielding though drought resistant crops with good storage properties including green gram, black gram, pigeon pea, gingerly and maize are most commonly grown. Off-farm sales may provide a small supplementary income prior to the harvest of the main maha (irrigated) crop, though much of the produce is retained for household consumption. In the Danduwellawe area with extensive remaining areas of primary forest, slash and burn is still the norm. However in Pahala Diulwewa there is no such resource and only fixed upland cultivation is practiced. Intensified land use, leading to reductions in fallow period and land productivity, particularly where fixed cultivation is practiced is raising serious questions as to the longer-term sustainability of this traditional farming system.

Livestock: Traditionally low livestock holdings in the Dry zone are declining further as a result of a combination of factors including: increased farm mechanization, loss of pasture/fodder resources and increasing conflicts with cultivators and decreased willingness to invest labour in livestock management in *lieu* of more lucrative off-farm employment activities. Most livestock holders adopt highly extensive production systems using local drought resistant, but low yielding, varieties. In the current study, most livestock owners came from the poor wealth ranks with mean holdings of only 2-8 cattle (buffalo and cows). These are held primarily as assets that can be rapidly liquidated in times of need (i.e. family illness or drought) in the absence of cash savings. Only a few 'better-off' farmers with large herds (>40) derived any income from dairy production.

Home gardens: A range of woody perennials including coconut, are grown in these gardens, often located close to tank bunds where they benefit from elevated ground water levels. Produce is used for both home consumption and/or income generation depending on site-specific criteria. In Danduwellawe of three 'better-off' households, two were exploiting niche

markets for betel a valuable cash crop, highly sensitive to elevated salinity levels, irrigated with good quality ground water available to them in their home gardens.

In conclusion, unlike the equitable market for inland fish with its daily turnover of small volumes, the low periodic surpluses generated by the majority of small-scale farmers are often incapable of attracting competing buyers and the farmers become 'price takers' accepting low margins. Farmers regularly complained of receiving low prices, but demonstrated little ability to act collectively to address this problem. Consequently, many eschew the market entirely, reverting back to subsistence paddy production and relying on off-farm labour for cash income. By contrast, richer farmers who consolidate productive resources (land and labour) are in a strong position to manipulate the market in their favour. Hettige (1984, in Kodithuwakku 1996) reports that it is not uncommon for the position of poorer farmers to be worsened by liberalisation, where fixed prices and production subsidies have been removed yet accessibility to new markets remains poor.

In the past it has often been assumed that farm output growth would not only secure rising incomes for farmers, but also non-farm income opportunities in the rural economy through linkage effects. This position is widely regarded as being no longer tenable (Ellis 2000, Mulleriyawa, 2000). However this has been the effective response of recent Government policy initiatives, which have stressed the need to increase overall food production and economic development at the national level, through the 'commercialization of agriculture'. Key tenets of this policy include consolidation of land holdings into more viable commercial units and continued application of the 'transfer of technology' approach to extension. Whilst such a policy can be expected to benefit 'progressive' relatively resource rich farmers, it is unclear how this will benefit the 5 million or so resource poor farmers in the dry-zone who currently live below the official poverty line. Similarly, other commentators are debating whether small-scale Non Plantation Agriculture (NPA) has a future at all in Sri Lanka's rapidly changing economic environment (Tudor Silva *et al* 2000). They suggest a concurrent increase in 'off-farm' employment opportunities might ultimately re-deploy much of the work force, whilst Government safety nets must be strengthened to support the rest during transition. A recent report indicated that 44% of Samurdhi³⁵ recipients are in fact above the official poverty line raising serious doubts about the effectiveness of such programmes (Daily Mirror 2001).

In North West Province this labour market transition is already in progress with the livelihoods of many of the villagers interviewed in the current study already heavily dependent on income generating activities associated with the large-scale irrigation infrastructural developments that abound in the Province. However, extensive rain-fed areas to the North, South and East of the Dry-zone have received far less in the way of such inward investment over recent decades. Farmer livelihood strategies here are likely to rely heavily on diversified and sustainable use of their immediate natural resource base for the foreseeable future and more effective ways of addressing their needs are urgently required.

The NGO CARE has identified the overall lack of market orientation amongst such farmer groups as a key area for intervention. In the past, a key focus of integrated development programmes has been on technology transfer, such as production of low risk cash crops such as cashew and post harvest value addition technologies. Whilst useful in themselves, such technologies have often been 'delivered' to farmers in a manner ultimately contributing to their empowerment. Rather than treating farmers as passive recipients of packages, new approaches are focusing on enhancing the problem solving and decision-making capacities of farmers in order to stimulate self-help learning and innovation. Mulleriyawa, (2000) goes on to state that.

³⁵ The primary Government rural welfare programme

‘Poor farmer’ responsive programs need to be more participative, less ambitious and effectively address their site-specific needs. In many cases a small and simple change in farming practice may be the most strategic in removing bottlenecks and providing a basis for accelerated development’

With this in mind the subsistence orientated, adaptive low-input enhanced fishery system evolved from this situation analysis (Working Paper SL1.1) may have greatest relevance as a livelihood diversification strategy for marginal populations in the rain-fed areas to the North East and West described above.

14 Conclusions

Greatest demand for animal protein sources in project villages was identified for locally produced fresh inland fish, and imported dried marine fish. Demand for fresh marine fish remained low despite its good availability in one study location. Demand for substitutes was found to be low due to its relatively high cost and a combination of cultural and religious attitudes.

Amongst lower wealth groups’ greatest demand exists for commercially available small low-cost tilapias (<150g), which originate from perennial tanks. However, largely seasonal tilapia production from small village tanks is excluded from commercial markets due to negative consumer perceptions associated with off-flavours. Advanced stocking strategies that facilitate partial harvests during the low season (May – June) could realise commercial potential. This is most likely to be achieved on a sustainable basis using locally available seed. Snakehead, a highly popular predatory variety with a high market value is more refractory to off-flavours and should be a candidate species. When stocked in combination with tilapia, prey-predator synergies can lead to net increases in the production of both species.

Fast growing Chinese and Indian major have good potential to play a similar production role, whilst also fulfilling an unfulfilled niche demand for larger sized fish. However seed availability for these species, which are incapable of self-recruiting locally, remains a serious constraint. Even if demand for seed were stimulated, it is unlikely that the private sector would become involved in production due to an opportunity cost for more lucrative ornamental fish production. Therefore considerable and sustained, state investment with NGO support is required for such a scheme to succeed. This is an unlikely scenario given the current institutional position (Working Paper SL1.1). Further research on the potential impact of increased production on demand for carp is also required given the current low consumer preference for many introduced varieties.

Whilst strategies yielding maximal harvests during the conventional dry-season window at the point of lowest waterspread are less likely to have commercial application, they are more in tune with the priorities of multiple stakeholder groups who use water for a variety of purposes including bathing (Working Paper SL1.3). A broad stakeholder analysis is therefore essential to understand and mitigate potential conflicts, which are likely to arise from increased production and staggered harvesting options.

More extensive subsistence strategies may be more in tune with the needs of the most marginal groups in remoter rain-fed areas of the dry zone with poorer major irrigation infrastructure.

The harvest and marketing of fresh fish is a male dominated activity. Currently the only opportunity for women’s participation is limited to the processing and retail of smaller dried varieties that are highly perishable in their fresh state. Furthermore participation is mainly restricted to Tamil and Christian communities originating from coastal areas. Women from Buddhist Sinhalese backgrounds are still restrained from participation by persistent social

taboos, though low status groups including single female-headed households and low caste women are less inhibited. Elsewhere small-scale aquaculture activities such as cage or backyard pond production have presented good individual opportunities for women, however it is more difficult to envisage a strategic role for women based on enhancements in collection property resources such as seasonal tanks.

The highly equitable small-scale marketing system, which has evolved around tilapia fisheries in major irrigation systems, has proved itself superbly adapted to meeting the needs of the rural poor. Careful consideration should be given to potentially negative impacts of policy initiatives, which stress rapid output-growth above distribution. This includes commercial initiatives designed to target demand in more affluent regional, urban or export markets.

15 Recommendations for future research

Based on the findings of this work it is recommended that follow-up research be undertaken in the following areas.

- It is recommended that further market research of a general nature be urgently undertaken in inland, rain-fed areas to the North, East and South of the Dry-zone. Farmers in such areas are likely to have poorer access to major irrigation infrastructural developments and the commercial inland fishery yields and off-farm labour opportunities that come with them. Such farmers are more likely to benefit from low-input seasonal tank production enhancements.
- It is recommended that the economic and non-economic linkages between producers' vendors and consumers, and the entry patterns of small-scale actors in and out of the market, should be further characterised using techniques of direct participant observation to better understand the potential for livelihood diversification at different levels of the network.
- It is recommended that further investigation of seasonal consumer preferences and consumption patterns within different wealth and geographical strata be undertaken for different fish species, size and form (i.e. dried and cured). In addition to regional variations, this should attempt identify variation between communities living in higher and lower positions within cascade systems. In particular the likely demand scenarios that may arise from increased production of exotic carps requires urgent investigation.
- It is recommended that further investigation of seasonal yields from a range of minor and major irrigation systems be undertaken to better understand the contribution of these different resources to the market.
- It is recommended that seasonal tank production strategies capable of yielding product during the low season (May – July) be identified. This should include the sustainable low-input advanced stocking strategies identified in Working paper SL1.1 in addition to traditional strategies relying on fast growing species including Chinese and Indian major carps.
- It is recommended that further investigation of the comparative yield available from different post processing activities be undertaken including their regional and seasonal potential to add value. Such activities may include, drying, curing, filleting, enhancements in product quality and mitigation of postproduction losses. Potential depuration and post-harvest processing strategies that might reduce the off-flavours adversely affecting small-tilapias in seasonal tanks should also be investigated. This research could be undertaken in participation with farmers.
- It is recommended that the inland dried fish networks emanating from remote northern and eastern regions be investigated with a view to increasing the benefits accruing to small-scale actors in these markets.
- Further gender specific research is required to see how women could benefit from increased production given the persistent social taboos, which currently constrains their participation.

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Appendix 1 Itinerary:

Tue 24/11/98 – Regional Market survey

- Bastian Perara: Fish Retail and Wholesaler Katagusta Kandy 7AM
- Van Fish salesmen Peradeniya Road 11 AM
- Fish shop Vendor (sole trader) Paragahdenya, Weruda PO (20 miles from Kandy) 12PM
- Motor Cycle Fish vendors (on route), Galewella Nr. Dambulla 2.30PM
- W.M Wimalabandara: Secretary of fisherman's co-operative (seasonal tank) and other ordinary members No 69 Ambulambe Dambulla (NW Province) 4PM

Sub- regional market survey.

- Fri 11/12/98: Amandaduwa Weekly Fair
- 5x Female dried fish vendors
- 4x Male dried fish vendors
- 4x Vegetable vendors
- 1x Pork and beef butchers
- 2x Fresh inland fish vendors
- 1x Fresh marine fish vendors
- Tue 15/11/98 Galgamuwa Weekly Fair
- 4x Wayside (bicycle) fresh inland fish vendors
- 1x Wayside (van) fresh marine fish vendors.
- 3x Female dried fish vendors
- 5x Male dried fish vendors
- 3x Vegetable vendors

Sub-regional consumer Preferences

- Mon 7/12 – Mon 14/12 PRA in Pahaldiulwewa cascade, Anamaduwa divisional secretariat.
- 38 farmers interviewed, fish preferences ranked and scored
- Tue 16/12 – Tue 22/12 PRA in Dandulawellawe cascade, Galgamuwa divisional secretariat
- 27 farmers interviewed, fish preferences ranked and scored

Producers:

- Tue 15/12/98 3PM GH Ariyadasa (B) Fisherman and co-op member, Rajangane reservoir.
- Tue 15/12/98 3PM Roadside fish vendors Kala Oya – Rajangana Reservoir.
- Wed 16/12/98 2.00AM KM Banda, Fisherman – Usgala Reservoir
- Wed 16/12/98 2.30AM Gamini Wijekoon, Fisherman Usgala reservoir
- Fri 18/12/1998 9AM Fish – Mr Tillakeratne (25), Fishermans co-op Mahusa wewa

Appendix 2. Semi-structured interview format used in market analysis.

Fish producers:

Socio-economic background

Historic and seasonal market patterns:

- Supply and demand
- Volumes and species composition
- Pricing mechanisms

What do you do with your produce?:

- Personal consumption,
- Direct and indirect sales
- Post harvest processing (storage and preservation)

Relations with traders:

- Tied credit relationships, multiple, single, periodic.

Relations with other producers

- Cooperative marketing activities.

Mobile and static traders (fresh, dried fish and meat)

Socio-economic background and home town.

Daily, seasonal and historic marketing patterns

- Outlet location and distances
- Supply and demand,
- volumes and species composition
- Pricing mechanisms

Margins

- Costs of stock
- Transport costs (and mechanisms)
- Site rental
- Time investment

Relations with intermediate traders

- Tied credit relationships
- Cooperative marketing activities

Relationships with nature of customers:

- Wealth, gender
- Non-economic linkages

Contribution to trader livelihood.

- Primary or secondary activity

Local Consumers

Wealth rank and family characteristics (from PRA)

What kinds of fish and meat do you eat?

- From where (including local tank production and participation in fishing activities).
- How often and when
- How much
- What price
- In what form (dried, cured, fresh) and preferences.

What do you look for when you buy fish:

- Quality, taste, size, price etc.
- (responses used for ranking exercises).
- If you don't eat exotic carps why not.

Relationships with traders.

- Credit
- Non-economic linkages

Religious and cultural attitudes towards consumption

Appendix 3. Results of statistical analysis of fish preferences:

Criteria used to make decisions about purchasing fish were identified and subsequently scored and ranked by villagers (see Working paper 1). After eliminating logically inconsistent results (by comparison of ranking, scoring and frequency data), remaining scoring data were subjected to Friedman's test (a non-parametric 2-way analysis of variance). Results were first analysed for all respondents pooled within each village and subsequently by wealth ranking within each village to assess whether these sub-groups exhibit different priorities. The results of 'rich farmers' scoring exercise were pooled between both villages due to the small number of respondents in this category.

1. Pahala Diulwewa village

1.A Friedman test for Pahala Diulwewa - all wealth ranks

S = 18.50 DF = 3 P = 0.000

S = 18.93 DF = 3 P = 0.000 (adjusted for ties)

	N	Est Median	Sum of Ranks
Cost	22	3.375	64.0
Quality	22	3.125	67.5
Size	22	2.375	54.5
Taste	22	1.625	34.0

Grand median = 2.625

1.B Friedman test for Pahala Diulwewa - poor wealth ranks

S = 9.73 DF = 3 P = 0.021

S = 9.89 DF = 3 P = 0.020 (adjusted for ties)

	N	Est Median	Sum of Ranks
Cost	12	3.750	38.0
Quality	12	3.250	34.5
Size	12	2.375	27.5
Taste	12	1.625	20.0

Grand median = 2.750

1.C Friedman test for Pahala Diulwewa medium wealth ranks

S = 9.96 DF = 3 P = 0.019

S = 10.27 DF = 3 P = 0.016 (adjusted for ties)

	N	Est Median	Sum of Ranks
Cost	10	2.375	29.0
Quality	10	3.375	30.0
Size	10	2.500	27.0
Taste	10	1.375	14.0

Grand median = 2.500

2.A Friedman test for Danduwellawe - all wealth ranks

S = 11.14 DF = 3 P = 0.011

S = 13.22 DF = 3 P = 0.004 (adjusted for ties)

	N	Est Median	Sum of Ranks
Cost	14	3.750	36.0
Quality	14	3.750	38.0
Size	14	4.750	44.0
Taste	14	1.750	22.0

Grand median = 3.500

2.B Friedman test for Danduwellawe - poor wealth ranks

S = 6.00 DF = 3 P = 0.112

S = 7.50 DF = 3 P = 0.058 (adjusted for ties)

	N	Est Median	Sum of Ranks
Cost	7	4.125	21.5
Quality	7	2.625	18.5
Size	7	3.375	19.5
Taste	7	1.375	10.5

Grand median = 2.875

2.C Friedman test for Danduwellawe - medium wealth rankings

S = 9.78 DF = 3 P = 0.021

S = 10.40 DF = 3 P = 0.015 (adjusted for ties)

	N	Est Median	Sum of Ranks
Cost	5	3.250	11.5
Quality	5	3.500	14.0
Size	5	4.750	18.5
Taste	5	1.500	6.0

Grand median = 3.250

3. Pahala Diulwewa and Danduwellawe Villages.

3.A Friedman test for in Pahala Diulwewa and Danduwellawe - pooled rich wealth ranks

S = 1.86 DF = 3 P = 0.602

S = 2.16 DF = 3 P = 0.539 (adjusted for ties)

	N	Est Median	Sum of Ranks
Cost	5	3.3750	9.5
Quality	5	4.6250	15.0
Size	5	4.1250	13.0
Taste	5	4.3750	12.5

Grand median = 4.1250

Appendix 4. Data sets used in text.

Table A4.1 Total fish production by Sub-sector in Sri Lanka from 1972-1996.

Year	Coastal		Offshore		Inland		Total
	mt.	%	mt.	%	mt.	%	
1972	90,717	47.1	2,557.0	1.3	8,438	4.4	192,429
1973	91,312	90.7	2,385.0	2.4	7,005	7.0	100,702
1974	100,805	91.1	2,230.0	2.0	7,660	6.9	110,695
1975	114,863	88.9	970.0	0.8	13,307	10.3	129,140
1976	122,783	90.4	548.0	0.4	12,540	9.2	135,871
1977	125,386	90.4	312.0	0.2	13,068	9.4	138,766
1978	136,900	87.4	2,949.0	1.9	16,738	10.7	156,587
1979	148,851	88.4	2,099.0	1.2	17,425	10.3	168,375
1980	165,246	88.1	2,148.0	1.1	20,266	10.8	187,660
1981	175,075	84.6	2,178.0	1.1	29,590	14.3	206,843
1982	182,532	84.1	1,078.0	0.5	33,323	15.4	216,933
1983	184,049	83.4	689.0	0.3	36,068	16.3	220,806
1984	136,642	80.7	823.0	0.5	31,882	18.8	169,347
1985	140,266	80.0	2,400.0	1.4	32,743	18.7	175,409
1986	144,266	78.8	3,400.0	1.9	35,390	19.3	183,056
1987	149,278	78.6	4,259.0	2.2	36,465	19.2	190,002
1988	155,099	78.5	4,425.0	2.2	38,012	19.2	197,536
1989	157,411	76.7	8,155.0	4.0	39,721	19.3	205,287
1990	134,132	82.0	11,666.0	7.1	17,866	10.9	163,664
1991	159,151	80.4	15,080.0	7.6	23,832	12.0	198,063
1992	163,168	79.1	22,000.0	10.7	21,000	10.2	206,168
1993	169,900	76.9	33,000.0	14.9	18,000	8.1	220,900
1994	174,500	77.9	37,500.0	16.7	12,000	5.4	224,000
1995	157,500	66.3	60,000.0	25.3	20,000	8.4	237,500
1996	149,300	65.3	57,000.0	24.9	22,250	9.7	228,550

Table A4.2 Frequency of consumption by mean wealth ranking in project villages.

	1x/month	1x/year	>1x/year	Never	Total
Dandulawellawe					
Frequency	1	7	13	5	26
Wealth	2	1.7	1.4	1.6	
Pahaladiulwewa					
Frequency	4	15	11	3	33
Wealth	1.9	1.5	1.6	1.5	