

5 Market interactions of culture and capture fish

I do not doubt that were the system which it is the object of this little treatise to describe, generally adopted, a very great demand for fresh-water fish would ensue; for it is a business-like adage that if you provide for a market by a regular supply, a market is created and increased demand follows. (Boccius 1841, p.1)

5.1 Introduction

This chapter continues an analysis of meso-scale influences on living aquatic resources by critically assessing the specific contribution of culture and capture fish to markets in Savannakhet province. The chapter focuses on the economic motivation of living aquatic resources use and development whereas the previous chapter was primarily interested in environmental influences. By critiquing key orthodoxies of market development with grounded empirical research the contribution of both aquaculture and capture fisheries to the supply of fish in urban and rural markets can be assessed. In doing so the chapter focuses on who participates in the trade of capture and culture fish and who benefits by addressing three major assumptions that underlie the promotion of rural aquaculture for poverty alleviation and rural development.

The first major assumption is that as capture fisheries decline increased aquaculture fish production benefits poorer consumers by providing a cheap source of protein. This assumes that as capture fish become scarce their price will rise beyond what is accessible to poor consumers (Income elasticity). This is explicitly stated in the 1995 Kyoto Declaration of the Sustainable Contribution of Fisheries to Food Security outlined in Chapter One. A number of international policy documents have supported this. The FAO (2002) argues that rising prices of capture fish will make the decision to develop aquaculture easier for policy makers. ASEAN (2001) also stresses that the impending deficit of food fish supply is more likely to be met in markets by increasing the supply of aquaculture fish.

The second assumption of an increased supply of cheap aquaculture fish to markets is reducing the demand of capture fish and therefore reducing pressure on the resource. This is implicit in the references made to global fishery decline. Arresting decline of capture fish is often seen as a simple equation of providing an alternative source of fish through aquaculture. As Delgado *et al.* outline "... lower food fish prices mean lower

incentives to apply capture effort”.¹⁶ This is derived from the work of Anderson (1985) who argues that the entry to the market of a competitive culture species can conserve its wild stocks by increasing supply and reducing prices, leading to reduced fishing pressure. Ye and Beddington (1996) extend Andersons model by introducing substitute species. This is premised on fishing costs remaining constant and culture fish costs decreasing. They conclude that if culture species are close substitutes then similar positive effects on capture fish are possible.

The final assumption of increased market trade of culture fish is national economic development through export markets. This is explicit in the government’s move to a market economy through the New Economic Mechanism, which aims to develop a multi sector economy, with access to regional markets. This has prompted a move from the government’s current position of banning export and import trade, in pursuit of self-sufficiency, to selective export trade, as shown in the capture fishery markets in Southern Laos (Bush 2002, 2004).

This chapter is based on the first systematic 12-month market survey ever conducted in Lao PDR reporting on the volume, composition and value of fish trade in Khantabouli, Outhomphone and Chumphone districts. Specific attention is given to the geography of domestic trade flows between districts as well as trade from Thailand. The net volume of trade is then further broken down into the market share of specific species. Finally, the value and seasonality of trade examined.

5.2 Method

Fish trade was monitored in the four main markets in the study districts over a 12 month period from July 2001 to June 2002. Each market was visited once a week. Every trader in the market on these days was asked what species they had for sale that day, the volume by weight and the price. Traders were also asked where the fish were bought and, if they knew, where the fish were caught (see sample survey form in Appendix A).

¹⁶ They qualify this statement by recognising that fishing pressure is only reduced in the absence of fish meal production for the culture of carnivorous species. A review of the impacts of fish meal on marine fisheries is given by Tuominen and Esmark (2003).

Survey data were supplemented with in-depth discussions with fish traders over the entire survey period. Relationships were developed with traders allowing in-depth discussions about the trading systems. I was invited to sit with them and, in some cases, help them with their work. This method builds on previous studies carried out in the Laos and elsewhere in the Lower Mekong Basin (Phonvisay and Bush 2001; Bush 2004, 2002, 2001; Sinh *et al.* 1997; Kunthy and Guttman 1997; Tana 1993; Naret *et al.* 2000).

The four markets chosen for the survey are the largest markets in the study districts (Table 5-1). The district market of Outhomphone is found in the district capital, Seno. It is a large rural market at the cross roads of Route 9 and Route 13, the two main roads in Savannakhet Province. Fish are traded in both the morning and evening by an average of 10-15 traders. In comparison the main market of Chumphone district is a small rural market. Fish are traded in both the morning and evening by three to four traders. This market is also characterised by the large number of traders that buy fish from surrounding villagers to sell on to Savannakhet town.

The two urban markets in Savannakhet town are Savansai and Samakheysai. Samakheysai is a small market located on the northern outskirts of town. Fish are sold in the morning and evening by between 10-15 traders. Fish in this market are traded from both around Khantabouli and Chumphone. The largest market in Savannakhet province is Savansai market. There are between 5-10 full time traders in this market selling fish all day and further 10-15 part-time traders that sell fish in the morning and evening.

5.3 Volume of trade

Previously no official quantitative data on fish trade existed in Lao PDR. Existing data has been based on recall or anecdotal evidence because of time constraints and poor information systems within the government. This survey provides the first systematic account of trade flows between different markets in Laos. Specific attention has been given to the variance between culture and capture fish.

Table 5-1 Surveyed markets

District	Market	Characteristics
Outhomphone	Seno	<ul style="list-style-type: none"> ▪ Large district market located in district capital ▪ Average of 10-15 traders ▪ Fish sold in the morning and evening
Khengkhok	Khantabouli	<ul style="list-style-type: none"> ▪ Small district market located in the district capital. ▪ Average of 5-10 traders ▪ Open morning and evening
Khantabouli	Savansai	<ul style="list-style-type: none"> ▪ Large provincial market located in Savannakhet town ▪ Average of 15-25 traders ▪ Fish traded all day
	Samakheysai	<ul style="list-style-type: none"> ▪ Small urban market located in Savannakhet town ▪ Average of 10-15 traders ▪ Fish sold in the morning and evening

5.3.1 Surveyed markets

The survey measured 29.6 tonnes of fish traded over the surveyed days. This gives a total of 223 tonnes per year traded through the four surveyed districts. This is substantially less than other areas of Laos. In Khong district in Champasak province, for example, estimates range from 435 to 4000 tonnes per year (Phonvisay and Bush 2001; Phonvisay 2003; Baird *et al.* 1998). In the capital Vientiane it is estimated that 2190 tonnes per year are traded through the five main markets (Phonvisay 2001).

Each of the four markets has markedly different volumes of trade. Khengkhok and Seno have a higher trade volume than the provincial market Savansai (Figure 5-1). This is a surprising result because Savannakhet town is the second largest urban centre in the country. Sampling error may account for the high volume recorded in Khengkhok, as it is possible that fish recorded in this market were on-sold to either Samakheysai or Savansai. However, there is also a higher volume of trade in Seno than in Savannakhet. It appears, therefore, that demand is higher for fish in rural than in urban areas.

5.3.2 Capture and culture species

One third of all fish surveyed over all markets were culture species (Figure 5-1). However, the proportion of culture and capture fish sold differs between markets. In Seno culture fish made up just over half of total trade while in Khengkhok culture fish made up only one fifth of the total sold. This result indicates a high demand for culture

fisheries in Outhomphone where there are limited aquatic resources (see Chapter 4). Conversely, the low proportion of aquaculture fish in Khengkhok highlights the abundance of the capture fishery across Chumphone. The two urban markets have a considerable proportion of their trade made up by aquaculture fish. Overall, however, the proportion of culture species is higher than estimates made for Lao PDR and Lower Mekong Basin, at 2.6% and 8% respectively (van Zalinge *et al.* 2003).

5.3.3 Geography of trade

Fish are traded between each of the districts, as well as imported from Thailand. The import trade accounts for 43% of all fish traded in the four markets (see Figure 5-2 and Figure 5-3). Fish trade from Chumphone accounts for 29% of the total volume, and Khantabouli and Outhomphone account for 19% and 0.5% respectively.

Both Khantabouli and Outhomphone districts are net importers. In the provincial market, Savansai, 50% of the fish traded originated from Thailand, and a further 26% from Chumphone. In Samakheysai, the Khantabouli district market, nearly half of all fish also come from Thailand. Seno is the most dependent on import fish with 94% of all fish sold sourced from outside the district. In Chumphone district, the majority of fish sold in Khengkhok market come from surrounding villages.

Thailand is the single highest source of capture fish to Samakheysai, Savansai and Seno (Figure 5-3). As expected, the bulk of the fish exported from Chumphone are capture fish caught across the extensive Se Chumphone wetlands (Chapter 4).

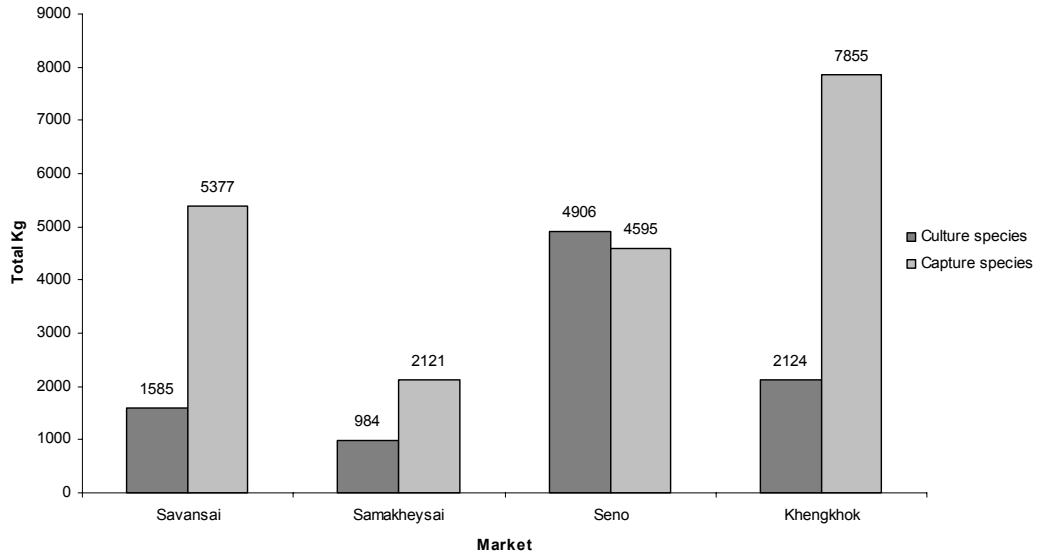


Figure 5-1. Comparison of total culture and capture fish species sold in each market.

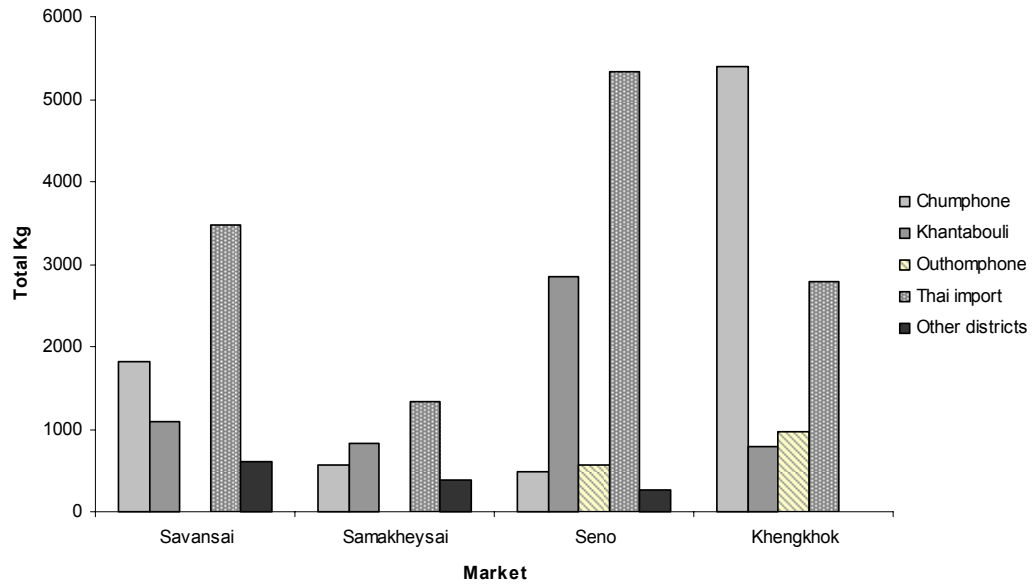


Figure 5-2. Volume of fish sold in markets by district

The specific sources of fish traded from Lao villages to markets show clear patterns. Capture fish come from villages across the western districts of Savannakhet. However, there is a high concentration of fish traded from villages in Chumphone, as shown by Figure 5-4. The source of capture fish appears to be associated with major aquatic

resources such as the Mekong, Se Bung Hiang and Se Bung Fai rivers. In comparison Figure 5-5 shows the distribution and volume of culture species concentrated mainly in Outhomphone district and villages close to Savannakhet town. This again is expected from the high concentration of ponds in that district.

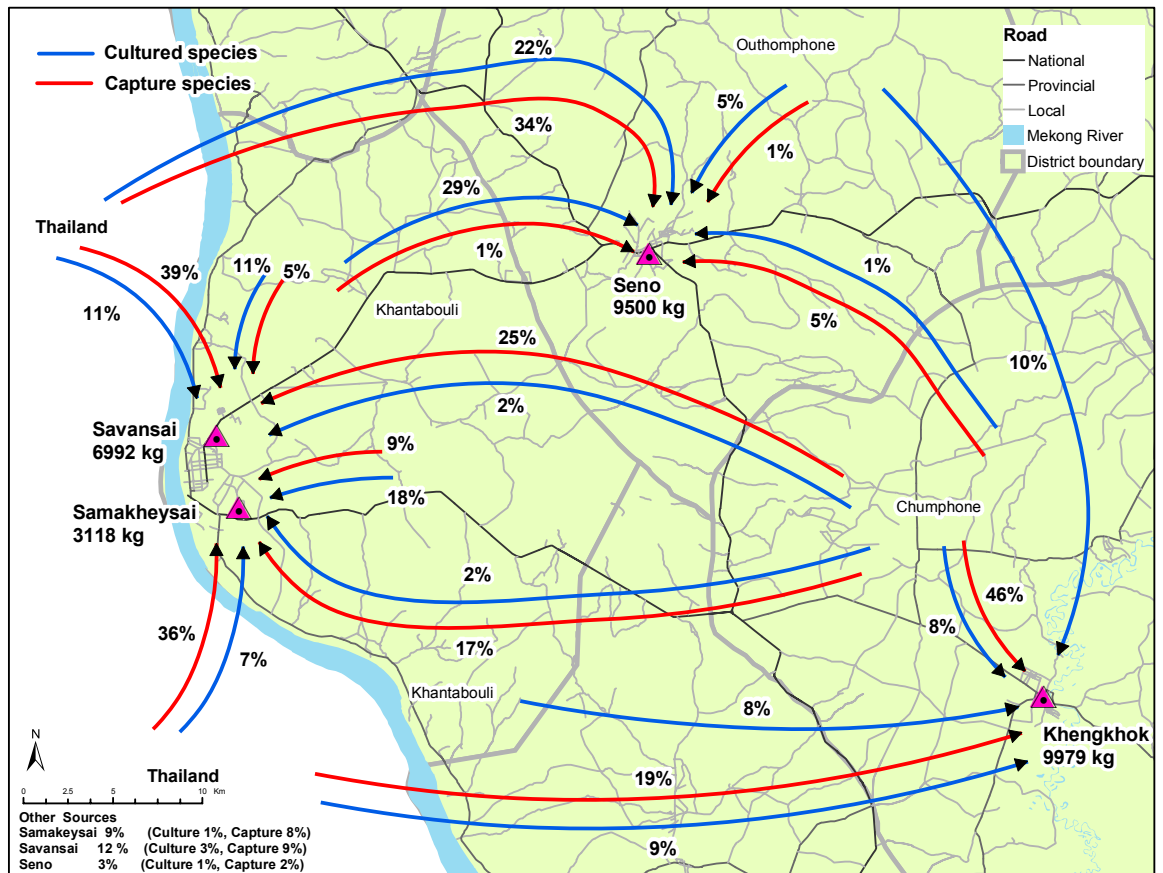


Figure 5-3 Import trade flows in surveyed markets.

Note: percentages are of total fish sold in the destination market

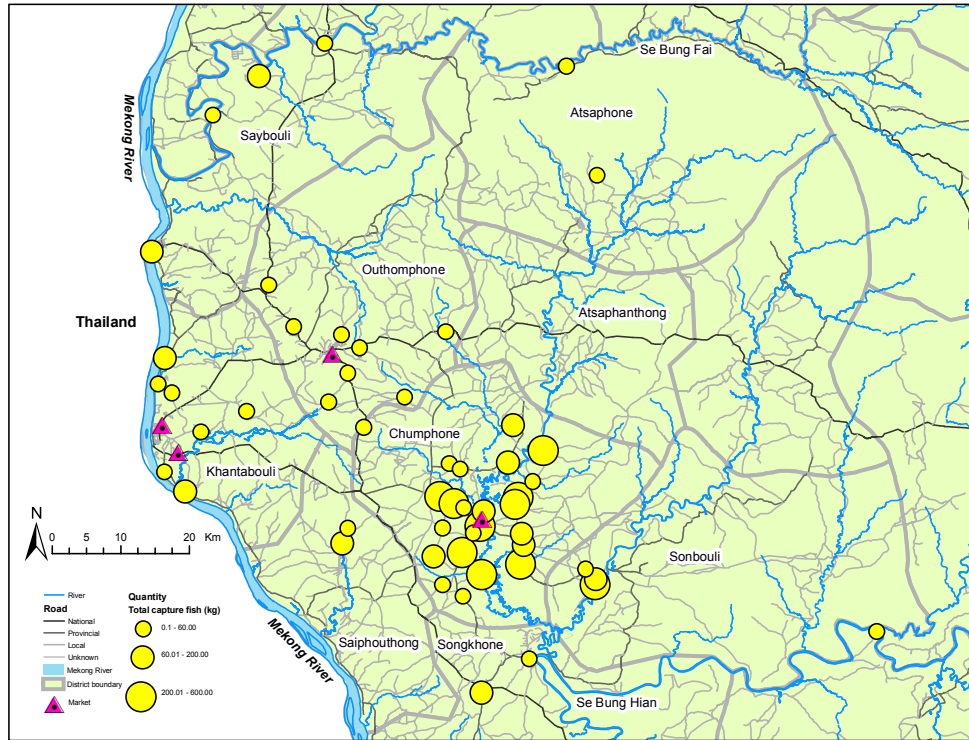


Figure 5-4. Distribution of supply of capture fish to markets



Figure 5-5. Distribution of supply of culture fish to markets

5.3.4 System of trade

Traders described the trade network as a diffuse system of small-scale traders that move fish from villages to district markets and then to provincial markets. This is similar to the trade system described by Bush (2004) in Champasak Province. These networks are facilitated by a complex network of relationships between traders that streamlines trade flows between villages and markets. As transport is slow and fish are primarily packed in baskets covered in ice, these relationships ensure that fish reach markets in as short a time as possible. Volume is not constrained by this system of trade. The large number of part time traders means that the system is highly flexible allowing increased volume of trade in peak seasons and lower volume in low seasons.

Capture and culture species are traded by different traders. The large volume of capture fish is sold through well established trade systems. Cultured fish are not as well established within these systems, with traders in all markets noting they do not specialise in aquaculture fish because they are not made available on regular enough basis. The only consistent source of aquaculture species are villages that come and sell what they harvest from their ponds. However, in order to make this worthwhile they wait until they harvest an entire pond, which mainly occurs at the end of the dry season. The trade network of each of the main fish categories are shown in Figure 5-6.

The high volume import fish and Sex Reversed Tilapia (SR Tilapia) grown in Savannakhet is traded through capital intensive trade networks. The live trade of SR Tilapia is controlled by a small number of traders who have invested in tanks, oxygen and trucks. The import trade from Thailand, which is illegal by Lao law, facilitates large volumes by well connected trading systems between the two countries. The close personal, social and cultural ties between Lao and Thai traders means that a select group of species, of which there is a large and regular volume, are traded. In comparison, large capture fish trade is not direct. The volume of fish is maintained at marketable levels by full time traders through a series of strong trading relationships. The traders invest in these relationships so that fish are moved quickly and efficiently between two or three traders before reaching a retail market. As such, the system of trade is highly diffuse reaching across a large number of villages and, in order to make the trade profitable, specialising in higher value species.

Small-scale aquaculture does not have established networks of trade. This reflects the lack of reliable supply and the low value of different species. Traders have not invested in this trade, instead culture fish are either incorporated into existing capture fishery trade networks or they are traded by pond owners when they are harvest a pond.

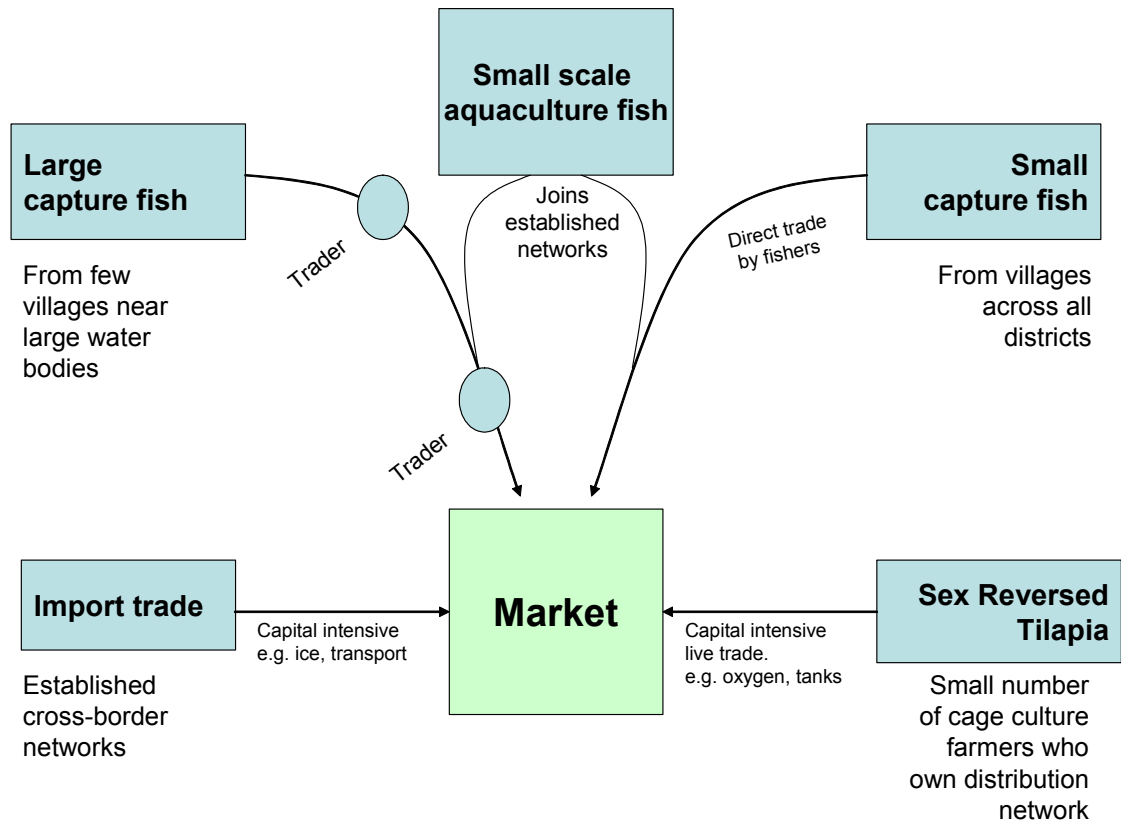


Figure 5-6 Fish trade networks in Savannakhet Province

5.3.5 Summary

The volume of capture fish traded is twice as high a culture species. Overall, there is a larger volume of capture fish available to consumers compared to culture fish. However, the supply of culture and capture fish are different in each market reflecting the overall geography of each district. The two district markets have a higher volume of trade than the provincial markets indicating demand for fish is higher in poorer rural areas than in urban areas. Fish are traded from all three districts through various trade networks. There are large imports of predominantly culture fish to Outhomphone which reflects the lack of aquatic resources. All districts are net importers of fish with the exception of Chumphone which is a net exporter. Interestingly the majority of imports to this district are also capture species from Thailand.

5.4 Species composition

Volume does not reflect the diversity and variety of trade. This section further analyses the volume of trade by dividing the categories of capture and culture fish into species. The aim is to determine what species of fish are sold in each of the markets. As culture fish are specific to different systems, such as intensive cage culture or small-scale fish ponds, the relative contribution of different forms of aquaculture can be assessed.

5.4.1 Capture species

More than 25 different capture species were identified within the four markets (Table 5-2). The most common of these is the two large capture species *Channa* spp. and *Clarias macrocephalus*. Together these fish make up 34% of the total volume of capture fish traded. Other common species include smaller fish such as *Hampala dispar*, *Mystus* spp. and *Trichogaster* spp. common across lowland areas of Laos, as well as *Notopterus notopterus* and the eel *Monopterus albus*, two species from the wetlands and reservoirs of Chumphone. Together these species comprise 46% of all trade.

The range of species traded is different between each of the markets. Khenkhok market is made up predominantly of smaller species such as *Hampala dispar*, *Trichogaster* spp. and *Mystus* spp (Table 5-2). Seno market is dominated by *Channa* spp. and *C. macrocephalus*. The composition of species in the provincial markets is more diverse with a range of small species also traded. These are mainly brought to market by part-time traders and villagers and sold together in small bundles referred to as *Phuut*. Large, high value species are almost exclusively traded in Savansai and Samakheysai. Species include *Heliophagus waandersii*, *Hemibagrus aubentoni*, *Dasyathis laosensis*, *Cyclocheilichthys enoplos*, *Cirrinhus microlepis*, *Ompok krattensis* and *Oxyeleotris marmorata*. However, overall these species make up less than one percent of total trade.

The vast majority of imports from Thailand is comprised of marine Horse Mackerel making up 92% of imports to all markets. In Savansai this species accounts for 36% of the total capture fish trade and in Seno it accounts for a 63%.

Table 5-2. Comparison of capture species volume and volume traded

Capture Species	Quantity sold in markets (kg)				Total (kg)	Average Price (Kip/kg)
	Savansai	Samakheysai	Seno	Khengkhok		
Total	2877	1256	1631	7690	13454	13080
<i>Bagarius spp.</i>	.	2	.	.	2	16000
<i>Barbodes altus</i>	16	8	.	0.1	24	12000
<i>Belodontichthys dinema</i>	7	8	.	.	15	20333
<i>Channa spp.</i>	754	301	646	1473	3174	14088
<i>Chitala ornata</i>	63	6	2	23.5	95	10167
<i>Cirrinhus microlepis</i>	8	10	.	.	18	27500
<i>Clarius macrocephalus</i>	614	283	291	573.1	1760	18606
<i>Cyclocheilichthys enoplos</i>	6	7	.	7.2	20	21250
<i>Dasyathis laosensis</i>	26	.	.	.	26	19000
<i>Hampala dispar</i>	5	15	3	1120	1143	5360
<i>Heliophagus waandersii</i>	15	13	.	.	28	20600
<i>Hemibagrus aubentoni</i>	9	9	.	.	18	18200
<i>Macrornathus siamensis</i>	.	9.5	.	10	20	15400
<i>Micronema micronema</i>	107	14	17	70	208	20656
<i>Monopterus albus</i>	238	33	60	562	893	12719
<i>Morulus spp.</i>	40	43	.	108	191	16423
<i>Mystus mysticetus</i>	3	10	95	871	979	5050
<i>Mystus spp.</i>	52	109	65	762	988	12838
<i>Notopterus notopterus</i>	616	84	380	675	1755	11415
<i>Ompok krattensis</i>	20	10	.	.	30	5667
<i>Oxyeleotris marmorata</i>	37	.	.	.	37	22000
<i>Trichogaster spp.</i>	.	20	.	536	556	6161
<i>Wallago attu</i>	94	142	27	420	683	11927
<i>Wallago leeri</i>	.	50	2	210	262	6206
<i>Unidentified</i>	147	71	44	269	531	11074
Imported species						
Total	2501	865	2964	165	6494	7399
<i>Mackerel</i>	1960	745	2195	165	5065	6674

5.4.2 Cultured species

Just over one third of fish sold come from aquaculture. Of this, 42% is comprised of species grown in small-scale aquaculture systems in Savannakhet (Table 5-3). The remaining fish sold come from intensive cage culture in Khantabouli or are imported from Thailand.

Cage culture systems in Savannakhet exclusively produce SR Tilapia. This fish is the most common species sold across all markets comprising 16% of the total volume of fish trade. It is found in high volumes in all of the markets and comprises half of the total export trade from Khantabouli district. In Seno SR Tilapia make up 23% of total volume in Seno and 14% of all fish traded in Khengkhok.

Only 45% of the *C. batrachus* sold in Savannakhet is from small-scale aquaculture ponds. The rest is imported from Thailand. These two species and SR Tilapia make up 70% of the total aquaculture fish sold in the market. This means that fish from small-scale aquaculture only contributes 3514 kg or 12% of the total volume of trade.

Table 5-3. Comparison of cultured species volume and volume traded

Species	Quantity sold in markets (kg)				Total (kg)	Average Price (kip/kg)
	Savansai	Samakheysai	Seno	Khengkhek		
Small-scale aquaculture						
Total	865	481	2687	644	4677	10655
<i>Aristichthys nobilis</i>	8	.	24	.	32	12750
<i>Cirrhinus cirrhosus</i>	.	.	174	.	174	10579
<i>Clarius batrachus</i>	330	257	2019	.	2606	11147
<i>Cyprinus carpio</i>	396	53	124	114	687	12343
<i>Hypophthalmichthys molitrix</i>	29	25	51	.	105	9267
<i>Labeo rohita</i>	2	.	69	.	71	12429
<i>Puntius goniotus</i>	90	126	204	360	780	9817
<i>Tilapia spp.</i>	10	20	22	170	222	10250
Cage culture species						
Total	1263	623	2988	1480	6354	9524
<i>Pangasius hypophthalmus</i>	541	120	769	.	1430	8124
Sex Reversed Tilapia	722	503	2219	1480	4924	10924

The most common small-scale rural aquaculture species sold in the markets is *Clarius batrachus*. The next most common species are *Cyprinus carpio* and *Puntius goniotus* (Table 5-3). The rest of the cultured species sold are found in relatively small quantities. Of these species cultured *P. goniotus* is the only species that is a direct substitution for its equivalent wild stock while *C. batrachus* provides a substitution for *C. macrocephalus*. All the other culture species compete directly with the large number of capture Cyprinids.

5.4.3 Summary

There is a large variety of both culture and capture fish species available in the market. In volume this trade is dominated by a small number of species. Capture fish are dominated *Channa* spp. and *C. macrocephalus*, while culture fish are dominated by SR Tilapia grown in intensive cage culture along the Mekong. Overall trade is dominated by marine Horse Mackerel as well as two culture species, *P. hypophthalmus* and *C. batrachus*. In contrast, a very small volume of species grown in small-scale aquaculture

systems are sold to market. Therefore, even though aquaculture fish are an important contribution to total fish trade, only a very small amount is grown by rural Lao communities.

5.5 Market value

A major orthodoxy of aquaculture development is that cultured fish will provide a cheap source of protein for poor consumers as the supply of capture fish declines. However, capture fish still comprise the majority of fish sold. The following examines whether cultured fish are able to provide cheap source of protein in existing markets dominated by capture fish.

5.5.1 Capture species

The price of capture fish ranges from 3000 to 45000 kip/kg with an average of 12278 kip/kg. This variation in the price reflects the range of species sold. For example, the part-time traders selling *Trichogaster spp.*, *Mystus spp.*, *Hemibagrus spp.* and *Hampala dispar* bundle the fish, selling them for 5000 kip. At the high value end of the market are the large riverine species such as *Wallago spp.*, *Belodontichthys truncatus*, *Cirrinhus microlepis* and *Micronema micronema*. These fish are traded and sold individually from between 20000 - 40000 kip/kg.

The price of capture fish differs considerably between each of the markets (see Appendix B). For example, *C. macrocephalus* sells for 21650 kip/kg in Samakheysai and for only 12323 kip/kg in Khengkhok. This reflects its relative abundance in Khengkhok.

According to traders the higher price in Savansai and Samakheysai is compounded by the large quantity of the poorer tasting *C. batrachus* available. In this case the capture species is positioned as a tastier, more desirable fish in contrast to its cultured equivalent.

The price of other capture species, such as *Notopterus notopterus* and *Chitala ornata*, is lower in Khengkhok than the other markets. This is because these fish are traded wholesale in Khengkhok before being sold in Samakheysai and Savansai. Conversely, some species have a much higher price in Khengkhok such as *Labeo barbatulus*, which sells for as high as 21667 kip in Khengkhok and between 12000-14000 kip/kg in Savannakhet town. Traders explained this difference based on the local abundance of this fish in the Mekong during the wet season.

5.5.2 Cultured species

Culture species have a lower average price of 10655 kip/kg (see Table 5-3). The price of these fish is based mainly taste and size. *C. carpio* is consistently the highest priced culture fish. Large fecund females are especially prized for their roe, increasing their market value. The lowest priced culture fish is *H. molitrix*, with an average price of 9267 kip/kg. It is not highly regarded for its taste, as it has flesh not suitable for many cooking methods.

Like capture fish, the price of cultured species also differs between markets. *A. nobilis* and *C. carpio* are around 4000 kip/kg more expensive in Savansai than it is in Seno (see Appendix B). *P. goniotus* is cheapest in Chumphone at 7136 kip/kg, where it competes with a range of small capture species, and 3000 kip/kg more expensive in Seno and Savansai. In comparison SR Tilapia is the most consistent species sold in each of the markets. It has a range of prices between 10016 kip/kg in Khengkhek and 12145 kip/kg in Seno.

5.5.3 Imported species

The three main imported species, *P. hypophthalmus*, *C. batrachus* and Horse Mackerel, are consistently the three cheapest fish sold in large volumes. Horse Mackerel is the cheapest of these species selling at an average price of 6647 kip/kg. *P. hypophthalmus* is slightly more expensive at 8124 kip/kg. This price is based on the large supply of fish that is sold to each of the markets. They also have a low price reflecting the poor quality of the fish imported from Thailand. It is usually packed in ice blocks of 50kg and traders sell these blocks over a number of days.

5.5.4 Price analysis

There seems to be distinct difference in the pricing patterns of urban and rural markets as evidenced by the parallel shift in trend lines of average prices in Figure 5-7. Variations in marginal costs such as transportation and storage would account for the differences in each of the markets. The larger shift between the rural markets highlights the higher marginal costs such as transportation in Outhomphone compared to Chumphone.

Capture fish in the two markets show a greater degree of income elasticity compared to the two rural markets. This is evidenced by the higher variation in prices across species.

Species such as *H. wandersii*, *D. laoensis* and *O. marmorata* (species 25 and above) have a high demand based on their highly valued taste, whereas smaller capture species such as *Trichogaster spp.*, *H. dispar* and *Mystus spp.* are relatively abundant and less desired. The smaller capture species therefore sell at lower prices than in the less affluent rural markets. One possible explanation is that because the demand is finite, the more affluent urban people compete for fish at the upper end of the market. This in turn means that there is little or no demand for cheaper species and prices are lowered. The demand for the large capture fish in urban markets also influences the price of small capture fish in rural markets. Because there are less large capture fish available in rural markets the demand for smaller capture fish increases in the rural markets. That is, demand is redistributed to the lower end of the market thereby increasing the price of small capture species.

Small-scale rural aquaculture species have relatively similar prices between market and species. *C. carpio* and *A. nobilis* are the most price elastic species while the two most abundant aquaculture species, SR Tilapia and *C. batrachus*, are inelastic. However, the market for these species is artificial. Competition for these species is also imperfect as there are a small number of suppliers that control the market. These suppliers maximise their marginal revenue by setting the supply, and therefore the price, to maximise the return.

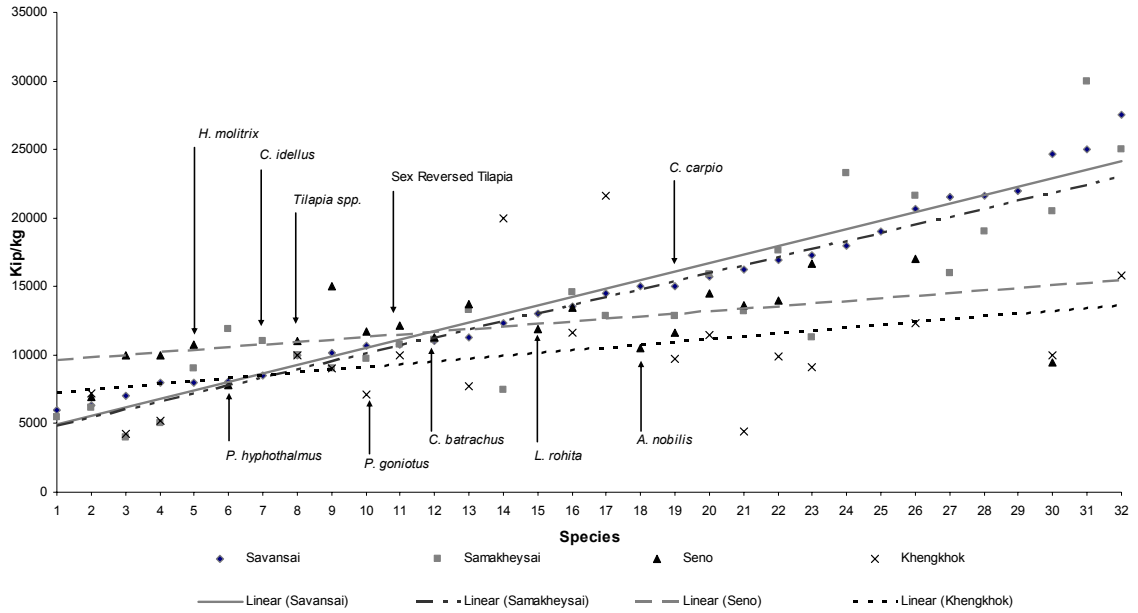


Figure 5-7 Price trends. Note: Species are listed from least to most expensive in Savansai. The other three markets are then compared. A list of species corresponding to numbers 1-32 is found in Appendix A.

5.5.5 Summary

The demand for capture fish is higher in urban markets than in district markets. Culture fish are positioned at the mid to low end price range of the fish market, demonstrating much less variation in price between species than capture fish. The demand for capture fish is highest and they are usually traded in the urban markets where buyers have more purchasing power and sellers can maximise their profits. Large capture fish experience a greater demand in urban markets, which not only pushes the price of the capture fish upwards but negatively affects the price of small capture fish when the larger fish are available. In turn, the absence of large capture fish in the rural markets pushes up the price of the smaller species in the rural markets. Capture fish prices demonstrate elasticity in the urban markets, as supply increases or decreases. However, the prices of fish in the rural markets show little or no elasticity. The price of culture fish, traded almost exclusively in the rural markets also shows little elasticity as both the supply and price are fixed by a small number of traders who control the trade of these species reflecting an imperfect market.

5.6 Seasonal variation

The supply of both cultured and capture fish is highly seasonal. Aquaculture development is regarded as a way of supplying fish during times of the year when there is a deficit in capture fish production. This section discusses two points. First, whether the price elasticity of culture and capture is due to seasonal supply. Second, whether the supply of culture and capture fish are related over different seasons.

5.6.1 Capture species

As expected, capture fish trade is highly seasonal. The average price and average volume sold is negatively correlated over the 12-month period ($p < 0.01$). Price is therefore driven by supply. The highest supply is during the height of the dry season from March to May (Figure 5-8). It is at this time of year that water bodies recede and fish become easier to catch. This is especially the case for species such as *C. macrocephalus* and *Channa* spp. that can tolerate poorly oxygenated water. A large quantity of fish is also traded toward the end of the wet season, in October, when fish are caught in large volumes as they migrate out of the flooded areas.

5.6.2 Cultured species

The largest quantity of aquaculture fish is also sold over the dry season. This is when most ponds are harvested. In comparison few little cultured fish are sold to market over the wet season. However, the proportion of culture fish, especially *C. batrachus* and SR Tilapia, is higher during these months. SR Tilapia, especially, accounts for between 16 to 35% of total monthly trade. In contrast, small-scale aquaculture fish contribute between 0.5 and 3% of total monthly trade. The price of cultured fish is not correlated with supply reflecting trader's ability to match supply with demand.

It therefore appears that culture fish do not provide a replacement for capture fish. Instead, culture fish supplement fish supply at times when capture fish are traditionally abundant. There is a positive significant correlation ($p < 0.05$) between the supply of culture and capture fish between seasons. This indicates that supply of culture and capture fish is influenced by social activities, such as increased demand for fish during the festival season at the end of the dry season, and work schedules limiting fishing times. However, if SR Tilapia is removed the relationship is weak and not significant

indicating SR Tilapia, as an intensively produced fish, is more similar to the supply patterns of capture fish than small-scale aquaculture species are.

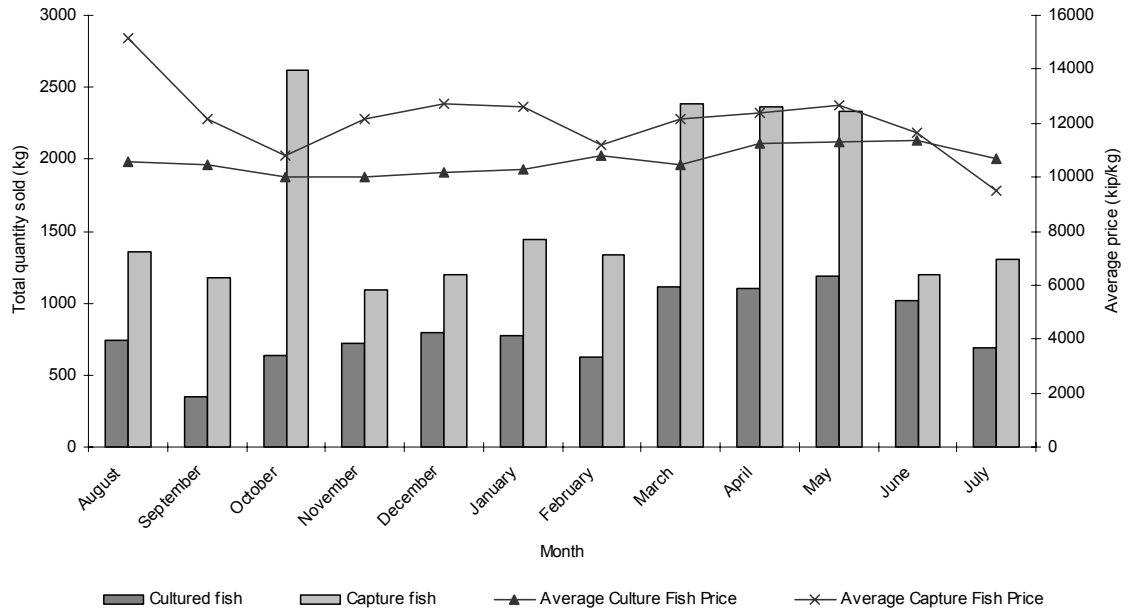


Figure 5-8. Estimated volumes and average price per kg of culture and capture fish by month.

5.6.3 Summary

The supply of both capture and culture fish is highly seasonal. Fish from small-scale aquaculture contribute little to markets in any month. In contrast SR Tilapia is the largest contributor to markets, providing supplementary supply to capture fish throughout the year. This is especially the case in the wet season when lower catches of capture fish are recorded. However, it appears that there is little potential for small-scale aquaculture to supplement capture fish during the wet season because, unlike cage culture systems, few fish are harvested during this time of year.

5.7 Discussion

This chapter challenges the three general assumptions of the importance of aquaculture fish outlined in the introduction. Firstly, the results of the survey show capture fish are more important as a source of cheap protein for poor consumers than culture fish. Secondly, culture fish do appear to reduce demand for capture fish. And thirdly, there is no clear indication that culture fish are a driving force in the development of increased

market trade in the Lao economy. However, these statements need qualification. Instead of critiquing the role of culture and capture fish, the following discussion considers the specific contribution of different sub-categories of both types of fish.

5.7.1 Categories of culture and capture fish

A variety of fish was sold in each of the markets over the 12-month survey. The volumes and values of species, both capture and culture, differ considerably. A number of different categories of fish are evident, each with a different market share. The market for capture fish are divided into large, high value species and small, low value species. High value species are seasonal, sold mainly in large provincial market, while low value species are sold in large quantities across all markets, and are more prevalent in the rural district markets. Culture fish are divided into small-scale rural aquaculture, SR Tilapia from cage culture and imported species from Thailand. Small-scale fish are sold predominantly in Seno market, while SR Tilapia and imported fish are distributed across all markets.

Large capture fish are almost exclusively traded in the urban markets in Savannakhet town where consumers have higher purchasing power, where they sold at high prices. This is seen in other areas of Laos where the larger, more expensive species, are traded to national and international markets and smaller species are the basis of local trade systems (Bush 2004). In contrast small capture fish fill a niche at the low end of the market, providing the cheapest source of fish available in the urban markets. These species are common across all districts and sold by part-time traders from villages across the province. Mid-priced species making up the major proportion of trade are *Channa spp.* and *C. macrocephalus*. Both species are highly prized for their taste and are also two of the most abundantly caught species throughout the year. These are the staple capture species in the markets and also two species that are very common in aquaculture ponds as outlined in Chapter 4.

All three sub categories of culture fish do not have a market niche. They are not the cheapest fish in the market, nor do they compete with high value capture species. They are comparable in value to common capture species such as *N. notopterus* and *M. albus*. Species grown in small-scale rural aquaculture have a relatively small market share. As such their trade is opportunistic and, as a result of dry season harvest of ponds, highly

seasonal. They therefore do not provide a consistent source of fish to market. The only aquaculture fish grown in Laos that provides a reliable supply to market is SR Tilapia from intensive cage culture systems along the Mekong River in Savannakhet town.

The most consistent species sold to Lao markets in high volume apart from SR Tilapia are the two culture fish are *P. hypophthalmus* and *C. batrachus* and the marine capture fish Horse Mackerel. These three species make up the majority of fish sold across all markets.

5.7.2 Protein for the poor

Aquaculture fish do not provide the cheapest source of protein to poor consumers. However, this statement needs to be qualified based on the type of aquaculture fish. It is true that culture fish are not the cheapest in the market but the two culture species imported from Thailand, *P. hypophthalmus* and *C. batrachus*, provide the most consistent source of low priced fish at high volumes across all seasons. The price and volume of SR Tilapia is consistent throughout the year but their price is fixed by supply, whereas small-scale aquaculture fish are supplied in low volumes to market. This means that there is a not a viable supply which can lower prices or meet demand for cheap protein.

The survey shows that the cheapest fish available are consistently small capture fish. These are sold in all markets in relatively high volumes. The price of these fish is lower in urban markets as a function of the high income elasticity of larger capture species. The wealthier urban markets shift demand to the large riverine species. As demand is finite, the price of smaller capture fish falls. The low price of these smaller species is maintained in the urban markets by competition, which is not seen in the rural markets. This also indicates that a cheap supply of fish can also be fostered by maintaining the high value capture species in the market.

Small-scale aquaculture fish appear to provide a cheap source of fish for rural poor consumers. Because overall prices in rural markets are inelastic it follows that increased supply of culture fish would potentially reduce their price. However, these fish must compete with the cheap imported fish from Thailand, which are supplied in high consistent volumes. The imported species are likely to continue to provide a cheap

source of protein in the markets. The lack of small-scale aquaculture fish in the markets appears to indicate that they are providing an important source protein at a subsistence level in rural communities. This is investigated further in the next chapter.

5.7.3 Income for the poor

Implicit in the role of aquaculture in alleviating poverty is the provision of income from the sale of cultured fish. The results of the survey indicate that the ability of pond owners to market their harvest is limited. One obstacle may be a lack of access to markets as indicated by the concentration of villages, with farmers that sell to market, found along the main roads around Seno. As shown in Chapter 4 most of fish ponds are dug along local roads, presumably with less access to markets. This is contrary to what Delgado *et al.* (2003) conclude. They believe that the development of aquaculture provides isolated rural communities with an income opportunity through integration into wider market systems. In Savannakhet the only aquaculture fish that are strongly integrated in the market system are SR Tilapia, which have had considerable investment in not only the cage culture systems but also distribution infrastructure for live fish trade. These systems are lucrative but the level of investment required prohibits poorer farmers.

Capture fish by comparison are sold from all over the three districts. However, there is a concentration of trade from villages across floodplains and along major rivers. The diversity of fish sold from floodplain habitats, ranging from small Cyprinids to migratory Silurids, indicates that the fish are sold to market as either opportunistic income or selectively when cash is needed. Small capture species in particular are used as a natural asset that can be quickly used to raised financial capital as they are traded directly to markets by the fishers themselves. Although fish pond owners also trade their fish direct to market these fish are only available at specific times of the year.

5.7.4 Reducing pressure on capture fisheries

The argument made by Anderson (1985) and Ye and Beddington (1996), that aquaculture fish can provide a substitute or replacement to capture fish therefore reducing fishing pressure, is not apparent in Savannakhet. Despite the variety of aquaculture species found in the market, only two, *P. hypophthalmus* and *P. goniotus*, are direct replacements for a capture species. In a rational market, these species would provide alternatives to equivalent capture species. However, markets are not rational.

Capture *P. hypophthalmus* is not found in large quantities in Savannakhet and similar species such as *W. attu* or *B. dinema* are highly regarded in taste.¹⁷ The poor quality of cultured *P. hypophthalmus* means that this fish is not a viable substitute. Wild *P. goniotus* is not found in large quantities in the market, therefore it does not provide a viable replacement for closely related species such as *Hypsibarbus* spp.

C. batrachus and *C. macrocephalus* provide an example of species substitution. Both species are supplied in large volumes throughout the year in all markets. It appears, therefore that *C. batrachus* provides a substitute species that could reduce the demand of a similar capture species. However, *C. batrachus* fails as a substitute because its taste is regarded as inferior to *C. macrocephalus*. It therefore appears that pressure on capture species is not reduced by increased supply of aquaculture species in Savannakhet.

5.7.5 Developing the market economy

The long term aim of the government is to establish export markets for culture fish (Phonvisay 1994, 1997). This is part of the government's wider policy of market transition from both a central and subsistence based natural economies (see Chapter 3). In practice this transition involves increasing income opportunities for rural communities by developing agricultural production through modernisation. Aquaculture is not only seen as a way of increasing production but also increasing regional market integration. However, this is highly presumptuous when the majority of extensive small-scale rural aquaculture is found in relatively isolated rural areas, and there is high competition from existing import markets.

The development of some forms of aquaculture will increase the share of culture fish over others. SR Tilapia is the most likely species to be developed into a viable marketable fish. Small-scale aquaculture fish, on the other hand are less likely to promote increased market share of aquaculture. They are capital intensive and not accessible to rural poor communities.

¹⁷ These species are considered similar, grouped together by their common characteristic of a lack of scales and classified as *Pa Nang* which translates literally as 'skin fish'.

It is noted that an obstacle to higher growth of the agriculture sector is its insulation from the rest of the economy (Bourdet 1995). Living aquatic resources are also insulated as the current contribution of capture fish is not recognised. There are no records of the volume of fish trade and price records from major provincial markets are averaged and summarised within two non-descript categories, *Carp 1* and *Carp 2*. There is therefore little formal recognition of the value or volume of fish that pass through market and the importance of the fish to the economy. The value of existing domestic fish trade of capture fish is high, even in Savannakhet province. Incorporation of living aquatic resources shows a shift to a market economy that has been in place for a number of years already.

5.8 Conclusion

This chapter has highlighted the disjuncture between the simplified statements of development orthodoxies and the complexity and diversity of living aquatic resources use. The results show that aquaculture fish make an important contribution to trade in Savannakhet but also highlight an important distinction between the different classifications of culture species based on the systems in which they are grown and where they are traded from. The three classifications found in Savannakhet are small-scale aquaculture fish, SR Tilapia from cage culture and imported culture fish from Thailand. The results of this chapter show that the contribution of culture fish in providing protein to poor consumers, reducing the demand of capture fish and contributing to the national economy are all contingent on the type of fish sold.

In response to key development orthodoxies it is concluded that small-scale rural aquaculture does not contribute a cheap source of protein for poorer consumers. These fish are supplied seasonally to the markets, have a medium ranged price and are not highly regarded by consumers. Both SR Tilapia and the imported species from Thailand provide a cheap, reliable, high volume supply of fish to both rural and urban markets. As such, small-scale rural aquaculture fish cannot compete as they have much higher supply and lower prices.

It is possible that the impending deficit of food fish, as outlined in the rhetoric of the global fisheries crisis, can be met by increased aquaculture supply. However, a question remains as to whether a deficit exists in Savannakhet. There is no seasonal deficit in

supply as both capture and culture fish are sold in similar proportions throughout the year. It is also unclear whether capture fish prices are increasing in response to increased scarcity. Although the price of larger species is considerably higher than aquaculture fish there remains a range of small capture species available in large quantities and low prices. Therefore, capture fish appear to be available to a wider range of consumers than culture fish and, as such, appear to be more important in contributing to overall food security.

In comparison, capture fish are the most important source of fish for poor consumers. Even though aquaculture fish meet one third of the total demand capture fish provide a range of species that meet demand for high quality fish in urban markets as well as provide a staple supply of cheap fish for poor consumers. These fish are also readily traded by villagers providing an important source of income. It is therefore these fish that contribute to the provision of protein for poor consumers and also a source of income for rural communities.

Market related development orthodoxies appear to be oversimplifications that do not account for the complexity and diversity of fish trade in the Lao context. In addition, the grounded research presented in this chapter shows a series of new patterns that highlight this diversity and complexity. Similar to the assumption that fish ponds are a resource dedicated to aquaculture in the previous chapter, the results of this chapter show that the broad categories of capture and culture fish trade veil the role and importance of different species and production systems for traders, fishers and farmers. Recognising the variety of categories within aquaculture and capture fish improves a general understanding of where fish are produced and by whom. By showing that small-scale aquaculture does not have the market penetration that is assumed, its place within a wider portfolio of living aquatic resources should be reassessed within policy and planning.