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**"Give a man a fish..."  
Contextualising Living Aquatic Resources  
Development in the Lower Mekong Basin**

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Australian Mekong Resource Centre  
University of Sydney  
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*Women with scoop nets on their way to fish in Savannakhet, Laos. (Photo: Simon Bush)*



*Old fisher making drift net in village along Se Bung Hiang River, Laos. (Photo: Simon Bush)*

## ABSTRACT

Capture fisheries in the Lower Mekong Basin are an important living aquatic resource exploited for both food and income by rural communities. The importance of capture fisheries has been recognised by archaeologists studying the Angkorian Empire and by French travellers during the 1800s. In recent years, these resources have increasingly been recognised as an important part of rural livelihoods. Yet, they are highly undervalued in development policy. This has been based on two assumptions: firstly that capture fisheries are in decline (despite a lack of accurate data) and secondly that fish are a culturally acceptable development intervention. This paper argues that the focus on fish culture is derived more from outside perceptions of Asian culture than any real understanding of the importance of capture fisheries, and that this has resulted in natural living aquatic resources having a low profile in riparian government planning and policy. The paper begins with an historical review of culture and capture fisheries development in two Mekong riparian countries, Thailand and Lao PDR. The paper then explores how the ‘cultural appropriateness’ of fish (*per se*) in Asian cultures has been used as a justification for aquaculture extension in international aid and national government policy.

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*Children fishing on Se Bung Hiang River, Laos. (Photo: Simon Bush)*

## LIST OF ABBREVIATIONS

AAP	Accelerated Aquaculture Program
AARM	Aquaculture and Aquatic Resources Management Network
ADB	Asian Development Bank
AIT	Asian Institute of Technology
AOP	Aqua-outreach Project
BDS	Bangkok Declaration and Strategy for Aquaculture
CCRF	Code of Conduct for Responsible Fisheries
CIDA	Canadian International Development Agency
CMEA	Council for Mutual Economic Assistance
DFID	Department for International Development
DoF	Department of Fisheries (Thailand)
DLF	Department of Livestock and Fisheries, Lao PDR
FAO	Food and Agriculture Organisation of the United Nations
ICLARM	International Centre for Living Aquatic Resource Management (World Fish Centre)
IDRC	International Development Research Centre
IMF	International Monetary Fund
JICA	Japan Agency for International Cooperation and Aid
LMB	Lower Mekong Basin
MRC	Mekong River Commission
NESDP	National Economic and Social Development Plan
OECD	Organisations for Economic Cooperation and Development
SIDA	Swedish Agency for International Aid
SFPP	School Fish Pond Programme
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VFP	Village Fish Pond Project
UN	United Nations
UN-ESCAP	United Nations Economic & Social Commission for Asia-Pacific
WB	World Bank

# 1. INTRODUCTION

Although aquaculture can have an important place in the livelihoods of rural communities in Southeast Asia, capture fisheries are more important in terms of income and nutrition, especially for the poorer people in those communities (Bush 2003). Despite the reputed Asian-ness of aquaculture, until the 1950s there was very little in the Lower Mekong Basin (LMB).

Today increases in aquaculture are heralded as the ‘blue revolution’ (Borgese 1977; Smith and Peterson 1982; Coull 1993; Ackefors *et al.* 1994; Edwards 1999; Kwei-Lin 2001), a technocratic solution for eradicating poverty, taken from the much debated green revolution approach to rural development. Kelly (1996) argues that “...the discourses of development that underpin aquaculture as a development strategy are flawed, since they neglect the impacts of fish farming in the local resource base and those social groups dependent upon it” (p.40). Despite this, institutions have continued to develop aquaculture as a “common-sensical and irrefutable positive solution to underdevelopment” (ibid. p.43).

Kelly takes a strong stance. While aquaculture has its place in rural development, it is not the panacea of food security that it was once considered. This is especially the case in the Lower Mekong Basin (Figure 1), where around 70-80% of animal protein comes from fish, 90% of which, it is estimated, comes from the capture fishery (Hortle and Bush In Prep.).

It is argued here that despite early accounts of the importance of capture fisheries, natural living aquatic resources have not been given enough attention in government planning and policy in the LMB. The first aim of this paper is therefore to provide an historical review of culture and capture fisheries development in the Mekong Basin by comparing Thailand and Lao PDR, two countries with similar environmental and socio-cultural backgrounds but very different politico-developmental histories (Figures 1 & 2). The second aim is to explore how ‘cultural appropriateness’ of fish (*per se*) in Asian culture is derived from an association with the capture fisheries of Southeast Asia rather than any inherent disposition for raising fish in ponds. How this misinterpretation has been translated into a justification for aquaculture extension in international aid and national government policy is then discussed. By doing so the paper reflects on the evolution of aquaculture as a development activity promoted over the last century.

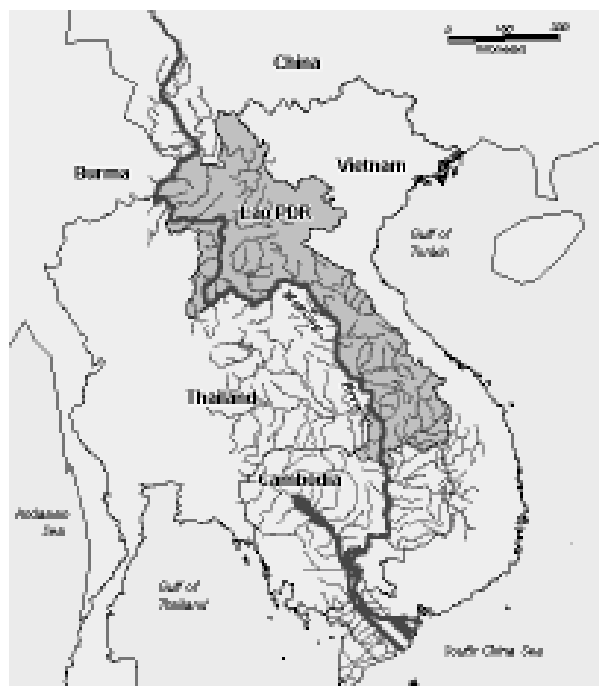


Figure 1. Lower Mekong Basin



Figure 2. Lao PDR

## 1.1 Fish production and consumption in the LMB

Living aquatic resources are one of the most important sources of nutrition and income for over 55 million people living within the six riparian countries of the Lower Mekong Basin (LMB) (MRC 2000). The official and unofficial total catch estimates for the capture fishery for the LMB are highly contested, currently ranging between 1.0 and 3.1 million tonnes (Jensen 1996; Sjorslev 2001a; Hortle and Bush In Prep.). The political sensitivity of this figure continues to rise as competition for water resources throughout the region increases (Van Zalinge *et al.* 1998; Van Zalinge and Thuok 1999; Hirsch 2003).

A comparison between Lao PDR and Thailand, the two distinctly landlocked areas of the LMB, shows the relative importance of aquaculture and culture fisheries to consumption. In Lao PDR aquaculture produced fish make up approximately 2.6% of all fish consumed while in Thailand it makes up 5.7% (see Table 1). Both are relatively low figures. However, previous planning has been based on estimates published by the Food and Agriculture Organisation of the United Nations (FAO).

The Food and Agriculture Organisation of the United Nations (FAO) has estimated that aquaculture production is substantially lower than capture fisheries in all riparian countries in the LMB (FISHSTAT 2003). In Lao PDR aquaculture production is estimated at around 35% of capture production while in Thailand aquaculture production is estimated to form 50-65% of inland capture fish production. Although these percentages are likely to be smaller in reality, these figures give an approximate proportion of the importance of aquaculture and capture fisheries to the populations of Laos and Northeast Thailand.

The proportion of aquaculture to overall production is based on poor reporting systems (Coates 2002). In Laos for example it is unlikely that aquaculture makes up 35%, but high end estimates such as this may lead to a greater level of importance placed on aquaculture in planning and development than is warranted. Based on such a rationale, the importance given to natural living aquatic resources is inversely proportional. Therefore the capture fishery is increasingly becoming an “invisible fishery” - invisible in policy and planning - while remaining the most visible of activities of rural communities across in the LMB.

Fish consumption is an increasingly acceptable measure of yield in mainly subsistence fisheries (Bayley and Petrere 1989; Hortle and Bush 2003). Using consumption, the most fish abundant country is Cambodia

**Table 1 Fisheries Production Estimates in the LMB** (from van Zalinge, 2003)

Country	Population (million)	Average per capita consumption (kg)	Total <sup>1</sup> fish consumption (tons)	Capture <sup>2</sup> Fisheries catch (tons)	Reservoirs <sup>3</sup> Fish Catch (tons)	Aquaculture <sup>4</sup> production (tons)
Cambodia	11	65.5	719,000	682,150	22,750	14,100
Lao PDR	4.9	42.2	204,800	182,700	16,700	5,400
Thailand	22.5	52.7	1,187,900	9,323,00 <sup>5</sup>	187,500	68,100
Viet Nam	17	60.2	1,021,700	844,850	5,250	171,600
<b>Total LMB</b>	<b>55.3</b>	<b>56.6</b>	<b>3,133,400</b>	<b>2,642,000</b>	<b>232,200</b>	<b>259,200</b>

<sup>1</sup>Sjorslev (2001) recalculated by Hortle and Bush (2003)

<sup>2</sup>Total consumption minus Reservoir catch and Aquaculture production

<sup>3</sup>MRC Management of Reservoir Fisheries data

<sup>4</sup>Phillips (2002)

<sup>5</sup> Includes a large part of the probably more than 50,000 tons of freshwater fish products exported from Cambodia to Thailand (Van Zalinge *et al.* 2001).



with an average estimated per capita annual consumption figure of 75.6 kg/person/yr<sup>1</sup>. Lao PDR has consumption estimates ranging from a national figure of 7 kg/per/year (Phonvisay 1994) to site specific estimates of 42 kg/per/year in Khong district (Baird *et al.* 1998)<sup>2</sup>. Within the Songkram River Basin in Northeast Thailand, consumption figures have been estimated at 41 kg/per/year (Sjorslev 2001b). In general however the nutrition value of the Mekong fishery is considered substantial and an important source of protein, vitamins and minerals for the communities that exploit the various resources (Jensen 2001).

## 1.2 Focusing on Thailand and the Lao PDR

Thailand and Lao PDR highlight the different development paths of living aquatic resources in the LMB. They are considered a good case study for two reasons. Firstly, they share a border along the Mekong River and have strong socio-cultural ties and a rural population dependent on fisheries as their main source of protein. Secondly, the governments of both countries have focused fisheries development on aquaculture despite having very different political systems and development histories.

Both countries also fit into an emerging regional economy and development discourse (Hirsch 1993; Rigg 1997; Hirsch 1998). Laos is of particular interest as the only landlocked country in the LMB, with the smallest population surrounded by large populations and economies in Thailand, Vietnam, China, and Cambodia, all countries with distinctly different development histories over the last 30 years.

## 1.3 Outline of paper

Section 2 starts by outlining some of the historical accounts of capture fisheries and living aquatic resources in the LMB. This is not an extensive history of Mekong fisheries but rather presents a variety of accounts from Angkor to the French travellers in the 18<sup>th</sup> and early 19<sup>th</sup> centuries.

Section 3 then gives a similar history of aquaculture in the LMB. This section presents an historical dichotomy between Asian and Western beginnings of aquaculture. It is argued that despite the lengthy history of aquaculture in Asia, most of the major promotion and development work has been achieved by Western institutions. It is further argued that the apparent Asian-ness of aquaculture has been used as a justification for aquaculture extension whereas capture fisheries have remained more important for Asian populations.

Section 4 then outlines the historical development of aquaculture in Laos and Thailand and the intervention of western based organisations. Section 5 reflects on the development of government policy in Laos and Thailand in light of this intervention.

Section 6 discusses and concludes some of the main issues faced in bringing in a higher profile to capture fisheries in the LMB in consideration of the development histories of Laos and Thailand.

## 2. HISTORICAL RECORD OF CAPTURE FISHERIES IN THE LMB

While culture fisheries are relatively new, capture fisheries have provided a livelihood base for communities and kingdoms within the LMB for centuries. Although the historical importance is increasingly recognised in government and popular circles it remains outside of many riparian development agendas<sup>3</sup>.

The following is not an exhaustive account of the history of fisheries in the LMB. Instead it offers examples of how the fishery has been perceived by mainly European outsiders. This offers a comparison of Euro-

pean accounts of the fishery in the late 1800s and how fishery development and management has been progressed by mainly western institutions over the last century, as dealt with in the following sections of this paper. It also contextualises the progress that has been made in understanding the importance of Mekong fisheries over the last 130 years, with many observations and questions being asked then, only now being addressed.

## 2.1 Cambodia and Angkor

The first records of fish and fishing activities in Cambodia are the Bas Reliefs at the temples of Angkor, built in the 11<sup>th</sup> Century, on the edge of The Great Lake, Tonle Sap. Fish are represented in daily activities: in markets, in boat racing and warring vistas. They also appear in agricultural scenes. Fishing activities are shown in Bayon and Banteay Chhmar temples including the use of cast nets and lobster pots (Roveda 1997). Fish are also shown in the forks of trees possibly representing the fall of water in the dry season from the flooded forests (ibid.).

Depictions of Hindu folklore also entail images of fish, such as the story of Praduyma, where the son of Krishna is thrown into the sea and swallowed by a fish (Roveda 1997), and the Churning of the Sea of Milk (see Zhou 2002 [1902]).

The detail and variety of the fish species shows the intricate relationship between the Khmer people and the living aquatic resources of the Great Lake. This relationship was first described by Zhou Daguan (or Chou Ta-Kuan), a Chinese diplomatic mission sent by Timur Khan, the grandson and successor of Kublai Khan (Zhou 2002 [1902]), a Chinese traveller to Angkor in 1295. Pelliot translated his description in 1902:

Of fish and tortoise the black carp is the most abundant, and very abundant too are bastard carp, ts'ao-yu. There are 'spitting fish'; the big ones weigh at least two pounds. Many fish exist of which I do not know the names. All these are found in the Great Lake; but there are also many sea fish of every kind, eels, and congers. The Cambodians do not eat frogs, so that at night they are all over the roads. Tortoise and iguana are as large as ho-ch'u, and even tortoise with liao-tsang are eaten. The prawns of Ch'a-nan weigh a pound or more. The legs of Che-p'u tortoise are up to eight or nine inches long. There are crocodiles as large as ships, they have four legs and look exactly like dragons, but they have no horns; their belly is very crisp. In the Great Lake you can catch bivalves and octopus. (p.61)

This provides the first account, 700 years ago, of a dependence and importance by people of the LMB that has changed little. This abundant array of aquatic life remains to this day.

## 2.2 French Indochina: Cambodia, Laos and Northeast Thailand

The next accounts of capture fisheries came from French and English travellers in Indochina and Thailand during the late 1800s. Although concerned primarily with economic surveys and travelogues, there are a few, often disinterested, observations of fishery activities and their importance to the local peoples.

The geographic extent is mainly confined to 'exotic', or economically important areas. These included the Great Lake near Angkor, the mainstream Mekong to the Khone Falls, the Mun River, the surrounds of Vientiane and Luang Phrabang. The more intrepid travellers extended themselves to the Se Bung Hiang River, Attapeu and North of Luang Prabang to China. It is interesting to note that most of the fishing activities reported were on the Great Lake and the main tributaries of the Mekong such as the Mun River in Thailand, and the Nam Kan and the Se Bung Hiang in Laos. Collectively they form an historical picture of a variety of Mekong fisheries.

## 2.2.1 The Cambodian Lot System

The richness of the fisheries in Cambodia has been described numerous times throughout the last century (see Pétilot 1911; Chevey and Le Poulain 1940; Bardach 1959; Fily and d' Aubenton 1965). Some accounts concentrate on the range of fishing gears available (Fily and d' Aubenton 1965). However, the majority concentrate on the establishment and management of the Lot System, which was recently re-formed by a community fisheries bill based by the Cambodian government in 2001 (see Degen and Thuok 1998).

The Lot System, established throughout the Mekong and Bassac river systems in 1908, was a mechanism to internalise revenue from the extensive fisheries of Cambodia. Fisheries laws and regulations were formalised for the first time in 1908 by the colonial administration of the French Protectorate and published through several royal ordinances (Degen and Thuok 1998). These however merely formalised pre-existing rules for fisheries activities (*ibid.*).

Francis Garnier (1996 [1885]) noted that there was no one but the “*annamites*<sup>[4]</sup> to exploit the fruitful fisheries” (p.142) of Tonle Sap, a comment that may have led to French intervention, in capturing revenue from the fishery. Under the existing system King Norodom (1859-1897) was entitled to arbitrary dues on fishing. The public servants collecting the taxes were predominantly Chinese investors who leased areas of the fishing grounds out to farmers at an agreed price. The income collected by these Chinese businessmen (known as “tax farmers” in Thailand) was up to two times as much as went into the Royal Treasury (Degen and Thuok 1998). The French ordinances allowed the Royal Government to directly collect taxes and so increase revenue by 17%, so that in 1910 the fishery taxes made up one-ninth of the French administration budget (*ibid.*).

## 2.2.2 Fishing activities

Some of the fishing gears used along the Mekong were described in great detail. Paul-Marie Néis<sup>5</sup> (1997 [1884]) observed fishing in the Nam Kan near Luang Prabang. He detailed the setting up of the traps when the water was rapidly lowering. The structure was described as having :

...huge tripods formed with three stakes, pushed deep into the soil and with their upper parts strongly tied together with rattan rope. On the inside of each of these tripods a bamboo floor was built, which was loaded with heavy stones to provide still more strength to the structure and to prevent it being taken away by the current. Simple bamboo racks linked the struts. The racks, pierced in the center, received hoop nets which were remarkably similar to those of our lobster fishermen. When the water was deep and the current not so fast, they made these hoop nets in huge sizes. They were not less than fifty to two hundred meters in diameter. (Néis 1997 [1884], p.89).



Figure 3. Chip trap on the Se Bung Hiang River in February 2003.  
(Photo : Simon Bush)

The trap he refers to is the same as, or similar to, a modern day *Chip* trap of which there are many kinds (e.g. Claridge *et al.* 1997). Descriptions given by members of the expedition are very similar to present day forms of Chip trap as shown in Figure 3.

McCarthy<sup>6</sup> (1994 [1900]) describes the fishery in Luang Prabang as a busy one for fishers in June, the time of the first upstream migrations following the new rains. He identified two species, *pla buk* (*Pangasianodon gigas*) and *pla rerm*<sup>7</sup> (*Pangasius sanitwongsei*) as the target for the fishers. He also reported a rent system paid to local authorities for the right to fish, the price being a large fish from the catch. This was clearly a system of rent from a productive annual fishery. He gives a good account of this migratory fishery:

The fish [*P. gigas*] is taken in the sixth, seventh or eighth month, or June, July, and August, when on its upward journey. Returning in November, it keeps low in the river, and a few stray ones only are caught.... The net for catching these fish is from 150-200 feet long and 6 feet wide, made of cord one-eighth of an inch thick. This is dropped across the river from a small boat, usually by two men, and is supported at one edge by calabashes, used as floats, 8 feet apart, the other edge being sunk by stones placed opposite the floats. In June the water is almost red, and the fish, keeping near the surface, are easily caught. The more they struggle the more firmly are they secured in the meshes; and the stones rattling against the side of the boat as the fishermen pull in the net, indicate a successful cast. This method of fishing is not without danger, for men have been known to be dragged from the boat and entangled in the meshes of the net with the fish. (McCarthy 1994 [1900], p.60).

This fishery is much the same as the gill net fisheries found all over the Mekong today (see Figure 4). The introduction of mono-filament gill line, replacing the thicker lines McCarthy describes, is generally recognised as one of the major causes of fish decline due to increased fishing efficiency in the LMB.



Figure 4. Gill nets being set on the Mekong River, 2002. (Photo: Simon Bush)

### 2.2.3 Natural science observations

The travellers also made some interesting observations on the biology and ecology of fish. These descriptions concentrate on the larger, more ‘exotic’ species such as *P. gigas* and *P. sanitwongsei*.

A *pla buk* that I helped to take weighed 130 lbs.; it was 7 feet long and 4 feet 2 inches round the body; the tail measured 1 foot 9 inches. The roe of this fish is considered a great delicacy.... Returning in November, it keeps low in the river, and a few stray ones only are caught. It confines itself to the Nam Kawng [Mekong], and does not go up the Nam U [Nam Ou], which the *pla rerm* seems to prefer. (McCarthy 1994 [1900], p.63).

The roe of the *P. gigas* is also referred to as being paid as part of a tribute, payable every 10 years, to the governor of Yunnan by Luang Prabang. The tribute consisted of:

4 elephants, 41 mules, 533 lbs. of Nok (Metal composed of gold and copper), 25 lbs. of rhinoceros’

horns, 1000 lbs. of ivory, 250 pieces of home spun cloth, 1 horn, 150 bundles of areca-palm nuts, 150 coconuts, and 33 bags of the roe of the fish pla buk. (McCarthy 1994 [1900], p.60 )

McCarthy (1994 [1900]), obviously the more fishery observant of the travellers, also reported the occurrence of a large fish kill in which “the water ran red, and the fish were poisoned by a plant called by the Lao “*idam*”...” (p.76). He reported that the only two fish species to escape the poison were *Anabas testudineus* and *Channa spp*<sup>8</sup> by “*taking trips overland*” (p. 76).

The most poignant and relevant observations were however made by Francis Garnier<sup>9</sup> (1996 [1885]). He made some very insightful observations of the ecology of the fishery firstly describing the habitat in which large fish are caught such as deep pools. He observes that the fishery concentrated on these areas:

A few locals used the remaining days before the rise of the waters to throw their nets for the last time into the parts of the river that were sheltered by a fortunate disposition of the rocks on the banks. In these cool, calm and deep places, the big fish which the Cambodian river nurtures find the rest that they need to milt. We were a witness to the capture of one of them, which astounded us by its enormous size: they needed the help of five or six men to lift it on to the bank. (Garnier 1996 [1885], p. 289).

Over 100 years later this observation of Mekong fish ecology is being confirmed scientifically. Studies by the MRC confirm that deep pools are important as dry season refuges (Poulsen and Valbo-Jørgensen 2001; Poulson and Jorgensen 2001; Poulson *et al.* 2002). Deep pools are classified as important areas for fish conservation in Southern Laos (Baird 1999; Baird and Flaherty 1999) and are the subject of further study by the Worldwide Fund for Nature on tributaries of the Mekong such as the Se Bung Hiang in Laos (Pers. Comm. Roger Mollot, 2003).

Garnier, obviously interested in the large species, also questioned wider scales of fish ecology in the Basin. He asks whether:

...it was a relative of one of the big species which is fed by the great lake of Cambodia and which are, when the waters recede, the object of very fruitful fishing. (Garnier 1996 [1885], p.289)

Again, the importance of fish migration and passage, especially from the Great Lake, has only been established in recent years (see Warren *et al.* 1998; Baird and Phylavanh 2000; Poulson and Jorgensen 2001). This is followed by a much broader questioning of the source of fish migration and spawning. As a challenge to inland fishery workers, Garnier’s questions remain important:

Is it in Tibet that we must find the spawning place of these fish which are surely the kings of fresh waters? The bed rocks and the enormous depths which one finds in the five great rivers <sup>[10]</sup>...are they the determining factors of their production? Here then are a number of questions for a naturalist to solve. (Garnier 1996 [1885], p. 289).

## 2.2.4 Importance to livelihoods

Despite such challenges, the importance of fisheries to local livelihoods is a recurrent theme through many of the early accounts. For example, de Carne (1995 [1872]) notes the ease with which fish are caught relative to other food gathering activities such as hunting. He describes an evening in Ubon Ratchatani on the Mun River when fishing was a much easier option to hunting:

...we set out to hunt in the forest, which was inhabited by wild animals of all sizes and kinds, from the tiger, the elephant, and the wild boar, to the hare and the goat...It would be necessary to study habits, and to surprise them by watching, and we had not the time. Fishing was at once easier and more successful. (de Carne 1995 [1872], p. 91 )

This shows that in the Mun River area fish were in great abundance and also describes an attribute of the fishery often given today: that fishing is important because it is more time effective than many other activities.

De Carne later goes on to describe, with far more colonial prejudice, the importance of the fishery near Paklai (near Vientiane). He identifies fish as making up a large proportion of the local diet and again makes reference to the allocation of time. He goes on to say:

the Laotians, who, indolent and hating work, prefer fishing to farming, and leave their rice-ground when evening comes, to visit the nets set in the morning in favourable places, or cast lines... (de Carne 1995 [1872], p.91)

This statement again shows the importance of fish for Lao communities and the importance of fishing in the management of daily work. It requires less work than other forms of agricultural activities and, for the French colonist is a degraded form of work. He goes on to stress however that he purchased from a fishermen for

...a fish a metre and a half long, and as fat as a fed pig, with flesh of the colour and consistency of beef. The capture of one of these monsters is a piece of good fortune for a family. It is cut into strips and smoked, and supports them for long. (de Carne 1995 [1872], p.91).

## 2.2.5 Conservation and management

In 1925 Hugh McCormick Smith, the first advisor to the Royal Department of Fisheries in Thailand, reported some recommendations for the future development of fisheries in the Thailand (Smith 1925). He was pro-conservation and his writings consisted of plans and recommendations for aquaculture development as well the conservation of freshwater and marine fisheries. He noted the importance of aquatic animals and their role in self sufficiency to the future welfare of Siam.

He notes, quite counter to the accounts of rent acquisition by Mc Carthy in Luang Prabang and others in Cambodia (Van Zalinge *et al.* 1998), that in Thailand:

...in no important fishing ground and in no important organised fishery has there ever been any adequate protection afforded the fishes, and in most cases there has been no protection whatever. (Smith 1925, p. 48).

Smith stresses the importance of local access to the fisheries. The lakes and swamps are the “fountain-head” of the inland fishery resources. These resources, he notes, had been taken over by government-created monopolists. Smith suggests that these resources should instead be in the hands of farmers and the interests of the monopolists should be curtailed in favour of “the great agricultural community” (Smith 1925).

In the first attempt at reducing the pressure on the inland fisheries and stock augmentation he made a series of recommendations including the following regulations:

1. Withdrawal of commercial fishing from lakes and swamps connected to rivers for the purposes of spawning habitat.
2. Restriction of fishing in areas surrounding spawning grounds at the end of the spawning season.
3. Raising water levels in swamps and lakes to avoid these water bodies drying up.
4. Installation of fish-ladders or fish-ways to enable migrating fish passage.
5. Restriction of fishing in surrounding areas above and below dams and in irrigation canals to allow fish safe passage.

6. Prohibition of fishing gears that remove all fish within their scope.
7. Supplementation of native stocks by artificial propagation.

The right questions were being asked 80 to over 100 years ago. Smith identifies the need in Thailand for the mediation of water management project impacts to inland fisheries. It also shows insight into access and control over inland fisheries and debate over the active management of community fisheries, all of which remain contemporary issues for the management of fisheries in the LMB.

## 2.3 Conclusion

The importance of Mekong fisheries to riparian rural communities can be acknowledged from the above accounts. At present there is much debate over production figures and species abundance in the LMB, however, a basic appreciation of the importance of inland fisheries to the Basin's inhabitants, must be fostered.

The European travellers who left accounts of the Mekong recognised and accepted the importance of fishery resources. Despite economic interests in the LMB the French only sought revenue in any systematic way from the fisheries of the Great Lake. On the whole the fisheries of the Mekong Basin were left alone by foreigners. For half a century, apart from some taxonomic work, capture fisheries have taken a back seat to water management and development. The capture fisheries of the Mekong Basin have only gained political ascendancy in the last 5-10 years, the main governmental proponent being the MRC. The focus that has instead remained on aquaculture is, as argued below, the result of external actors and the perception of Asia as the home of fish farming – a European representation of the centrality of fish in Asian culture.

## 3. ANCIENTS OR ADOPTERS: AQUACULTURE IN SOUTHEAST ASIA

The Organisation for Economic Cooperation and Development (OECD) only identified aquaculture as an emerging industry in 1989 (OECD 1989). However, small-scale rural aquaculture has been practised for hundreds of years in various parts of the world (see Bowen 1970; Ling 1977; Parker 1989; Ackefors *et al.* 1994; Brummett and Williams 2000). It is only relatively recently that aquaculture has been formalised within western science and packaged as an object of international technical assistance.

While there is much evidence to show the importance of fish in Asian cultures, commentators have tended to see fishing and aquaculture as an 'essential' part of the 'Asian' character (e.g. Liao 1988). Textbooks often start with a statement of the Asian roots of fish farming (e.g. Iversen 1968; Ling 1977; Bardach 1997b). Without denying the essential role of fish in Asian societies, it can be demonstrated that most of the technical assistance to South, Southeast and East Asia has its roots in western countries, with its own aquacultural histories. The following therefore begins by outlining the Asian history of aquaculture before tracing the European history of aquaculture and western influence on aquaculture in Asia.

### 3.1 The ancient origins of fish culture

*“Give a man a fish and he eats for a day, teach a man to fish and he eats for a lifetime”*

Chinese proverb

*“Give a person a fish and he will have food for a day; teach him to grow fish and he will have food for a lifetime”*

Shao Wen Ling the first man to raise the Malaysian prawn from egg to adult undercontrolled conditions (Ling 1977)

It is believed that aquaculture goes back approximately 3500 years to Weng Fang, the founder of the Zhou Dynasty in what is now modern day China. From around 1135-1122 BC it is reported that he built ponds in Hunan Province, filled them with ornamental fish, and made the first ever recording of culture techniques (Ling 1977).

In 460 BC Fan Li, a minister of Emperor Guo Jian in Yue State, wrote his classic treatise on the culture of Common Carp (*Cyprinus carpio*), making the first effort to record the process of fish cultivation (Ling 1977; Ackefors *et al.* 1994). His interest in the culture of fish for food is thought to have been a strategy for strengthening the state against war and revolt (Sun 1987). Modern day China is also regarded as one of the first areas of the world to develop forms of mariculture when 200 years after Fan Li, people began an era of sea animal husbandry during the Qin dynasty (221-206 BC) (Sun and Sun 1999) and also 1000 years later during the Sung dynasty (960-1279 AD) when people began to develop the first oyster, pen shellfish, and pearl fields (*ibid.*).

The evolutionary process leading to aquaculture is thought to have started with storing wild caught fish in baskets submerged in water (Ling 1977). It is believed that this practice gradually developed into the rearing of caught fingerlings in nets and eventually earthen ponds (*ibid.*). Other evolutions of aquaculture may have involved the use of trap ponds much the same as are used extensively in Northeast Thailand today. These trap ponds are developed in response to the hydrological patterns of floodplain areas to trap fish in depressions during the receding waters. Much of this evolution continues to occur as present day farmers move up the 'ladder of intensification' from capture to culture (Setboonsarng 1993). Such evolution could have occurred in a number of places around the globe, however China is seen as the source of aquaculture as it developed the first entirely closed husbandry techniques. Mariculture has also had a long history in other Asian nations such as Japan where communities raised clams in the 8th century and seaweed in the 11th century (Ackefors *et al.* 1994).

It is thought that the introduction of fish husbandry to Southeast Asia occurred around 1000 years ago (Williams 1997; Edwards 2000). As ethnic Han Chinese moved down the Southeast Asia peninsula bringing with them the hardy *Cyprinus carpio* (Common Carp) as well as the required technical knowledge for both rice-fish and urban aquaculture systems, they settled and disseminated their technologies. It is thought that during this time the Giant Goldfish (*Carassius auratus*) was introduced to the upland regions of Laos and Thailand where it remains endemic to this day (Funge-Smith, Pers. Comm.).

It was not until the end of the Second World War that real advances in the techniques of fish farming were made with the selective breeding of species and controlled reproduction by hormonal injection (Coull 1993). This set a platform for incorporation of fish rearing techniques in green revolution technology during the 1960s.

With such an historical legacy it is not surprising that Asia and Asian traditional practice has become, in some circles, the assumed antecedent to present day fish culture. The opening two quotes of this section show how the idea of aquaculture and fish husbandry have in some respects been co-opted and perhaps even normalised into a fundamentally Asian practice. Despite such beliefs however, it appears to be not widely recognised that, apart from ancient practices within China, modern day protagonists of aquaculture are mainly western-based institutions pushing aquaculture as a practice yet to reach its potential as a panacea for food production and income generation in developing countries (Coull 1993; Bardach 1997a; Edwards 1997; Williams 1997). Therefore a European history is important in giving context to the current practices of aquaculture in rural development within Asia.



## 3.2 Ancients, adopters and developers: Europe and United States

Both ancient Greece and the Roman Empire also have long histories of fish husbandry. It is interesting to trace these histories as they show that Europe has a tradition dating back 2000 years. Evidence from this time includes the description of Carp by Aristotle (384-322 BC) - *kyprinos* or *kyprianos*, derived from the Latin *Cypria* (secondary name for Aphrodite the god of love and fertility) a function of the fecund nature of the fish (Balon 1995a). Both the Greeks and the Romans grew Carp, however confined themselves to the rearing of wild caught juveniles (Ackefors *et al.* 1994).

### 3.2.1 European origins

It is proposed by Balon (1995b) that the origin of aquaculture, although documented as starting in China, may have also had origins in Europe. He argues, through a history of the domestication of the Common Carp (*Cyprinus carpio*), that the origins of fish culture may have occurred simultaneously in China and Europe. The basis for this argument is evidence showing that the contemporary species *Cyprinus carpio carpio* evolved from a riverine species found in the Danube, and early reference to 'Carp' in Asia may in fact refer to the East Asian subspecies *Cyprinus carpio haematopterus*. The implication of convergent evolutions of Common Carp is that it appears plausible that the development of aquacultural technologies in Asia and Europe have occurred in isolation from each other.

Within Europe the spread of aquaculture is attributed to the Roman Empire. Archaeological evidence of Roman period fishponds has been found from Rome to Britain. These ponds are usually associated with manner houses or royalty (Zeevat 1988). There is also evidence from Roman literature describing fish being kept for food, pleasure or profit, fishponds being referred to as *piscinae* or *vivaria*, and those that kept the ponds *piscinarii*. These early aquaculturalists raised freshwater trout (roman: *salar*), roach (*rhedo*), perch (*perca*), tench (*tinca*) and gudgeon (*gobius*) and saltwater sea-eel (*murena*), bearded mullet (*Barbatus mullus*), turbot (*rhombi*), or bass (*lupi*) (ibid.).

In medieval times numerous fishponds were built as a system for the provision of fish for the royal courts of the United Kingdom (Roberts 1988; Steane 1988). In England, and across Europe, cathedrals were also responsible for the development of the culture of Common Carp (*C. carpio*), kept for days of fasting (Balon 1995b). In Scotland the rearing of trout and salmon has occurred from at least medieval times where their systematic production was used by various church institutions (Coull 1988).

### 3.2.2 North American history

Across the Atlantic the United States has had a much more recent history of aquaculture roughly spanning the last 200 years. One of the first records of fish culture in North America was in 1853 when two aquaculturalists were among the first to fertilise the eggs of brook trout (*Salvelinus fontinalis*) (Bowen 1970). Until the 1880s the main focus of aquaculture in North America was on stock enhancement in rivers that had depleted salmon or trout stocks from pollution or overfishing. Stocks were also introduced for the purposes of sport with the introduction of brown trout from Scotland and Germany in 1883 (Parker 1989).

In 1875 leather and mirror carp were imported from Germany and were the basis for the development of the first food culture in the southern states (Bowen 1970). The 1880s saw a massive increase in interest in the culture of carp and further links were made between European fish culture societies and the newly named American Fish Cultural Association (Parker 1989). However this interest subsided with the recognition that it had a detrimental impact on native fish stocks (Bowen 1970).

The early 1900s then saw growing interest in the development of aquaculture at educational institutions and for the first time in the world aquaculture was formalised and institutionalised. The earliest course in aquaculture started in 1812 at Cornell University. Other Universities took lead from this institution and courses were soon developed at the University of Washington and Stanford University. In 1930 courses were also developed at a number of other institutions. Of note was the commencement of the course at Auburn University in Alabama under Professor H.S. Swingle who was heavily involved in aquaculture development in Thailand through the 50s, 60s and 70s (Swingle *et al.* 1970). In 1970 the University opened The International Centre for Aquaculture organised within the Department of Fisheries and Allied Aquacultures. The centre then received a continuing grant from United States Agency for International Aid (USAID) for the development of its international assistance work (Parker 1989).

Early training concentrated on raising baitfish in small water bodies during the 1930s, catfishes in the 1940s and warm water species such as Channel Catfish in the 1960s (Smitherman and Dunham 1985). With added funding from USAID teaching and research built on their warm water fish experiences and by 1987 courses gave emphasis to species such as Tilapia (Almazan and Boyd 1978; Balarin and Hatton 1979; Jauncey and Ross 1982; Macintosh 1984; Rouse *et al.* 1987; Smitherman and Tave 1987; Bocek year unknown) and Common Carp (Bocek year unknown).

As such the development of aquaculture in US and European Universities began to institutionalise aquaculture in education and directly influence the development of aquaculture in Southeast Asia through technical assistance.

## 4. FISH CULTURE IN THE MEKONG REGION

For Northeast Thailand, and more recently Laos, research and development of aquaculture has been mediated by the development of an aquaculture programme at the Asian Institute of Technology (AIT) in Bangkok. Aquaculture at AIT was introduced in 1981 and sought to promote the science through three sub-programmes: Education and training Research and Outreach. Aquaculture and Aquatic Resources Management (AARM) is now a unit of work under the Agricultural and Aquatic Systems and Engineering Program of School of Environment, Resources and Development offering Doctorate, Masters and short courses in technical aquaculture development (AIT-Aquaculture 1993).

The development of aquaculture in an institution such as AIT has been one way of creating a technologically driven development of fish culture with fundamentally Western European origins. The recent shift of aquaculture at AIT to a more holistic framework of agricultural systems is driven by a need for balanced approaches to living aquatic resource management and poverty alleviation (Edwards 1998; Edwards *et al.* 1999; Phillips and Boyd 2000).

It is argued here that these institutions have contributed to the scientific development of transferable technology for rural communities in the Mekong Basin. The success of these institutions and institutions like them has been reliant on the internal politics and politico-development histories of recipient countries. As such the history of aquaculture development in Laos and Thailand are now presented.

### 4.1 Thailand

The introduction and development of aquaculture in Thailand has been well documented. It is believed that aquaculture was first introduced to Thailand in 1910 by Chinese immigrants bringing with them Chinese carp. Most of this fish culture is said to have developed in Bangkok among the immigrant communities as

poly-culture with some native species including some Pangassid catfish (*Pangasius sutchi*) (FAO 1949). At this time all fingerlings were from wild fisheries or imported from China (ibid.). However, records show that there was some culture of wild caught fish in bamboo grids in Ayutthaya during the middle of the 19<sup>th</sup> century (Bocourt, 1866 cited in Komolmarl 1992). Smith (1945, cited in Komolmarl 1992) also noted that wild caught Pangassid catfish had been raised in ponds since the middle of last century.

A Division of Fish Propagation and Preservation was established in 1926 under the Ministry of Agriculture after recommendations were made by Hugh McCormick Smith, Advisor in Fisheries To His Siamese Majesty's Government. In 1923 Smith arrived in Thailand and remained as advisor to the Division of Fish Propagation and Preservation and then, under his direction, to the Thai Fisheries Department set up in 1926. Smith was the first international fisheries advisor to Thailand writing in 1925 his recommendations for the formation of a Division of Fisheries with the conviction that:

the immediate creation of a Department of Fisheries is one of the most vital needs of Siam in the matter of conservation of the fish supply and perpetuation and development of the fishing community. The sooner the department is established, the sooner will the government have at hand the means for safeguarding the country's fish foods. (Smith 1925)

Smith was conservation oriented. In his 1925 report he wrote of the importance of fishery resources for Thai communities all over the country and recommended the mitigation of dams and weirs through the building of fish passes. He recommended that divisions of Biological Investigation, Fishery Protection, and Fishery Reserves, Nurseries and Hatcheries should be set up in the Department of Fisheries. Notably the role of the Division of Fishery Reserves, Nurseries and Hatcheries was to:

have immediate charge of the establishment and operation of fish hatcheries, the encouragement of private aquiculture (sic.) enterprises in fresh and salt waters, distribution and introduction of fishes and other aquatic animals for breeding purposes, erection and operation of fish ways, improvement of lakes and streams for fish conservancy (Smith 1925)

More specifically he saw aquaculture as a means of replenishing, maintaining, or increasing the supply of aquatic organisms. To encourage pond culture he suggested that taxes be lifted and training resources be distributed around the country for free. However, he also suggested that artificial propagation of fishes be held in reserve as a backup to "the institution of other procedures for restoring, maintaining, and increasing the supply of food fishes" (p. 57) such as the development of regulation of fishing practices and technology. This philosophy supposedly stems from the North American practices of aquaculture for stock enhancement for 'restoration' of wild fish stocks (Parker 1989). This is evidence for the first identification of aquaculture as a project for the provision of fish in the expectation of stock decline.

Through Smith's recommendations a Department of Fisheries was inaugurated in 1926. Then in 1933 the Department was formally recognised as The Department of Fisheries (DoF) and placed under the Ministry of Economic Affairs. In 1935 provincial administrations of the DoF were established in Chumphon, Samut Sakorn and Chanthaburi and the first research station at Bung Boura Phet reservoir in Nakorn Sawan. It was not until 1941 that the Department of Fisheries became a department in its own right under the Ministry of Agriculture. Today, the DoF comprises 28 divisions and institutes including the Freshwater Fisheries Division, Extension Division (under which come provincial and district operations) and the Freshwater Fisheries Research Institute.

Hatcheries and nursery development began from the 1940s as the DoF began seed production in areas near reservoirs in the Northeast such as Sakon Nakorn (Komolmarl 1992; Little *et al.* 1996). Then in the 1950s it expanded to Udon Thani, Khon Kaen, Mahasarakam, Nakhon Ratchasima and Ubon Ratchatani (Little *et al.* 1996). Other provinces followed through the next 4 decades. Most of the consumption of

the fingerlings produced up until the 1980s was concentrated among the urban and peri-urban elite in conventional ponds (ibid.).

For the last 70-80 years Thailand has been a recipient of overseas development aid, that in the last 30-40 years has applied green revolution technologies as a means of increasing rural production and subsequently 'development'. Part of this development has been the application of pond aquaculture technologies. During the late 1970s and early 1980s there was a shift from conventional pond construction to more practical and easily adopted forms of culture. This saw an increase in the attention given to integrated approaches to aquaculture and rice-fish systems and farmer based spawning in Northeast Thailand. The successes in rice and fish development was seen as a response to the cultural philosophy of the Thais, encapsulated in the phrases, *Nai nam mii pla nai na mii khao* (*In the water there is fish and in the fields there is rice*) and *Kin Khao Kin Pla Lao Yang* (*Have you eaten rice and fish yet?: a common way of asking whether someone has eaten yet*) (Suraswadi 1998).

In 1982 the capture fisheries in the Northeast were decimated by an outbreak of ulcerative disease syndrome (UDS). Stocks of Snakehead (*Channa spp.*) and Walking catfish (*Clarius macrocephalus*) were particularly affected. This had far reaching effects on a rural population that placed so much emphasis on fish as food. Interestingly the outbreak occurred at a time when interest in aquaculture was starting to gain momentum in the region, especially with nascent forms of integrated aquaculture being developed by AIT (Edwards *et al.* 1983; Edwards and Kaewpaitoon 1984) and ICLARM (Edwards 1994). It is generally believed that this event increased both the potential and need for aquaculture in the Northeast.

By the end of the 1980s aquaculture in Thailand, and especially the Northeast, was dominated by a series of donor-funded projects. These included the Freshwater Extension Project, Greening Isan project, Village Fish Pond Project (VFP), School Fish-Pond Program (SFPP), the Accelerated Aquaculture Programme (AAP), Fish Culture in Rice Fields Program and a Seed production program from a revolving fund from the government. In the Northeast these were supported by the Canadian International Development Agency (CIDA) after the signing of an Memorandum of Understanding in 1985 with the Royal Thai Government (Potipikat 1996).

The focus of the Department of Fisheries and the projects that have been conducted through it have changed over time. The focus of the DoF up until 1982 was divided between aquaculture and capture fisheries. Most farmers had dug their own ponds from the 1950s onward under individual provincial initiatives. At this time the DoF was more involved in stocking water bodies in which natural stocks had declined as well as focusing on the enhancement of the growing number of reservoirs in the country. In 1969 the Inland Fisheries Program supported by the United States Agency for International Development (USAID) conducted the first Survey Programme of inland fisheries in the country led by H.S. Swingle of Auburn University, Auburn, Alabama (Swingle *et al.* 1970). This was shortly followed by the Village Fisheries Demonstration Programme in Udon Thani in which improvements to water bodies to be a source of fish and agricultural water sources was instigated and by 1979 this project was extended to 12 provinces in the Northeast, again with the help of USAID. Such water body enhancement and construction ideas continued into the late 1980s under the VFP.

The VFP was developed during the 5<sup>th</sup> National Economic and Social Development Plan (NESDP) (1982-1986), as a focus for rapid production of protein in rural areas and has been developed through to the 8<sup>th</sup> NESDP in 2001 (Virapat 1998). The DoF realised their own technical and budgetary constraints and focused on the enhancement of capture fisheries (Komolmarl 1992). The DoF continued, however, to focus on the production of fingerlings. In seven fish stations in the Northeast 79% of fingerlings produced were used to enhance the small water bodies that had been constructed or improved by the VFP (Komolmarl 1992). These fingerlings were used for capture fisheries while only a corresponding 29%

were officially used in aquaculture. This skewed utilisation of fingerlings is representative of the policy of the DoF during the 5<sup>th</sup> NESDP during which extension and conservation were separated. To meet the ideologies associated with the conservation of the capture inland fisheries the DoF had little opportunity other than to release fingerlings into as many water bodies as they could. Other benefits of such a policy would seemingly have been the low levels of expertise and infrastructure required for stocking as well as the perceived lack of need due to extreme difficulties associated with enhancement for follow up studies to assess stocking activities (Komolmarl 1992).

The only aquaculture projects developed by the DoF during this time were the Seed Production Project started in 1984 and the Accelerated Northeast Thailand Aquaculture Development in Irrigated Area Project from 1986. Other projects included the Greening Isan Project, implemented by the Thai military, and the continuation of the VFP in 'Poverty Areas' along the Thai-Lao and Thai Cambodian borders. The VFP in these areas came under various names such as: *VFP in Self Defence and Developing Areas*, *VFP in Backward Areas* and *VFP Along Border of Neighbouring Countries* (Komolmarl 1992).

The 1990s has seen the involvement of AIT Aqua Outreach and the continuation of the VFP. AIT has focused on the development of small-scale aquaculture and the development of seed supply through the development of low cost technologies such as nylon *hapa* spawning and nursing (Little *et al.* 1996; Edwards 1998; Demaine *et al.* 1999; Edwards *et al.* 1999). Such developments have been extended through the development of networks and integrated fish culture practices throughout Northeast Thailand and Savannakhet Province in Lao PDR (Kosy 1998).

Aquaculture in Thailand has had external assistance since it was initiated in 1923 as a way of conserving the supply of fish to rural Thai communities. This history means that small-scale rural aquaculture now has a strong tradition in many parts of the country. However it would appear that contrary to Smith's initial recommendation 76 years ago, less attention has been given to the regulation and management of the capture fishery as the popularity of aquaculture has grown to the point where it is the primary activity of the Department of Fisheries in inland areas of Thailand. This is now at the point where through simple supply and demand Laos and Cambodia are the main sources of high value capture Mekong species (Bush 2001; Phonvisay and Bush 2001; Bush 2002b).

## 4.2 Lao PDR

In most rural parts of the lowland plains [of Laos], as well as in much of the uplands, fish and other aquatic animals provide between seventy and ninety percent of the animal protein in people's diet. For many of these people, not yet or barely in the cash economy, there is no affordable substitute source of protein. (Claridge 1996).

The recent history of aquaculture in Laos is similar to that of Thailand and in particular Northeast Thailand. In fact the development of aquaculture in some provinces of Laos such as Savannakhet has been based on the experiences of small-scale rural aquaculture development in Northeast Thailand. However, the political and socio-economic differences between these countries have meant that aquaculture has been developed in very different contexts. In Laos, as highlighted by Claridge, aquatic resources are of over-riding importance given the lack of alternative sources of food for much of the population.

The modern history of aquaculture in Laos can be broken into four distinct periods. The first of these is the pre-revolution period from the 1950s to 1975. The second is the post-revolution period from 1975 until the Fourth Congress of the Lao People's Revolutionary Party in 1986. This marked a change in emphasis of the role of aquaculture in the provision of food security and was the first recognition that aquaculture could offset the decline in the capture production (Phonvisay 1994). The third period, from 1986 to 2000

is characterised by increased accessibility to Laos by international development organisations. The current period, post-2000 is characterised by a shift toward a holistic view of aquatic resources management.

Laos has a broad aquatic resource base that can be divided into upland and lowland areas with varying degrees of resource access and productivity. This natural, resource and skills based distribution appears to have existed up until the 1950s when the first aquaculture development intervention was undertaken. A plan for inland aquaculture was written in 1956 with support from USAID and the Government of Thailand identifying the construction of 7 centres around the country (USAID 1973). The five stations targeted were Nongteng in Vientiane, Km 8 at Pakse, Phak Bo in Savannakhet and Khongsedone in Salavane (ibid.). However the stations were never completed due to political instability in 1959 (Figure 5 shows the location and number of ponds during this time in provinces where the stations were built). In 1965 further development resumed after a USAID study into the feasibility of aquaculture in the country (USAID 1973). A contract was written between the Lao and American governments consisting of the development of aquaculture, the restoration of the abandoned stations and the training of Lao personnel in the production of Common Carp and Tilapia. During this time Japanese assistance built a series of spawning facilities. Only three of the stations were developed, Nong Teng, Pakse and Luang Phrabang (Ministere-de-L'Economie-Nationale 1972; USAID 1973). Then in the early 1970s stations were also constructed in Houa Phan, Xieng Khouang and Oudomxay with assistance from Vietnam and China (Gupta *et al.* 2000). These stations were however isolated and based on the Chinese methods of mass production rendering them inappropriate and ineffective.

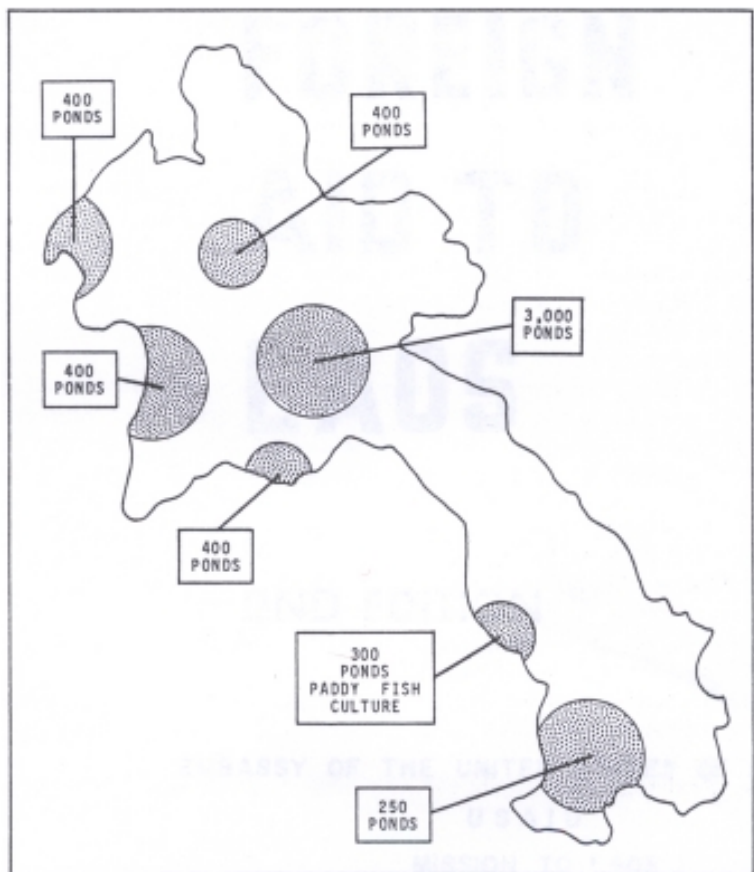


Figure 5. Location and number of ponds in Laos by province at the end of the 1950s. (Source: USAID 1973)

The interest in aquaculture as a development programme was only part of the much wider aid portfolio estimated at US\$74.4 million per year from 1968 to 1973 (Chanda 1982). This massive input made citizens living in the Vientiane special zone the highest per capita recipients of aid in the world (ibid.).

In 1975 with the end of the revolution and victory to the communist Pathet Lao there was an abrupt end to US aid with the closure of USAID and Multilateral budgetary assistance (Chanda 1982). The new regime then sought unilateral and bilateral assistance from socialist block countries such as the then Soviet Union, Hungary, Czechoslovakia and nearby Vietnam (Burley 1982). From 1975 to 1982 over US\$400 million non-military aid was delivered to Laos from such connections, most of which was programmed after the 1978 Moscow meeting of the Council for Mutual Economic Assistance (CMEA), an organisation consisting of socialist states. However, funds from the Asian Development Bank (ADB), International Monetary fund (IMF), World Bank (WB) and United Nations (UN) continued to some degree through the initial transition (ibid.).

Most of the programmed aid from politically aligned states generally came in the form of fellowships for Lao students to study overseas. The appropriateness of many of the industrial, technology driven skills obtained through these fellowships is questionable in an agrarian context such as Laos. Many of the returning students had degrees up to Masters and Doctorate level in large animal husbandry and engineering, with little chance of meaningful employment on return. Those that did find employment through the government were placed in jobs in which they had no training at all. This is especially evident in the case of the fish stations where to this day some of the managers in place have engineering degrees and have had to develop their skills through subsequent projects and self-reliance. Other returning students with skills relevant to areas such as fisheries found that their skills were ignored by a government more interested in the collectivisation of rural production than in the development of the fishery sector. This was also, it appears, a function of poor institutional understanding of, or indifference to, fisheries resources that is still an issue of rural development in the country (Guttman 2000).

One of the international institutions involved in agricultural development able to maintain a presence through the revolution was the Interim Mekong Committee (forerunner to the Mekong River Commission) under the United Nations Economic and Social Commission for Asia-Pacific (UN-ESCAP). In 1977 UN-ESCAP instigated a project to once again rehabilitate the Nong Teng Fish station in Vientiane with funding from the Government of the Netherlands and so begin a presence of the UN in Lao aquaculture for the next two decades (Gupta *et al.* 2000). This project also introduced Silver Carp (*Hypophthalmichthys molitrix*), Big Head Carp (*Aristichthys nobilis*) and Grass Carp (*Ctenopharyngodon idella*) from Thailand and later in 1979 successfully bred the Indian Carps Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus cirrhosus*). Despite a drought these fish were successfully bred in the same year (*ibid.*). As a follow up to this success the Interim Mekong Committee, again with funding from the Government of the Netherlands, built a pilot farm for the production of fingerlings to supply to farmers in Vientiane province from 1978-1980.

In 1980 the Interim Committee once more developed a project for the development of the Fish stations targeting Pakse, Savannakhet and Luang Phrabang. This plan was taken up by the FAO UNDP and so initiated an involvement in aquaculture development in Laos that lasted for the next two decades. The first two Phases, LAO\78\014 and LAO\82\014, were predominantly concerned with increasing seed production and the technical capacity of the hatcheries. Towards the end of the 1980s the project had accounted for the production of 32 million fingerlings of both Indian and Chinese Carps (Gupta *et al.* 2000). This supply reportedly increased the demand by farmers and forced pressure on some farmers to develop producing seed in their own ponds (*ibid.*). The FAO UNDP were mainly focused on upgrading existing aquaculture facilities. The development of the central hatcheries was a major part of the production of fry and a series of 'model farms' were set up as a means of disseminating the technologies.

The Fourth Party Congress of the Lao People's Revolutionary Party in 1986 marked a turning point for much of the policy related to agriculture. The Congress placed greater emphasis on the role of aquaculture in the provision of food security (Phonvisay 1994). At this time the DLF identified the development of aquaculture as their primary component for achieving this goal (*ibid.*).

The next involvement of the FAO UNDP was a continuation of the model farmer program through the "Development of Fish Culture Extension" (LAO\89\003) project designed to develop an extension network for aquaculture in Pakse, Savannakhet, Luang Phrabang, Xieng Khouang and Sam Neua. The main aim of the project was 'to disseminate suitable scientific aquaculture technologies to the farmers to improve their traditional methods and in turn improve their nutritional level and family income' (cited in Guttman 2000). The project collected large amounts of information on the progress of model farmers in these provinces who acted as village level extension workers. It was during this project that the first efforts were made to breed Silver Barb (*Puntius goniotus*) and Pa Phone (*Cirrhinus microlepis*);

the former successfully, the latter unsuccessfully (Gupta *et al.* 2000).

The next FAO UNDP project, “Provincial Aquaculture Development” (LAO\97\007), sought to strengthen the extension models began in the “Development of Fish Culture Extension” and increase the number of provinces involved in the project. This project was not only instrumental in increasing the national extent of aquaculture development but also the information on aquaculture and aquatic resources and technical knowledge of both farmers and government hatcheries (Funge-Smith 2000). The main aim of this project was to develop aquaculture accessible to farmers and so raise both income and nutrition of the target communities.

Other efforts in the development of aquaculture include AIT Aqua Outreach (AOP) in the South. An extension of the AIT AOP in Northeast Thailand, the project has focused on the extension of low technology nursing and spawning technologies as a means of decentralising fish production from government run hatcheries (Litdamlong *et al.* 1998). The project has focused strongly on the development of spawning and nursing networks, enabling technology to spread from farmer to farmer (Haitook 1997; Litdamlong *et al.* 1998; Haitook *et al.* 1999).

Smaller projects such as the ACIAR IDRC Indigenous Fisheries Development and Management Project (IFDMP), the Small-Scale Wetlands Indigenous Management Project (SWIM) and MRAG Adaptive Management project are focused more on enhanced fisheries. However, they have also been responsible for the upgrade of government hatcheries and training of government staff (Lorenzen and Garaway 1999; Noraseng *et al.* 1999b). One of the most recent projects dedicated to aquaculture development and extension is the AQUIP being developed through JICA.

As outlined above, aquaculture in Laos has had a relatively short history. Its application as a means of targeting poverty in rural communities has been adopted by both pre and post revolution governments. Although the current government has been active in adopting aquaculture into its agriculture and aquatic resources management policy, international development institutions such as FAO, UNDP, AIT and JICA have implemented the projects.

### 4.3 Conclusion

International assistance in both Thailand and Laos has been influential in developing aquaculture. This has meant that despite having been perceived by many as an essentially Asian practice much of the development and extension of aquaculture has been developed through western-based institutions and projects. In spite of the documented Asian-ness of aquaculture, the main impetus behind its modern development has been western technical assistance.

The recent history of aquaculture in Laos has highlighted the growing interest by not only the Government of Lao but also international development institutions. It is proposed here that the goals and agendas of these institutions rather than the capabilities and needs of local communities have driven the development of aquaculture in Laos. This is now investigated in light of the contemporary goals and expectations of aquaculture at various scales by different organisations.

## 5. LIVING AQUATIC RESOURCES POLICY AND DEVELOPMENT

Living aquatic resources are now recognised as an important area for rural development interventions by the international development industry. The potential for aquaculture as a panacea for food and income in security has been fostered within the productionist philosophy of development, epitomised by the green



revolution in agriculture. This mode of thinking has further displaced inland capture fisheries from policy and entrenched aquaculture in its place. Historically, capture fisheries management has been poorly recognised in planning and policy. Despite its recent emergence as a key issue in environmental and water management, management of living aquatic resources is still finding its place within traditional productionist modes of rural development. The following investigates the development histories of living aquatic resources in Laos and Thailand, looking at the role and importance assigned to both aquaculture and capture fisheries in current government policy.

## 5.1 Lao PDR

Lao Government policy on the management and development of living aquatic resources has had a lengthy history, associated with international institutions as outlined above. Most recently the two documents that guide policy developed by the DLF are the *Bangkok Declaration and Strategy (BDS) for Aquaculture in the Third Millennium* and the *FAO Code of Conduct for Responsible Fisheries (CCRF)* (Phonvisay 2002).

### 5.1.1 Codes, declarations, strategies and statistics

The fisheries status in Laos is not the same as its neighbours. The CCRF is predominantly focused on marine, industrial fisheries. This is highlighted by a section referring to island state developing countries, with no reference to inland fisheries. The guiding principles – conservation, sustainability, precaution, environmental protection, participation and regulation - of the CCRF are applicable. However, a separate reference is made for the protection of resources for artisanal and small scale fisheries. In Laos this is the overwhelmingly central situation and theme for capture fisheries management. Therefore the relevance of the CCRF for the Lao situation has to be looked at closely by the government.

The BDS is more relevant for Lao policy development, focusing, in part on small-scale rural aquaculture in developing countries. Again, the guiding principles are most relevant, including: environmental protection, minimising social impacts, food security, economic growth and sustainable livelihoods. The BRD is relevant to Laos. By maintaining a strong focus on inland aquaculture this document lends more weight to living aquatic resources development than the CCRF in current policy.

Underlying all of the policy work in Lao PDR is the assumption that fisheries are in decline. The DLF forecast is based on FAO figures for Laos, with a 2020 estimation of 188600 tonnes (see Table 2), whereas recent estimates put the current total consumption at approximately 204800 tonnes (Hortle and Bush In Prep.). The low consumption figures given by the DLF, and the prospect of meeting a consumption figure in 2020 double that of 1996 mean that attention to living aquatic resources has continued to turn to aquaculture.

### 5.1.2 Policy sectors

The policy sectors for living aquatic resources are divided into *priority areas* by the DLF (Phonvisay 1994; Phonvisay 1997; Phonvisay 2002). These reflect a natural division of water resources, highlighting the dominance of lowland floodplain areas. The four priority areas are:

1. Aquaculture and Floodplain Management
2. Reservoir Management
3. Aquatic Resources Identification, Assessment, Research and Management
4. Post Harvest Fisheries Technology and Regulations

**Table 2. DLF forecasted Production trends for fisheries in Lao PDR**

Source: (Phonvisay, 2002)

	Year				
	1996	2001	2005	2010	2020
Estimated Population*	4.7	5.2	5.7	6.4	8.2
Requirement of aquatic animal products (kg/person/year)**	10.2	14	16	19	23
Total amount (Tonnes)	48000	73000	91200	115200	188600

\*Population increases from National Statistics Office

\*\*DLF information 1997 revised according to FISHSTAT

The first and second priorities are divided into specific management units: floodplain, riverine, reservoir and pond (Phonvisay 1994). Activities relating to reservoir fisheries are mainly confined to Nam Ngum reservoir. Capture fisheries management policy has concentrated on the development of regulations outlined in a decree of the councils of Ministers Number 118/PCM (see Box 1), on the management and protection of aquatic animals, wildlife and on hunting and fishing (5<sup>th</sup> October 1989). These regulations are recognised throughout the country and enforced by the DLF by village committees.

### Box 1. Lao National Fishing Regulations

1. Decree of the councils of Ministers Number 118/PCM, on the management and protection of aquatic animals, wildlife and on hunting and fishing (5<sup>th</sup> October 1989):

- Prohibits the use of military weapons, grenades, poison or other equipment of a “mass destruction” character.
- Prohibit catching of protected species, endangered species, pregnant or nursing animals or during the fish spawning season.
- Protected species may be caught in self defence but ownership reverts to the state.

2. Institutions on the execution of council of Ministers Decree No. 118/PCM on the management and protection of aquatic animals, wildlife and on hunting and fishing (5<sup>th</sup> October 1989), require registration of all weapons used for hunting and prohibit use of weapons modified from war.

3. Hunting and fishing ban during the Buddhist Lent (30 July 1993):

- This was sent to all ministries, provinces and special zones – reiterates the need to enforce the provisions of Decree No. 118.
- Stop hunting, animals and fish cited in lists of prohibited and controlled species.
- Prohibit the selling, service in restaurants and consumption of wildlife meet.

The most complex, site specific regulations for capture fisheries management has been derived from community fisheries projects. These have mainly been developed in wetland and back swamp habitats in the south, consisting of community devised management systems in cooperation with district and provincial staff (see Noraseng *et al.* 2001; Garaway *et al.* 2002). There has also been success with co-management of fish conservation zones in Champassak province (see Baird 1999; Baird and Flaherty 1999) which has

subsequently been adopted in provincial planning in other provinces such as Savannakhet, Salavane and Sekong. Central planning has however not institutionalised these systems of management.

### 5.1.3 Central policy

Based on external influences such as the BDS and the CCRF within the main priority areas, the central level DLF has outlined a policy schedule which reflects the attention given to aquaculture (see Box 2). Overall the aims are multifarious, ranging from food security and income generation to alternative livelihoods to upland swidden agriculture - a contested issue of agricultural reform. There is a stepwise process reflected in this policy agenda of achieving self-sufficiency first and development of export markets second. At the top of the list however is aquaculture. As Phonvisay (1994) outlines:

Aquaculture, as the first priority program, is widely recognised in Lao PDR as having great potentials to offset present declining production trends. Fish ponds in the country are popular because of their multiple uses (e.g. domestic use, irrigation and livestock) and that culturing fish in these ponds could provide farming families with an inexpensive and readily available source of nutrition food during the time of year when natural fish are difficult to find.

The role of aquaculture as a way to meet the deficit in wild capture fish is once again referred to. However, such a statement for aquaculture is also realistic. There is recognition that the development of fishponds is beneficial for more than the production of fish. This provides another way of looking at small-scale rural aquaculture. The multi-use nature of the ponds is an important factor in the adoption of pond construction and then adoption of fish culture. As Funge-Smith (2000) and Phonvisay (1997) rightly point out, once a fishpond is built it is rarely abandoned providing a good source of additional farm and household water.

#### **Box 2. Lao National Agricultural and Fisheries Development Policy Objectives**

(Source: Phonvisay 1997)

1. Meet food security.
2. Provision of fishery products as commercial commodities for local market and for future export.
3. Supporting the rural development in the perspective of poverty alleviation and income generating opportunity and a complimentary source of cash.
4. Contributing to the gradual reduction of slash and burn shifting cultivation by integrating fish culture into the upland farming systems.
5. Contributing to the sustainable use, appropriate management and protection of aquatic resources including aquatic bio-diversity.
6. Upgrading and establishing appropriate basic infrastructure required for further Aquatic Resources Research, management and development for the country.
7. Strengthening upgrading and performing the technical support services in Research, Extension, management and development of the sub-sector such as Living Aquatic Resources Research Institute, Inland Fisheries Development Centre, Aquatic Animal Health Diagnostic Network with more and more capacity and capability to collaborate and participate in the Sub-regional \ Regional and International Aquatic Resources Research and development ventures.

## 5.2 Thailand

Thailand, as the closest neighbour of Laos, in terms of accessibility, culture and trade, has influenced the development of aquaculture both formally and informally. The Thai government has been involved in Lao aquaculture since the 1960s (USAID 1973) and trade of fingerlings into southern Laos from private hatcheries accounts for around 93% of all seed used in Savannakhet province during the mid to late 1990s (Haitook 1997).

Komolmarl (1992) provides an analysis of the goals of the Thai Department of Fisheries (DoF) as compared to the first six National Economic and Social Development Plans (NESDP's) of the Thai government from 1957 to 1991. Komolmarl concludes that the

DoF's objectives in fisheries development were not focused which made it difficult to formulate a policy to support them. p. 18

Even though the effectiveness of the policy is ambiguous the main goals of aquaculture development remain the same: to increase fish production in rural communities to supply sufficient protein, to elevate levels of income from domestic and export trade and to ensure the conservation of a healthy state of fisheries into the future (DoF cited in Komolmarl 1992).

The aims of the DoF have changed through the development of the six NESDPs. These changes are tracked by Komolmarl and provide an interesting history of the evolution of aquaculture in Northeast Thailand, as he is able to show a shift in emphasis through the development of the five-year rolling NESDPs described below.

Beginning in 1925 with Smith until the first NESDP in 1971 the emphasis was on the accumulation of knowledge with regards to marine and freshwater fisheries. Then, from 1972 to 1981 the DoF focused on efficient domestic utilisation of marine fisheries and the development of freshwater fisheries production. Then during the 1980s the emphasis changed to the efficient use of fishery resources for domestic consumption as well as promoting export trade. The Sixth NESDP in 1988, placed emphasis on the reduction of social problems and raising the standard of living of fishers and farmers. More specifically aquaculture was emphasised as a way of decreasing the dependence on natural systems and developing a higher quality fish for export. The seventh NESDP developed in 1992 focused on a range of issues regarding the conservation of aquatic resources and spawning of indigenous species. Interestingly this plan encouraged aquaculture as a way of decreasing the necessity for inland capture fisheries.

Small-scale rural aquaculture has also had political motivation in Thailand. The Village Fishpond Programme (VFP), during the 5<sup>th</sup> NESDP, under the Department of Fisheries, had a series of component projects such as the 'VFP in Self-Defence and Development Areas', and the 'VFP in Border Areas'. Activities along the Thai-Lao and Thai Cambodian Borders attracted funding from the US Government, in parallel with political emphasis in Laos to reduce the production of opium.

## 5.3 Conclusions

These national aims appeared to have framed fisheries as a declining resource and provide as a solution the development of extension services for aquaculture. That is, the development of fish culture for income generation and nutrition supplementation as a result of declining capture fisheries. It is argued here that such macro accounting stems from international level policy applied to the national level. Both Laos and Thailand have sought to develop aquaculture as a panacea for problems of food security, income generation and conservation of capture fisheries in accordance with international, global aims of aquaculture

development centred on food security and income generation. The achievement of these aims lies in the adoption of aquaculture at the local level. In some cases, however, there may exist a discrepancy between the ability of governments to implement these projects. Cultural relations, such as those between Northeast Thailand and Laos, may also be important in determining development trajectories. Such influences add another layer to an analysis of factors leading to successful implementation. Especially when international organisations advocate the benefits of aquaculture in areas influenced more by these trans-boundary ties than government policy.

This is not to say that rural communities in Laos are being solely influenced by Thailand. It is merely to suggest that the development of aquaculture in Laos has been and continues to be contingent on a wider set of factors and protagonists than many realise. Communities in Laos are also influenced strongly by their respective resources base, a factor that should be taken into consideration more in the extension of fish culture (Gregory and Guttman 1996). What is needed is a more inclusive living aquatic resources management regime that places aquaculture in a broader context of the existing natural resource and cultural base in consideration of nutritional and economic circumstances of the target population.

## **6. DISCUSSION: HISTORY, POLICY AND PRACTICE**

The challenge that the Lao government faces is a dilemma between food security and the need for export income. Although aquaculture has been identified as a future potential supplier of export items it is wild capture fish that at present provide the largest potential for export earnings as seen in Champassak province (Bush 1999; Phonvisay and Bush 2001). Trade to Thailand brings in a substantial income for local traders in the area estimated at up to US\$450000 a year (Phonvisay and Bush 2001). The challenge for the government in such cases is to ensure that adequate attention is given to wild fisheries within a broad aquatic resources management system so that local fisheries are maintained as a source of not only income but also of food for local communities (Bush 2002a).

In Northeast Thailand, the VFP in Border Areas and the VFP in Self-Defence and Development Areas have used small-scale rural aquaculture within government policy to address issues greater than food security and income generation. Although not a conscious political intention, the exposure of fish culture and the close socio-cultural links between Northeast Thailand and Laos could help to facilitate the development of aquaculture in Laos. The difference between the two countries in regards to future development of aquatic resources is that Laos still has a large and abundant capture fishery whereas Thailand's inland fishery (despite recent moves to rehabilitate dammed waterways such as the Mun River) is far more culture based.

Such a scenario may hinder a broader shift to the management of capture fisheries in aquatic resources development projects more widely as donors, as well as the government, negotiate the needs of local communities and export opportunities. Donors may help to formalise a convergence between local realities and the wider ideologies of capture fisheries management. Donor agencies such as DFID (see Carney 1998), and SIDA before them (Pers. Comm. Dr. Magnus Torrell 2001), are well advanced in developing holistic models of poverty alleviation through their Livelihoods Approach to development adapted from Chambers and Conway (1992). The approach is based on incorporating all aspects of rural livelihoods including vulnerability and human/ natural/ financial/ social/ physical capital (see Figure 6, DFID 1999).

The development of small-scale rural aquaculture within integrated production systems, such as a broadly based living aquatic resources management, may not be absolutely desirable, or likely to occur. Instead, strategic research between aquaculture and capture fisheries developed from a local perspective and carried out through to context specific extension is needed. As Peter Edwards, Professor of Aquaculture

at AIT, identifies:

Major gaps in knowledge remain of interfaces between culture and capture of fish; and between agriculture and aquaculture, including use of fish as a strategy in integrated pest management. Relatively little is known about social and economic aspects of aquaculture's actual and potential contribution to sustainable livelihoods of the poor. (Edwards 1999, p.6)

Indeed little is known about the actual and potential contribution of aquaculture or capture fisheries to the livelihoods of agrarian communities in the Mekong Basin (c.f. Garaway 1999; Noraseng *et al.* 1999a; Garaway *et al.* 2000; Sjorslev 2000; Sjorslev 2001b). It appears that for policy and practice to converge within the Mekong Basin all levels of management must be willing to accept that aquatic resources are an important resource for local communities, and activities such as aquaculture and capture fisheries must be developed within the local context. As such, small-scale rural aquaculture becomes only one form of intervention by regional and national actors within a wider portfolio of aquatic resource development and management tools.

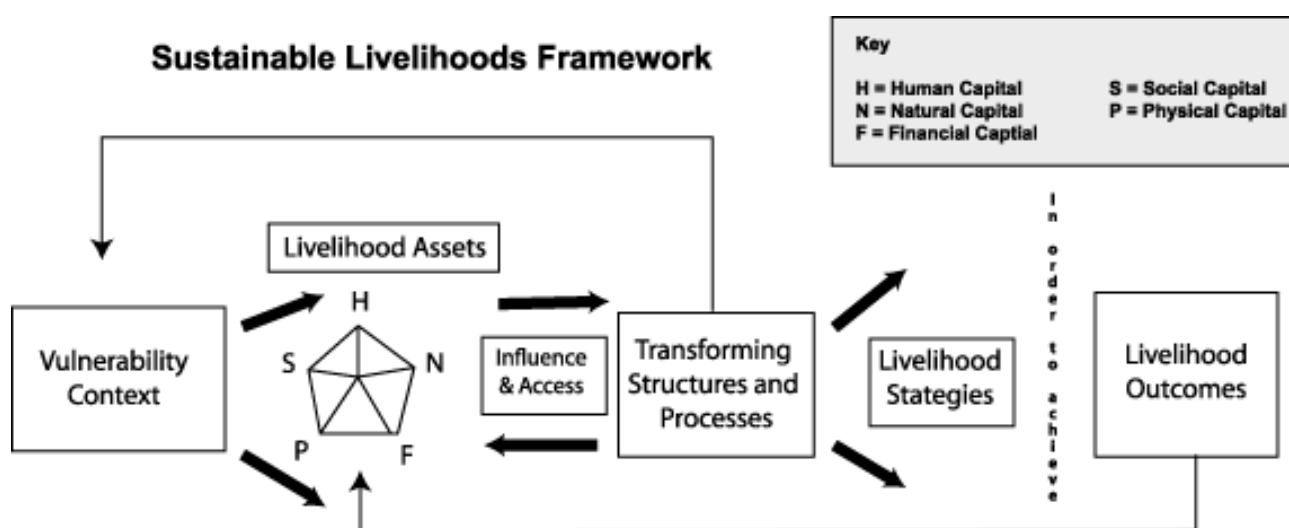


Figure 6. DFID livelihood framework. (Source: DFID 1999)

## 7. CONCLUSIONS

Capture and culture fisheries are important components of living aquatic resources in the LMB. This paper has outlined the importance of each within an historical context and has provided a background to critically assess the policy directions of government and non-government organisations.

The history of capture fisheries provides a variety of early accounts of the capture fisheries. The French colonial authority took control of the Cambodian fishery but, pre-occupied with other natural resources, interfered minimally. This is reflected in Laos. As a result the capture fishery became almost invisible in subsequent development policy. This invisibility has persisted within some development agencies and is still prevalent in projects related to water development in the LMB.

In the face of limited statistical accounts of the capture fisheries in much of Indochina the dominant pathway to developing living aquatic resources has been through aquaculture. This has been reinforced by the

association of fish *per se* with Asian society and culture. The result has been the use of aquaculture as a common-sensical solution to underdevelopment, as described by Kelly (1996) in the Philippines.

Capture fisheries have therefore become an undervalued resource. Early travellers to the LMB recognised the importance of fish for local communities in nutrition and income. Some of their observations and questions referred to migration, river habitat and the importance of fisheries to local livelihoods. These all remain contemporary issues - 100 years after they were first formally recorded. Instead, fisheries have become more focused on production and, as such, in practice aquaculture has prevailed in both Laos and Thailand. The exception in the LMB is Cambodia, where capture fisheries have been valued economically through the lot system for near to one hundred years. This made that fishery both visible and valued. Thailand, despite early recommendations for the protection of inland fisheries, has concentrated mainly on the development of aquaculture systems. In Laos the development of living aquatic resources is pronounced but there is a recognisable policy directive toward aquaculture.

Despite the 'Asian-ness' of fish culture the technical assistance and funding for its development in the LMB has come from external sources, including Stirling University in Scotland, Auburn University in the US and AIT in Bangkok. In Laos the large numbers of students studying in Eastern Bloc countries focused on industrial aquaculture systems, which on return home were found to be inappropriate. There has therefore been a discernable convergence of scientifically developed aquaculture and cultural acceptance propagated through international development assistance.

Government policy in both Laos and Thailand has had a long history of international technical assistance. In Thailand this began with the first fisheries consultant, Hugh Smith who, despite a large emphasis on aquaculture, was the first to promote the responsible management of capture fisheries in the face of proliferating water development projects and over-exploitation. In Laos policy has been framed within a socialist mode of production into which aquaculture was developed as a means of production.

The net result is the continued undervaluation of capture fisheries in these two countries as well as in the LMB as a whole. The hope is that in the future fisheries will not be associated so overwhelmingly with aquaculture but instead aquaculture will be seen as only one part of a broader strategy of local livelihoods as well as regional management and development of living aquatic resources.



*Using cast nets on the Se Bung Hiang River, Laos. (Photo: Simon Bush)*

## NOTES

<sup>1</sup> This estimate is made up of 43.5 kg per capita of fresh fish, which is broken into 49.7 kg per capita for fishing families and 39.9 kg per capita for non-fishing families. If processed fish is included the amount of raw fish consumed is 75.6 kg (80 for fishing and 67 for non-fishing families). The total amount of fish consumed by people in the fishing provinces is hence calculated as 290 000 tones per year.

<sup>2</sup> Khong district is considered one of the most productive fishery areas in Lao PDR. Baird, I. G., V. Inthaphaysi, B. Phylaivanh and P. Kisouvannalath (1998). *A Rapid Fisheries Survey in Khong District, Champasak Province, Southern Lao PDR*. Environmental Protection and Community Development in Siphandone Wetland Project, CESVI. 31. It is located on the border with Cambodia.

<sup>3</sup> The Mekong River Commission has played an important role in the promotion of capture fisheries through video and radio media. This promotion is an ongoing aim of the MRC Fisheries Component, as outlined at the 2003 Annual Meeting of the Fisheries Component, Udon Thani, Thailand, 4<sup>th</sup>-5<sup>th</sup> June 2003.

<sup>4</sup> *Annamite* was an early term for Vietnamese from the Kingdom of Annam. The exploitation of Cambodian fisheries by Vietnamese remains a political issue for the Cambodian government today.

<sup>5</sup> Paul-Marie Néis was a medical doctor commissioned by the French government to survey the areas north and west of the Mekong in 1882. Osborne, M. (2000). *The Mekong: turbulent past, uncertain future*. Sydney, Allen and Unwin.

<sup>6</sup> James McCarthy was the self titled Director-General of the Siamese Government Surveys from 1881 to 1893. Tipps, W. (1994). Introduction. *Surveying and Exploring in Siam: with Descriptions of Lao Dependencies and of Battles against the Chinese Haw*. P. Neis. Bangkok, White Lotus: v-x

<sup>7</sup> *Pla Buk* and *Pla Reum* are the Thai transliterations. By the Lao transliterations they are known as *Pa Beuk* and *Pa Leum* (or *Pa Ling*).

<sup>8</sup> Both of these fish were reported by their Thai names. *Ananbas testudineus* is reported as *pla maw* (Lao: *Pa Kheng*) and *Channa spp.* as *pla chom* (Correct transliteration *Chon*, Lao: *Pa Kor*).

<sup>9</sup> Francis Garnier led the Mekong Expedition (1866-1868) after the death of Doudart de Lagrée died in China

<sup>10</sup> The five great rivers Garnier refers to are the Brahmaputra, Irrawaddy, Salween, the Cambodia (an early name given to the Mekong by early European explorers, see Osborne 2000) and the Yang-Tse-Kiang. The Cambodia refers to Mekong River, an early name given by the French (ibid.).



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