



**Assessing economic and welfare values of fish in the Lower Mekong Basin**  
*Project funded by ACIAR*

**Market Component**

# **QUANTITATIVE VALUES OF FISH IN RELATION TO OTHER NATURAL AND AGRICULTURAL RESOURCES (literature review)**

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## Abstract

This report is a literature review of the studies of the economic value of fish in Cambodia, in particular in relation to other natural and agricultural resources. Two aspects are detailed: i) the findings of these studies (for the 1998-2011 period) and ii) the methodology or conceptual approach of the major fisheries socioeconomic studies. This information provides the basis for the development of a fisheries welfare valuation project and underlines the weaknesses of the previous projects and the pitfalls to be avoided.

## Keywords:

Cambodia; fish market, fish prices, valuation, welfare

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# 1. INTRODUCTION

## 1.1. GENERAL BACKGROUND

Located on the peninsula of Mainland Southeast Asia and lying between latitudes 10 to 15 degrees north and longitudes 102 to 108 east, Cambodia is a mostly landlocked country and has an area of 181,035 km<sup>2</sup>. It is bounded by Thailand in the west and northwest, Laos in the north, and Vietnam in the east and southeast, and Gulf of Thailand in the southwest.

Cambodia is covered by forest, water bodies, and fishing zones of freshwater, which covers 1,687,000 ha (Ahmed and Touch, 1996). Excluding other water sources, the country consists of two main rivers known as The Great Lake-Tonle Sap, and Mekong River (as the lower tributary of the Mekong River system). Different from the Great Lake-Tonle Sap which is the biggest in South Asia and fully extends in the middle of the country, Mekong River – the 12<sup>th</sup> longest river in the world (MRCs, 1992) and the life line of South-East Asia, and the largest river in the Cambodia (the lower tributary of the Mekong River system) – partly flows across and dominates the hydrology of the country. The river originates in China and passes through Myanmar, Laos, Thailand, Cambodia and Vietnam before entering the South China Sea.

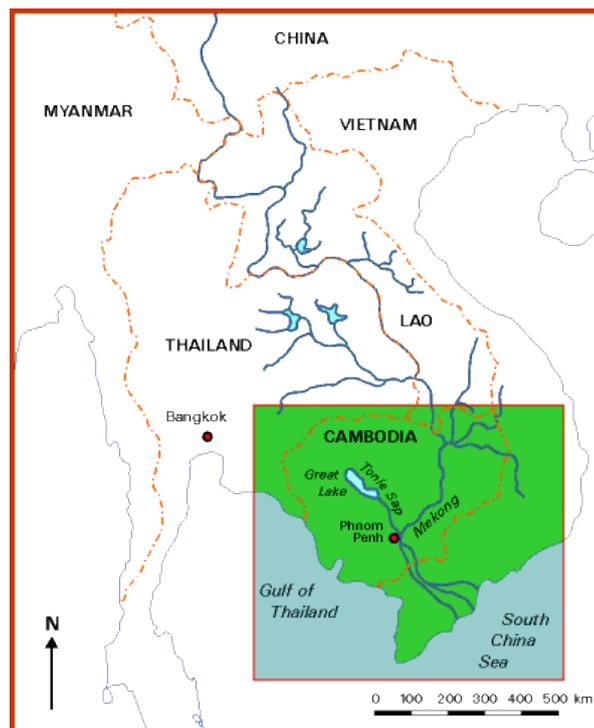


Figure 1: the Lower Mekong Basin and Cambodia.

The Great Lake-Tonle Sap and Mekong River, known as biodiversity sources of aquatic resources, provide a lot of benefits and values to millions of people living in the country, especially to those living in and around the rivers. Those people can enjoy both economic and non-economic benefits and values in many ways that the rivers provide, including food security and nutrition mainly from fish and other aquatic animals, and livelihood opportunities (fishing and fishing related activities for household income). According to National Environmental

Action Plan 1998-2002 estimated that over 3 million people depended on the Great Lake and Tonle Sap river for their livelihoods (MoE, 1998). It was estimated that the fisheries sector provided full-time, part-time and seasonal work to about 2 million people in capture, culture, processing, trade and transportation. Moreover, McKenney and Tola (2002) gave a good summary of the role of fisheries in rural livelihoods that fisheries diversified livelihood activities and insured against the risk of agricultural failures. Also, it provided easy access to income generating activities with very little capital investment and no land. Moreover, it played a vital in food security, maintaining and improving nutrition. All this has contributed to make fisheries an important sector for the national economy in the country. According to Fisheries Administration (FiA) (2001), in 1998, 35% of the Cambodian population was living in a fishing dependent commune. Based on scientific assessments conducted by Van Zalinge et al. (2000) revealed that annual inland fish catch in Cambodia from 1994 - 1997 was 289,000 – 431,000 tons with its retail market value of USD 250 – 500 millions. However, this figure was still underestimated. Furthermore, data from Food and Agriculture Organization (FAO) showed that annual inland fish catch in Cambodia in 2000, according to official country statistics, was 245,600 tons. FiA (2010) depicted that annual inland fish catch in Cambodia in 2009 was increased to 390,000 tons. Starr (2003) reported that the fisheries output accounted for approximately 12 percent of the GDP exceeding rice production which contributed only about 10 percent to the GDP. Moreover, Baran et al. (2007) also reported that the contribution of the overall fisheries sector to the GDP was between 10 and 12 percent.

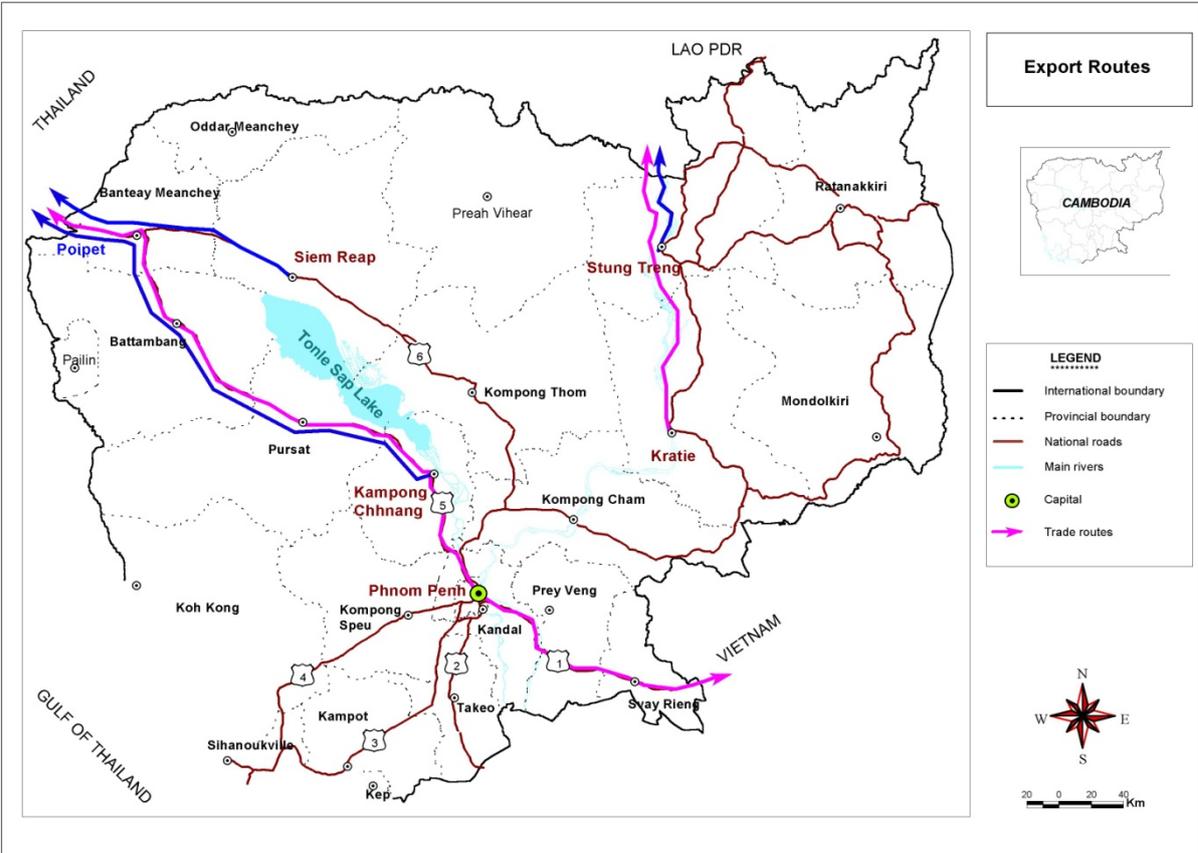


Figure 2: Fish export routes in Cambodia.

Although the lower Mekong Basin (LMB) and the Great Lake-Tonle Sap are totally beneficial and have million shares of inland fisheries, mainly of fish in Cambodia, a precise estimate of the economic value of fish of the LMB is lacking. So far, there exists some reports done by Baran et al. (2007) on values of inland fisheries in the Mekong River Basin, and Baran (2005) on Cambodian inland fisheries, etc. However, these reports generally describe benefit and value the river provided in the whole aspect rather than focusing on the concerned issue. Moreover, all the data used in these reports were based on secondary data. In addition, there are some more researches and studies conducted by Ahmet et al. (1998) about socio-economic assessment of freshwater capture fisheries of Cambodia, and by Rab et al. (2006) on socioeconomics and values of resources in Great Lake-Tonle Sap and Mekong-Bassac area. These reports were just mainly oriented on socio-economic aspects and values of fisheries resources as a whole rather than specifying much on economic value of fish and only in the LMB of Cambodia. Hence, a comprehensive study on assessing economic value of fish in the LMB of Cambodia needs to be done in order to build broader understanding as well as to assess benefits from fish in term of economic aspect the LMB of Cambodia values.

## **1.2. OBJECTIVES OF THE STUDY**

### **1.2.1. Objectives of the project**

The overall objective of the project is to quantify the multiple values of fish resources and convey information to national decision-makers and development agencies for sustainable and improved rural livelihoods. The objectives of the project are to:

1. Assess the economic value of capture fisheries in Cambodia;
2. Assess the welfare value of fish for rural populations in Cambodia;
3. Establish a Mekong regional network for monitoring fish resources in partnership with national universities; and
4. Identify livelihood strategies for maximizing the welfare value of fish and disseminate these findings.

### **1.2.2. Objectives of the Market study**

Information on the economic values of aquatic resources is extremely important for two reasons (Torrell and Salamanca, 2003): firstly, to determine the extent to which resources contribute to the country's economic and social welfare, including gross domestic product (GDP), and secondly, to ensure that policies and development circumscribe these benefits of the resources and address the issues related to their management and conservation.

The main objective of market study is to assess the economic value of inland fisheries in Cambodia. This study will mainly focus on the price and market chain of fish in inland fisheries in order to estimate the direct use value of inland fisheries resources in Cambodia. The specific objectives of this study are:

1. To review existing economic information systems relevant to fish resources in Cambodia and conduct surveys at selected representative study sites;
2. To estimate the economic value of key fisheries and aquaculture products along the full value chain in representative agro-ecological zones; and
3. To identify the main changes and trends in the production of different species and the creation of fish products in the different agro-ecological zones.

## **2. REVIEW OF THE FISH TRADE SECTOR**

### **2.1. OVERVIEW OF THE MEKONG RIVER BASIN**

The Mekong River is the lifeline of South- East Asia and flows through the riparian states of China, Myanmar, Laos, Thailand, Cambodia, and Vietnam. China and Myanmar are known as the countries of the upper Mekong River region, while Laos, Thailand, Cambodia and Vietnam are recognized as the countries of the lower Mekong Basin region.

There are various sources about to the rank of the Mekong River in term of the world longest river. According to MRCS (1992), length of the Mekong River is 4,200 km, making it the world's 12<sup>th</sup> longest river. However, based on Milliman and Meade (1983), the river is the world's 9<sup>th</sup> longest river with the length of 4,400 km. Moreover, depending on Welcomme (1985) the Mekong River is the world's 16<sup>th</sup> longest river with the length of 4,000 km.

Annual discharge of the Mekong River is 475 million m<sup>3</sup> (Mekong committee, 1987 in MRCS, 1992, in Baran, 2005). With this annual discharge volume, it is the 14<sup>th</sup> average discharge in the world, and 3<sup>rd</sup> maximum discharge after the Amazon and the Brahmaputra. The whole basin area are 795,000 km<sup>2</sup> and drainage area are 386, 560 km<sup>2</sup> (Welcomme, 1985). The lower basin area which covers approximately 609 000 km<sup>2</sup> contributes about 82% to the total annual flow volume. The contribution of each country to the average river flow is as follows: China 16%, Myanmar 2%, Lao PDR 35%, Thailand 17%, Cambodia 19% and Vietnam 11% (MRC, 1998).

In Cambodia, surface of Mekong wetlands are 3,500,000 ha (35,000 km<sup>2</sup>) (Mekong edges = 2,000,000 ha; Tonle Sap 1,500,000 ha), making up 19% of the country (Scott, 1989 and Lacoursiere et al., 1998 in Baran, 2005). Potentially, while other riparian countries see the Mekong River as a source of hydropower, a trade route, irrigation, and a way to oppose saline intrusion, Cambodia strongly depends on the river for wild fisheries extraction (Ratner, 2003; Campbell, 2005).

The Mekong River has connection with Tonle Sap River. Tonle Sap Great Lake drains through the Tonle Sap River toward the Mekong River in the dry season, contributing then about 16% of the Mekong discharge during this season. At the beginning of the rainy season, the flow reverses as the Tonle Sap Lake is then filled by the Mekong due to the fast water level rise in the mainstream. This results in an expansion of the Great Lake by four to six times (Van Zalinge et al., 2000).

### **2.2. OVERVIEW OF INLAND FISHERIES PRODUCTION**

Fish contributes about 75% of the animal protein intake for the Cambodian households and most of it comes from freshwater fisheries. It is considered to be the most productive inland fisheries of the world, sharing about 60% of the country's commercial fisheries production (Ahmed et al., 1998) and being ranked 4<sup>th</sup> in the world after China, India and Bangladesh (FAO, 1999). Of the total inland capture fisheries production, approximately 17% is from commercial (large-scale) fisheries, 25% from middle-scale fisheries, 36% from small-scale (family) fisheries and 22% from rice-field fisheries. FiA (2005) reported that inland fisheries, including capture and aquaculture represented over 75% of the total fisheries production in the country. Because the country's wild fishery is so productive, there is still low for development of aquaculture

(Hortle et al. 2004), which is reported to contribute less than 10% of the wild fish production (Nao and Ly 1997).

An official statistics of inland fish production from Fisheries Administration (2010) showed that total production of inland fisheries, mainly fish, increased in the last decade (2000-2009). Total inland caught fish was only 245,600 tons in 2000. This number reached its highest production amount to 422,000 tons in 2006 before decreasing to 390,000 tons in 2009 (Table 3.1).

Table 3.1: Total production of inland fisheries in Cambodia, 2000-2009. Source: FiA, 2010

Years	Inland fish ( tons )	caught	Aquaculture Production (tons)	
			Fish	Shrimp
2000	245,600		14,410	20
2001	385,000		13,857	143
2002	360,300		14,547	53
2003	308,750		18,410	90
2004	250,000		20,760	75
2005	324,000		25,915	110
2006	422,000		34,160	40
2007	395,000		35,190	70
2008	365,000		39,925	75
2009	390,000		49,925	75

## 2.3. MARKETING SYSTEM OF INLAND FISHERIES PRODUCTS

### 2.3.1. Overview on Marketing System of Inland Fisheries Products

The fish marketing and distribution networks were relatively well managed and developed for inland fisheries products although its most complicated components are the supply chain and distribution channels. There are many transactions taking place before fish and fish products reach the consumer or export markets. Lots of middlemen, often women, are very important in the transactions of the fisheries trade. The trading system would not function without these entrepreneurial individuals and their enterprises (Rab et al., 2005).

Freshwater fish was distributed in various ways. In many locations around the Great Lake Tonle Sap, Mekong River and along river systems, fish was sold to customers at the “farm gate”. This practice was more common among small/family-scale or traditional producers who processed for subsistence purposes and localized sales. In other cases, fish was transported by oxcarts, motorbikes and small trucks to urban markets. In addition, cages were towed to Phnom Penh from the Great Lake Tonle Sap and Mekong areas so that fish could be marketed alive (Rab et al., 2005).

### **2.3.2. Stakeholders in the Supply Chain**

There is high domestic demand on fish not only in live but also in preserved forms such as fish paste, fermented fish, salted-dried fish, steamed fish, smoked fish and fish sauce, etc. Fish, both in fresh and processed forms undergoes and relies on many stages of business transactions, many places and many types of stakeholders and beneficiaries before reaching consumers. Those main stakeholders of marketing system and supply chain of inland fisheries include fishing lot owners, fishermen, collectors/middlemen, wholesalers, retailers, processors and exporters. Besides these, there are some more stakeholders and beneficiaries who are also involved in marketing system of the fisheries, but do not directly trade fish. They are transporters, fish handlers/workers at landing sites and markets, fishing equipment producers and sellers, boat makers, money lenders, ice suppliers, salt suppliers, boat and motor-taxi drivers, fisheries officers, police and local authorities, basket producers and sellers, landing place owners, and market managers (Rab et al., 2005).

#### **a. Fishing Lot Owners**

In the past, fishing lot owners once used to control the fish product and functioned as fish suppliers to wholesalers/traders, fish processors, fish collectors and exporters either at fishing lots or at landing sites. They never exported fish by themselves, but normally stocked fish in pen, or cage for selling to markets in the city during closed season. They marketed their fish both in fresh and processed forms. Some of them were financed by larger exporters, traders or government officials, and were consequently obliged to sell their catch to these finance providers (Rab et al., 2005).

In August 2011, because of the great destruction to the country's fisheries resources and in order to rehabilitate and sustain fisheries resources, the Royal Government of Cambodia ordered to confiscate 35 privately owned fishing lots in Tonle Sap Lake, surrounded by 5 provinces namely Battambang, Siem Reap, Pursat, Kampong Thom and Kampong Chhnang provinces. The suspension of the fishing lots would take for at least 3 years to increase fish population as well as fish stock. However, in earlier 2012, seeing the need of local people on fisheries resources, poverty reduction and to sustainably manage the resources, the Royal Government of Cambodia reformed fisheries sector by abolishing all fishing lots in the whole countries. Those fishing lots were some given to local people for fishing and some were taken as fish sanctuaries or research, and some areas were considered as fish conservation zones.

#### **b. Fishermen**

Fishermen play a role as workers and are either part or full time involving in fishing. They are classified as small, medium and large-scale fishers depending on the size of catch potential and type of fishing gears. Normally, small-scale (family-scale) fishers consist of 1-3 persons who fish primarily for household consumption and income. The number of small-scale fishers is increasing annually as the population grows and as alternative livelihoods become scarce. Medium-scale fishers are extended families and village level partnerships (3-6 persons) who catch fish for family income and processing. These kinds of fishers sell fish to fish collectors and sometimes directly to consumers.

#### **c. Fish Collectors/Middlemen**

Fish collectors collect fish directly from fishers at the fishing ground. Generally, they have one or several boats containing several ice boxes for fish storage during the fish collection period. Fish collectors are specialized operators who proceed with fish buying throughout the year, buying fish from fishers and bringing these to the landing site. They set prices with fishers, depending on fish quality, supply situation and daily fish market demand. Most fish collectors

have capital for immediate cash payment to fishers although they also often provide credit in cash and in kind (e.g., fishing gear). In practice, some collectors also get loans from wholesalers, middlemen and exporters to whom they sell fish at the landing site.

#### **d. Wholesalers**

Wholesalers represent an important part of the fish marketing chain since major quantities of fish are channeled through them. In Cambodia, they are best compared to fish distributors who have a permanent fish stall at a fish landing site, floating village or distribution center. They usually buy fish from fishers, lot owners, collectors or middlemen and sell these to exporters, retailers and restaurants. This business is very much location-specific, and the scale may depend on whether a wholesaler is based in a provincial town or in the city area. Wholesalers were the main traders and providers of the capital to most of the fishermen in both medium and large-scale fishing.

#### **e. Semi-wholesalers**

Semi-wholesalers are those fish traders who have a permanent stall inside/outside a market, whereby fish are brought by fish collectors/middlemen or wholesalers and sold to them at the market. Semi-wholesalers act sometimes as retailers but they usually have an additional function in distributing fish to small retailers who sell fish at local markets directly to consumers and processors. Most semi-wholesalers are fish traders at the provincial level but some of them also operate in the city, or may transport fish from the capital to sell to retailers in fish-deficit provinces.

#### **f. Retailers**

Fish retailers are those who sell fish in markets directly to consumers or restaurants. In many cases, they have a permanent stall inside or outside the market. Generally, in each market (from provincial to local levels) there are many fish retailers selling fish every day. Fish retailers who sell fish in the market are mostly women but they often have their spouses or relatives who help them buy fish from the landing site or the distribution center. Some fish retailers who work alone (i.e., those who are widow/ers) buy fish from semi-wholesalers in the same market or place where they sell fish directly to consumers. In addition, there are also retailers who are itinerant traders in that they do not have a permanent stall but sell from a basket or another container by moving from place to place.

#### **g. Processors**

Fish processors are generally fishers or fish raisers (but not all of them) or businesspersons. The processors, who mainly buy fish from fishing lot owners or traders/middlemen/fish collectors, produce fish paste, salted dried fish, fermented fish, smoked fish, etc. Processed products are usually sold to domestic markets; some are also sold to international markets with specific products and species.

#### **h. Exporters**

Exporters export fisheries products to neighboring and other countries. They generally purchase fish directly from fishing lot owners or traders/middlemen, store them with ice in containers and export them by land or air as live fish.

#### **i. Transporters**

Fish transporters provide only transportation service to fish traders/wholesalers and do not buy or sell fish. They are important in the fish trade channel. The transportation means differ from

one area to another. Fish are usually transported by boat, motorbike, mini-truck, or pick-up car from fishing ground to landing site, local market and fish distribution center. Transporters own trucks and boats that transport fish from the fishing ground to the landing site, fish processors and markets in Cambodia and export markets at neighboring countries (Thailand and Vietnam). Transporters pay a registration fee to the Fisheries Administration (FiA) and also a series of unofficial road taxes from the landing site to the final destination.

All stakeholders in marketing system of inland fisheries, particularly fishermen, fishing lot owners, dai fishing owners, local collectors and local fish processors operate the trade without any organized information system regarding price, market demand or annual catch volumes. An overview of the supply chain for inland fisheries products is shown in Figure 3.1. Although there are different elements of the producer components – inland, aquaculture and processing – they have similar marketing channels as well as supply chains. Fish harvested by all scales of fishers and fish farmers are immediately landed (i.e. at the landing site or harbour), and transfer to fish collectors and/or fish processors. Sometimes, harvested inland fishes were kept alive in pens or cages for sale during periods when supply was scarce and prices were more satisfactory. Before reaching the consumer, fish and fish products would have passed through a number of transactions – fisher, fish collector, landing site owner, fish processor, collector/middlemen, wholesalers, retailer, etc.

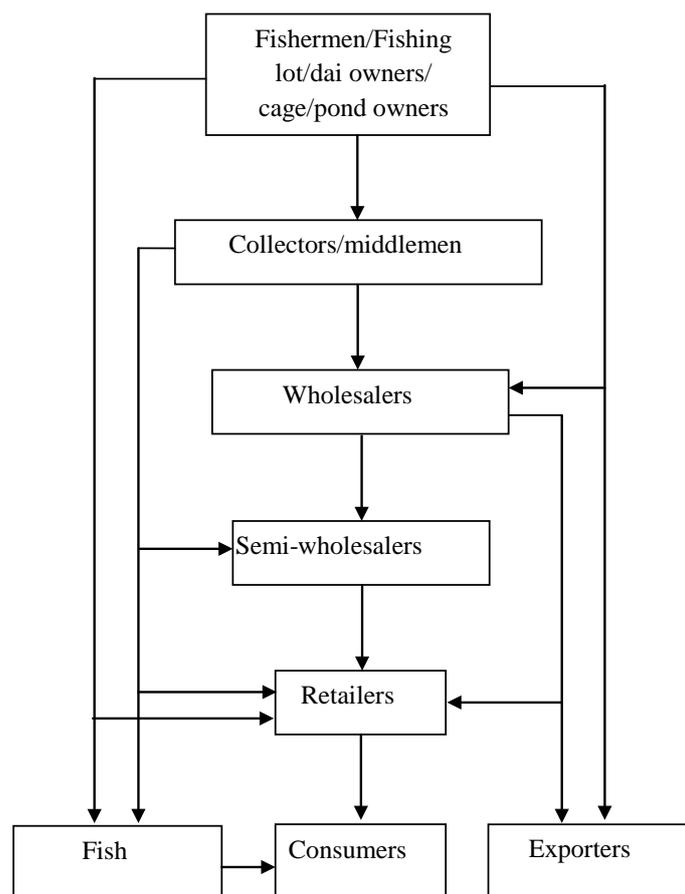


Figure 3: Supply chain of inland fisheries products in fish marketing system in Cambodia. Source: Rab et al. 2005

Generally, in the country the existing infrastructure for marketing and trade of inland fisheries products is still very poorly developed in term of landing, storage, preserving, transport and retail facilities which limit market opportunities and also prevent those selling fish to schedule selling decisions to their competitive advantage (Rab et al., 2005).

Fish processing and trade are often conducted in addition to fishing and/or farming, and therefore provide an additional source of income for many households. Fish marketing and trade offer one of the few opportunities to women and poor households who live in and near the Tonle Sap Lake areas to increase household income, and their engagement should consequently be encouraged.

#### **2.4. EXPORT MARKET**

Fisheries products, most importantly derived from inland fisheries, are the most valuable source of animal protein for daily food in Cambodia and in the world. Domestic and international demand for fish commodity and fish products is high compared to other animal meat.

While the domestic market for freshwater fish in Cambodia is relatively well established despite constraints to distribution and infrastructure, the export market is still developing. Fish export consists mainly of processed fish products from industrial-scale processing plants and high-value species as fresh fish to neighboring and other countries (Rab et al., 2005). The export of product from Cambodia is growing in response to increasing international demand for fish and the increasing prices achieved in other countries.

There are three types of exports in freshwater fisheries products in Cambodia: (1) export of chilled fish by land using big trucks and cars (to Thailand); (2) export of live freshwater species and catfish fingerlings by waterway using cages with big boats (to Vietnam); and (3) export of high-value live fish and some fish products by air (to Asian countries, namely Singapore, Malaysia, Hong Kong, and China. Taiwan, Japan, Australia and the USA are markets for frozen fish, fish fillet and ball, and salted dried fish). Based on KAMFIMEX, the fisheries export company, the most lucrative markets for Cambodia's fisheries exports are: first, USA and Australia; second, China, Hong Kong, Singapore and Malaysia; and third, Thailand and Vietnam (Rab et al., 2005).

The official figures of fisheries products exports are shown in Table 3.3. It is estimated that 43,600 tons of fish, of which 26,972 tons were from inland fisheries products, were exported in 2000. It then reached the peak of export volume to 56,400 tons (of which 28,135 tons were from inland) in 2003 before declining to 30,000 tons (of which 11,500 tons were from inland) recorded in 2009. Although figures are unlikely to reflect the true levels of export, much of it is done without being formally recorded. Moreover, Rab et al. (2005) revealed that the actual exports are generally much higher than these figures since exporters commonly do not report all exports at land border points. In 2006, the international Trade Centre of UNCTAD/WTO estimated that the current value of exports to be in the order of USD 100 million, largely based on the figures for the value of fish imported from Cambodia in the records of trading countries (ITC, 2006).

Table 1: Export of fish and fish products (tons) from 2000-2009. Source: FiA, 2010

Year	Volume		
	Inland	Marine	<b>Total</b>
2000	26,972	16,628	<b>43,600</b>
2001	18,270	19,830	<b>38,100</b>
2002	32,100	20,400	<b>52,500</b>
2003	28,135	28,265	<b>56,400</b>
2004	20,275	25,305	<b>45,580</b>
2005	23,660	28,340	<b>52,000</b>
2006	19,500	10,500	<b>30,000</b>
2007	10,550	13,550	<b>24,100</b>
2008	12,450	12,550	<b>25,000</b>
2009	11,500	18,500	<b>30,000</b>

## 2.5. CONTRIBUTION OF FISHERIES TO COUNTRY DEVELOPMENT

The Cambodian fisheries resources have been considered as a significant source of nutrition, income and livelihood support to many rural Cambodians (Gum 2000; McKenney and Tola, 2002). Van Zalinge et al. (2000) showed that the fisheries sector's contributions to the country's economy and food security is probably more than such fisheries do in any other country throughout the globe. Moreover, as mentioned in FiA (2011b), fisheries sector has many years contributed significantly to the employment and livelihoods of the poor, to food security, and to GDP and foreign exchange balance.

### 2.5.1. Contribution of Fisheries to Employment and Livelihood

Fisheries is believed to provide an employment and a livelihood for a large percentage of people across the fish capture, culture, processing, distribution and trade sub-sectors. It has been important occupation among Cambodian since its history. Estimates of numbers of people involve in fisheries sector vary widely. The National Environmental Action Plan 1998-2002 estimated that over 3 million people depended on the Great Lake and Tonle Sap River for their livelihoods (MoE, 1998). It is estimated that over 2 million Cambodian are directly and indirectly associated with inland fishery activities and it is the simplest and easiest means to maintain the livelihoods of the poor with comparatively little no investment (Rab et al., 2006). However, as mentioned in FiA (2011a), Cambodia's fisheries provide full-time, part-time and seasonal employment for up to 6 million people. When the families of these people are taken into account it can be seen that the fisheries sector has a major impact on the lives of people in Cambodia. The vast majority of these are poor rural people (FiA, 2011b).

80% of all poor people in Cambodia are involved in the agriculture and fisheries sectors and the incidence of poverty in the agriculture and fisheries sector is highest of all sectors at 46%. In the main, fishing households are poorer than non-fishing rural households (World Bank, 2006) only achieving 55% of the average income of non-fishing households. For many people, involvement in fisheries is an indication of poverty but at the same time the fisheries sector provides a mean for these poor people to have a livelihood. It also provides an important safety net for the very poor. Households whose heads have been sick in recent years are significantly more likely to

have to rely on fisheries as a source of income (World Bank, 2006). As such fisheries contribute to the livelihoods of some of the poorest people in the country.

Many of those involved in agriculture are also involved in fisheries. It is estimated that 10.5% of full-time employment and 34% of part-time workers are engaged in fishing. Many rice farmers and upland forest dwellers depend on fisheries as an important subsistent activity. There is a wide diversity of livelihood opportunities for the poor encompassing: laborers in fishing, small-scale fishers, fish farmers, rice-fish farmers, processors, retailers, laborers for wholesalers, transporters, ice producers, wood cutters, salt producers, boat builders, and net makers and repairers (FiA, 2011b).

For many people involved in fisheries there are no, or at best few, opportunities outside of the fisheries sector. The fisheries sector provides a mean of keeping these people out of complete destitution and is seen as a safety net for many people. Fisheries also provide a livelihood to many women who are engaged in fishing and fish farming, albeit to a lesser extent than men, but women play the most important part in the processing and trade of fish (FiA, 2011b).

### **2.5.2. Contribution of Fisheries to Food Security**

The fisheries sector contributes very significantly to domestic food security, providing over 81.5% of the animal protein in the national diet and also forming a critical source of essential vitamins and micro-nutrients in the country (FiA, 2011a), and 90% in fishing dependent provinces (Ahmed et al., 1998). Fish provides food for over 13 million people (13,395,682 people according to the Census of 2008) in Cambodia. Overall fish consumption is estimated to be around 52.4 kg/person/year (MRC, 2007) (whole fish equivalent) and is many times greater than the global average, reflecting the importance of the fisheries sector to the diet and culture of the country. For fishing communities, which are generally poorer than non-fishing rural communities, own-caught fish plays a very significant part of household food security (World Bank, 2006).

Not only fish from nature but also fish from cultured farms/ponds contribute to the livelihood of rural farmers for the whole year. They not only contribute to rural home consumption but to their yearly income. From year to year, many rural farmers have been involved in fish cultured and fish seed production activities that are taken into account by them as their major occupation, besides other agriculture activities.

Processed fish (e.g. fish paste, fermented fish, salted-dried fish, and fish sauce, etc) can be used for household consumption year round and during the time that fresh fish is scarce or even not available. Therefore, it is can essentially ensure food security to all people in the country, mainly to the poor.

### **2.5.3. Contribution of Fisheries to National Economy**

The contribution of fisheries sector to GDP seemed to increase since the late 1990s. Though the annual fish catch and value estimated during the late 1990s was relatively high and thus the contribution of fisheries sector to the GDP, some authors such as (van Zalinge et al., 2000; Hortle et al. 2004) believed that the reported yearly fish catch of 290,000 – 430,000 tons with

its retailed market value of USD 250-500 million (van Zalinge et al., 2000) was still underestimated. Using the official figure, Starr (2003) reported that the fisheries output accounted for approximately 12 percent of the GDP exceeding rice production which contributed only about 10 percent to the GDP. Moreover, Baran et al. (2007) also reported that the contribution of the overall fisheries sector to the GDP was between 10 and 12 percent.

The economic value of the sector to the country in terms of GDP is estimated to be around USD 200-250 million landed value. The total value after processing and transportation at the point of consumption or export is unknown but is thought to be between 8-12% of GDP. The total share of fisheries to GDP in 2005 was estimated to be USD 426 million (RGC, 2007).

### **3. CRITICAL REVIEW OF MAJOR SOCIOECONOMIC STUDIES ON MEKONG FISHERIES**

#### **3.1. REVIEW OF AHMED ET AL. 1998**

We review below the study “Socioeconomic Assessment of Freshwater Fisheries of Cambodia” by Ahmed et al. (1998)

##### **3.1.1. Methodology and sample selection**

The study starts out by stating it decided to survey 8 provinces that have access to fishery resources<sup>1</sup>. The authors do not explicitly explain why these 8 specific provinces were selected nor do they define “access to fishery resources”. Each district within the selected provinces is classified as either a fishing district or a non-fishing district. Then, every commune within a fishing district is classified as either a fishing commune or a non-fishing commune.

The survey defines fishing communes and districts as those which have access to a water body and whose population is active in fishing; this is the only explicit criterion to distinguish fishing from non-fishing districts/communes. However, the study notes that this classification is also based on information that was collected during: “1) meetings with province/district level fishery officials 2) interviews with Key Potential Informers 3) personal observations by project experts during site visits.” These observations, meetings and interviews also form the basis for stratifying fishing communes along two criteria: type of fishing ground<sup>2</sup> and dominant fishing practice<sup>3</sup>. Once stratified according to these two criteria, these fishing communes (328 in total) were listed and 83 of them (i.e. 25% of the total) were randomly selected for sampling.

Households in these fishing communes are listed. Five per cent of the households in the list of each commune are randomly selected to complete the survey. After the selection, households are classified as either fishing households or non-fishing households (that is, both fishing and

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<sup>1</sup> The 8 provinces selected: Kandal, Kampong Cham, Kampong Chhang, Siem Reap, Pursat, Battambang, Kampong Thom, Phnom Penh

<sup>2</sup> Four possible values: principle rivers/great lakes, small reservoirs/lakes/streams, inundated forests, ricefields/floodlands, other rivers/lakes

<sup>3</sup> Five possible values: mainly family fishing, family fishing and fishing lot, middle-scale and family fishing, middle scale and fishing lot and family fishing,

non-fishing households were surveyed). A household is defined as a fishing household if the household head or at least one member of the household is actively engaged in fishing most of the time<sup>4</sup>.

Ahmed et al. are explicit in that the study target population is the population living in fishing communes within fishing districts. According to the study, there are a total of 452,714 such households. 5117 household were surveyed, or about 1% of the population.

The survey, which consists of a pre-designed questionnaire, was completed in two phases, one in mid-1995 and one in early 1996. The survey was divided into two periods because of the limited manpower and capacity available to carry out field surveys. One supervisor and 3-6 data collectors were hired to conduct the survey in each province. The emphasis during the first period of the survey was on establishing and testing methodologies and creating a core group of researchers through on-the-job training and learning-by-doing.

### **3.1.2. Important aspects of the methodology**

*This study is not an inferential study.* Ahmed et al. do not attempt to draw conclusions from their sample to the population they are studying (i.e. fishing communes within fishing districts). Rather, they simply describe the results of their surveyed sample. There does not seem to be any inferential statistics in the report.

*Ahmed et al. most likely used a stratified random sampling method when selecting fishing communes, perhaps with proportional representation.* The study divides the fishing communes into strata using two criteria and then selects a random sample from each stratum. It seems likely that the sample size is proportional to the size of the stratum<sup>5</sup>. However, the final report is not explicit in this regard.

*The household sampling method is implicitly population-weighted<sup>6</sup>.* Thus, a commune with 100 households would have 5 surveyed households while a fishing commune with 200 households would have 10 surveyed households.

In determining which households are considered fishing-dependent, Ahmed et al. use a relatively loose definition. For instance, although 39% of surveyed households are considered fishing dependent, 76% of surveyed households would be considered “rice farming dependent” using the same criteria and data.

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<sup>4</sup> The definition of household in the study is: ‘Household is defined to consist of members of the family, including joint and extended families, who contribute to the common welfare of the family by providing production and income and who live and dine together whenever they are at home. Members residing outside their home for education, job and other purposes are also part of the household.’

<sup>5</sup> That is, sample size for a strata equals the total sample size times the size of the strata divided by the population size

<sup>6</sup> The population being households not persons

## **3.2. REVIEW OF RAB ET AL. 2006**

We review below the study entitled “Socioeconomics and Values of Resource in the Tonle Sap and Mekong-Bassac areas: results from a sample survey in Kampong Chnang, Siem Reap and Kandal Provinces” by Rab et al. (2006).

### **3.2.1. Methodology and sample selection**

The study selects three provinces in the Tonle Sap as well as in the Mekong-Bassac sub-basin, giving no reason as to why they were selected. Unlike Ahmed et al. (1998) who only surveys households living in fishing communities, Rab et al. group villages into three categories: fishing villages, fishing cum farming villages and farming villages<sup>7</sup>. In each province, the authors select one of each type of village for the study (i.e. 9 villages in total). Again, no reason nor selection method explain why these 9 villages were selected.

After village selection, Rab et al. interview the village chiefs and stratify households into three income classes (low income, middle income, high income), then randomly select 45 households from each village (15 household from each income group).

Ahmed et al. (1998) and Rab et al. (2006) pose similar questions (demographics, socioeconomic information) although Rab frequently asks respondents to provide answers in dollar figures. For example, respondents are asked for the present value (in Riel) of: homes, household assets, fishing equipment, the price/kg of farm products and fish (fresh and processed) households sold, input costs for fish culture, etc.

The survey was performed twice, first in the open fishing season (January 2004) then in the closed season (September 2003). The first cycle of data collection corresponded to an in-depth questionnaire, while the second cycle, in the open season (January 2004), was limited to fish catch, marketing and processing activities. Three teams of data collectors were formed and trained. The selected village head was interviewed to get general information by using guiding questions.

### **3.2.2. Important aspects of the methodology**

It can be noted that relying on various village chiefs to classify households into income groups without objective standards can create a substantial bias and does not formally allow comparison nor generalization. The survey include a question on household income, however, this question was asked after households were selected and classified into a wealth group. n.

Importantly, the survey is not population weighted with respect to income. For example, 30% of surveyed households are “high income” even though they may make a much smaller percentage of the overall village population.

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<sup>7</sup> Fishing villages have populations that is 80%-90% fully involved in fishing, farming villages have populations that is 80%-90% fully involved in farming, fishing cum farming villages have populations that are 80%-90% fully involved in fishing during the wet season and farming during the dry season

### **3.3. REVIEW OF HAP NAVY AND MADHUSUDAN BHATTARAI 2009**

We review below the study “Economics and livelihoods of small-scale inland fisheries in the Lower Mekong Basin: a survey of three communities in Cambodia” (Hap Navy and Madhusudan Bhattarai 2009).

#### **3.3.1. Methodology and sample selection**

This study is focused on gathering information about small-scale fishers (i.e. family fishers) in order to help inform pro-poor fishery policy. Specifically, the authors gather quantitative data on the costs and returns of Cambodia’s small-scale fishery to see if fishery is an economically viable activity for the poor. In addition, qualitative data on the fishers and their villages is presented.

The study is based on two information-gathering techniques: a participatory rural appraisal (qualitative information) and a household survey (quantitative information). The detailed methodology is in principle described in Hap and Bhattarai (2006) but this document is not publicly accessible.

The authors focus on three villages in three different Cambodian provinces representing three distinct fishery ecosystems: Kampong Chhnang (Great Lake ecosystem), Takeo (Mekong-Bassac ecosystem), and Stung Treng (upper Mekong). Local informants consulted helped select 10-12 fisher families for a participatory rural appraisal in each village; after the appraisal the information gathered is cross-checked by interviewing other informants and fishers.

Sixteen households in total are selected for a structured questionnaire. This questionnaire generated detailed cost/return information for small-scale fishers during the open and the closed fishing seasons. The questionnaire details information on socioeconomic characteristics, cost structures used in a fishing trip, level of fish catch, different measures of economic profitability (with and without taking family labour in to consideration), species of fish caught, market sale patterns and profitability. From this information the authors calculate gross return, net profit and real profit for fishing activities.

#### **3.3.2. Important aspects of the methodology**

This is a very small study, whose inferential power is most limited. The wide variation of costs/returns in the three surveyed villages suggests that these variables are highly location dependent. If anything this study provides evidence that larger samples are needed to generate accurate cost/return data.

The authors remark that about 10-15% of the daily fish catch is consumed by the family and not sold. However the economic value of this consumption is not included in the cost/return analysis and thus the analysis probably understates the economic returns to fisher families since they avoid purchasing food by consuming part of their fish catch.

In calculating an implicit family labour cost, the authors assume that two family members per day fish during the open season and one family member per day fishes during the closed season.

## 4. CONCLUSION

We reviewed in the above sections the findings of the major studies of the economic value of fish in Cambodia and the methodology or biases of these studies. This information provides a basis for the development of a fisheries welfare valuation project and underlines the weaknesses of the previous projects and the pitfalls to be avoided.

In complement to these points, Bene et al. (2009) in his study “Are fishers poor or vulnerable?” provides conceptual elements important for a welfare analysis project. Bene in particular makes a distinction between poverty and vulnerability. Poverty is a static measure at a given time, while vulnerability takes into account the fact that poverty is a dynamic condition and changes in time: a household subject to external shocks may become “transiently poor.” Vulnerability is now recognised as a central element of poverty (Chambers, 1989; Khan, 1998; Narayan et al., 2000; World Bank, 2000; Prowse, 2003).

Recent work demonstrates, however, that while vulnerability and poverty are related, they are not systematically correlated (e.g. McCulloch and Calandrino 2003). Thus fisherfolks are not necessarily the poorest of the poor in monetary terms, but may, instead, be amongst the most vulnerable socio-economic groups, due to their particularly high exposure to certain natural, health-related or economic shocks and disasters (Allison et al. 2006). The question of whether fishers are chronically poor because of the inherent low productivity of the sector, or vulnerable to poverty due to their high exposure to risks and shocks, or possibly both, has immediate relevance for the design of cost effective poverty reduction strategies.

Bene’s vulnerability index paves the way for assessing better the level of vulnerability in a sample of fishermen. This index is based on daily cash income dependent upon fish (i.e. *actual income* earned from selling the fish + “*in-kind income*” corresponding to i) the value of the fish used for household consumption (valued at market prices) and ii) the value of the fish used for barter). Four main groups of decreasing vulnerability are defined:

- full-time fishers (‘specialists’) who are not engaged in any other activity;
- ‘generalist’ fishers who derive the totality of their income from fishing but are also engaged in subsistence activities;
- ‘fishing–farming’ households engaged in multiple activities and whose cash-dependence on fish is greater than 50 per cent;
- ‘farming–fishing’ households engaged in a multiple activity livelihoods with a cash dependence on fish lower than 50 per cent

By integrating the above conceptual elements and drawing lessons from the previous socio-economic studies of the fisheries sector in Cambodia, in particular in terms of statistical robustness and representativeness, the current project “Assessing economic and welfare values of fish” can build on solid bases and provide an undisputed conceptual and practical contribution to the valuation of the fisheries sector in Cambodia and in the Mekong Basin.

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