Fish Yield Estimation in the Floodplains of the Tonle Sap Great Lake and River, Cambodia

by

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ABSTRACT

Cambodia's Great Lake (Tonle Sap) is known to be very rich in fish: it is one of the most productive freshwater lakes in the world. Fish yields are currently thought to be higher than ever, although fishers complain about lower catch rates. The more prolific, fast growing species dominate the catch. In this paper estimates are given of the catches made by the various fisheries operating in the floodplain and open waters of the Great Lake area. Based on this, the first rough estimate of the fish yield is 130–165 kg/ha. Cyprinid species, many of which are herbivorous, make the greatest contribution to the fish catch in the floodplain, accounting for *c.* 49% of the total catch. Although Snakeheads (*Channa* spp.) form a smaller proportion of the total catch, their value (25%) is almost equal that of the Cyprinids (28%).

1. INTRODUCTION

The Great Lake (Tonle Sap) is known to be rich in fish and is one of the most productive freshwater lakes in the world. Nevertheless many fishers complain about the decline in catch rates, and are under the impression that fish stocks are in decline. However, past estimates of the fish catch are well below the most recent ones. The reason for this is the present high level of exploitation caused by the strong increase in the human population in the last two decades.

Plans are being made to examine the relationship between the Mekong flood, the extent of inundation and the subsequent fish yield. This is a first attempt toward building a predictive model that gives the likely fish yield for a given inundation level. Fish yield differs by habitat, and estimates are needed together with inventories of habitat types in the Cambodian Mekong floodplain.

2. AVAILABILITY OF HABITAT TYPES

The Great Lake area comprises a number of different habitat types, ranging from marshes/swamps, shrublands, grasslands, and flooded forests to rice fields. The flooded forests cover the largest area, followed by rice-fields, and it is likely that the flooded forests make the greatest contribution to fish diversity (Table 2.1). All these habitats are situated in a belt around the Great Lake. The main fishing grounds are found in the channels, the small lakes of the floodplain and the open waters of the Great Lake. The availability of habitat is influenced by the flood regime of the Mekong River. Changes in the Mekong flood regime in the past 70 years may have resulted in changes in the extent of the floodplains around the lake (Figure 2.1). The center of the lake remains open water in the dry season and provides an important shelter where fish can survive when the floodplain dries out.

3. FISH SPECIES OF THE TONLE SAP FLOODPLAIN

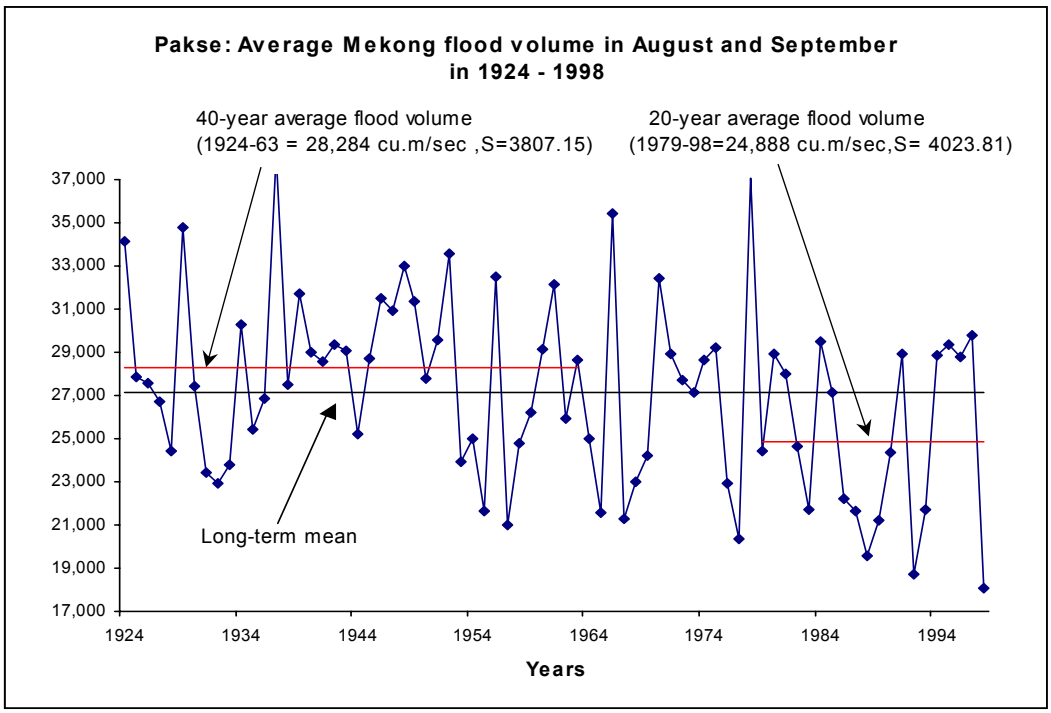
About 90% of the inland fish populations in the Lower Mekong Basin migrate seasonally into the flooded forest to spawn and feed. In the Great Lake, in particular, not only black fish but also white fish congregate in the floodplain, where there is forest cover in the flood season.

Table 2.1: Area of various types of land and water resources in the Great Lake floodplain area

Type of land and water resource	Area (ha)	%
Water surfaces	276,400	15.8
Marshes/swamps	1,500	0.1
Grasslands	152,100	8.7
Shrublands	215,000	12.2
Flooded forest	495,300	28.3
Rice fields	515,000	29.4
Other	95,400	5.5
Total	**1,750,700**	**100**

Source: Mekong River Commission, 1998 (the area of the floodplain is bounded by National Highways Nos. 5 and 6)

Figure 2.1: The negative trend in the Mekong flood volume, as recorded at Pakse, southern Laos, between 1924 and 1998, is an indication that the extent of the Tonle Sap floodplains in Cambodia may have decreased



Source: Sok Leang, 2000.

The life cycles of many fish species are necessarily associated with the flooded forest. The Snakehead, a commercially important and very popular fish that represents *c.* 11% of the overall catch, is one of those species; the Snakehead is a nest-builder. Other herbivorous fish species such as Silver Barb (*Barbodes gonionotus*), *Puntius* spp. and many cyprinids contribute *c.* 49% of the total catch (Table 2.2). The herbivores feed mainly on food from the flooded forest, such as plants, algae and insects.

The abundance of fish stems from the complex ecological features of the floodplains. However many people are not aware of the ecological importance of the natural habitats for fish production. The flooded forest, which is a critical fish habitat, has been felled or burned for other uses such as conversion to rice cultivation. A nationwide land-cover inventory showed that in 1993 flooded forest coverage had declined by one third since 1973 (Mekong Secretariat, 1994).

4. FISH YIELD IN THE GREAT LAKE

The range of the total annual catch of the Great Lake fisheries was 179,500–246,000 tons, yielding 139–190 kg/ha (see Table 2.3).

Table 2.2: Species composition and monetary value of the catch from lot, *dai* and medium-scale fisheries in Cambodia in 1995-96

Species name	Weighted share (%)	Value (%)	Type of fish
Henicorhynchus spp.	21	9	Cyprinid
Cyclocheilichthys enoplos	9	8	"
Dangila spp.	6	2	"
Osteochilus spp.	4	2	"
Cirrhinus microlepis	3	4	"
Barbodes gonionotus	3	2	"
Paralaubuca typus	3	1	"
Total for cyprinids	**49**	**28**	
Channa striata	2	6	Snakehead
Channa micropeltes	9	19	Snakehead
Total for snakeheads	**11**	**25**	
Pangasius sp.	3	3	Catfish
Total for catfish	**3**	**3**	
Weight % of top 10 species	**63**	**56**	
Weight % of other 65 species	**37**	**44**	
Total number of species recorded		**75**	

From: Van Zalinge *et al*., 2000a.

In Table 2.4 the estimate of fish yield is higher than the 25–50 kg/ha given for rice-field fishery by Van Zalinge *et al*., (2000a) and the 24 kg/ha recorded for the Amazon (Bayley and Van Zalinge, draft paper). Baran *et al*. (2001) also give an estimate of fish yield for the Great Lake: their estimate is higher than that in Table 2.3. The estimate depends on how the area of the water surface of the floodplain is calculated. The estimated yield for the Great Lake is higher than that for the floodplains in Bangladesh, Thailand and Indonesia. Under-estimation of the fish catch may be another reason for the differences.

Table 2.3: Range of annual inland fish production in the Tonle Sap, Great Lake, 1994–1999

Type of fishery	Annual catch range (tons)
Large-scale:	
- Fishing lot[1]	25,000–75,000
- *Dai* (bagnet)[2]	9,000–16,000
Medium-scale[3]	65,400
Small-scale[3]	73,600
Rice-fields	6,500–16,000
Total:	**179,500–246,000**
Fish yield (kg/ha)[4]	**139–190**

1. Range reflects uncertainty about actual catch level
2. Range shows approx. minimum and maximum values in 1994–98
3. Based on socio-economic survey data extrapolated to entire country.
4. Yield is calculated based on the maximum water level of 9.36 m; the surface area of the Great Lake is approx. 1,292,793 ha (Carbonnel & Guiscafre, 1963; Mekong Secretariat, 1993).

5. ONGOING RESEARCH

Two fishing lots in the Great Lake area, one in Pursat and one in Battambang, have been selected to study the fish yield per hectare of flood forest habitat. In addition, two lots in Prey Veng situated in the Mekong floodplains south of Phnom Penh will be studied. The Prey Veng lots have lost nearly all their natural habitats. The comparison will give an idea of what may be lost in fish species diversity and yields when most of the natural habitats have been removed.

Table 2.4: Comparison of floodplain fish yield estimates from various countries

Location	Fish yield (kg/ha/yr)	Source
Tonle Sap floodplain	139–190	Table 2.3
Tonle Sap floodplain	230	Baran *et al*., 2001
Amazonian floodplain	24	Bayley and Van Zalinge, draft paper
Nam Ngum Reservoir, Lao PDR	40–173	Mattson *et al*., 2001
Bangladeshi natural floodplain	104–130	Hoggarth and Halls, 1997, p.137
Bangladeshi modified floodplain	51–81	Hoggarth and Halls, 1997, p.137
Indonesian floodplain	72–118	Hoggarth and Halls, 1997, p. 231
Thai floodplain	25–52	MRAG, 1994, p. 87

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