



Assessing economic and welfare values of fish in the Lower Mekong Basin

Project funded by ACIAR

Biology Component

TRAMMEL NET TESTING IN OPEN WATERS

METHODOLOGY AND PRELIMINARY RESULTS

**CHHENG Phen
SO Nam**

Inland Fisheries Research and Development Institute, Phnom Penh, Cambodia.

July 2012



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1. INTRODUCTION

1.1. PURPOSE OF THE FISH PRODUCTION COMPONENT

The WorldFish Center supported by ACIAR launched a project in 2012 called “Assessing economic and welfare values of fish in the Lower Mekong Basin”.

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 detail objectives of the project are to:

- i. assess the economic value of capture fisheries in Cambodia;
- ii. assess the welfare value of fish for rural populations in Cambodia and identify strategies that maximize this value;
- iii. establish a coordinated monitoring of fish resources through a network of universities;
- iv. improve national statistics about fisheries resources;
- v. inform a large range of stakeholders about the actual role of fisheries in national economy and livelihoods.

The Fish Production Component is designed to address the first objective. Our approach is to review available literatures on fish production by habitat and close the information gaps by direct assessment.

1.2. PURPOSE OF THIS REPORT

This report describes the methodology on how to assess fish stock and fish production by habitats, and initial results of the fish assessment in this last 6 months of the project.

1.3. HABITAT BY ECOSYSTEM ZONE

The Cambodian Mekong ecosystem is divided by 3 ecological zones: Tonle Sap basin, South-eastern (Mekong Krom and Tonle Basac) and North-eastern (Stung Treng and Kratie provinces). In total five kinds of habitat are identified in each ecological zone, namely rainfed rice field, flooded rice field, flooded forest, open water, and reservoir (Table 1). Some fish productions by habitat are documented by other research studies within the last 15 years. However, many other are still unknown. Within the project time frame, the fish production component will carry out the fish production assessment.

Table 1: Different type of habitat following its zone and status of the study

Habitat	Zone	Studies available	Studies to be done
Rainfed rice fields	Tonle Sap	Hortle <i>et al.</i> 2008	Use literature
	Lowland floodplains	Guttman 1999, Gregory <i>et al.</i> 1996	Use literature
	Mainstream	Gap	Survey of Stung Treng Rainfed rice fields
Flooded rice fields	Tonle Sap	Hortle <i>et al.</i> 2008	Use literature
	Lowland floodplains	Dubeau <i>et al.</i> 2000, Troeung <i>et al.</i> 2003, JICA (2008)	Use literature
	Mainstream	Irrelevant	Irrelevant
Flooded forest	Tonle Sap	WCS Preak Toal (lot n°2) study	Use data and literature
Open water	Tonle Sap	Gap	Use trammel net CPUE data from a MSc and studies with Conservation International (72 samples in 12 locations in 3 seasons)
	Lowland floodplains	Gap	Survey of lowland floodplains open waters with trammel net
	Mainstream	Gap	Impossible
Reservoirs	Lowland floodplains	Gap	Survey of lowland reservoirs with trammel nets

2. FISH PRODUCTION ASSESSMENT BY HABITATS

In total, 13 habitats are defined in Cambodia's Mekong. 6 habitats had fully or partly conducted fish production study, while another 3 habitats are considered to be hardly assessed. This study will assess fish production of the remaining 3 habitats. They are rainfed rice fields in Stung Treng, reservoirs in South-eastern, Stung Treng and Stung Chinit, and the main Tonle Sap Lake. Trammel nets will be used for the assessment of fish production in these habitats.

Table 2: Time table of activities for year 1

Output 1	Activity	Feb				Mar				Apr				May			
		w1	w2	w3	w4	w1	w2	w3	w4	w1	w2	w3	w4	w1	w2	w3	w4
Trammel net efficiency study (Converting trammel net catches into kg/ha)	Consult with experienced fisherman on fish characteristic and fishing method		x														
	Fishing permission		x	x	x	x											
	Trammel nets making		x	x	x	x											
	Fence and poles preparing			x	x	x											
	Conduct fishing to determine trammel net efficiency							x	x	x	x	x					
	Data entry, analysis and report writing													x	x	x	x

2.1. TRAMMEL NET EFFICIENCY STUDY (CONVERTING TRAMMEL NET CATCHES INTO KG/HA)

2.1.1. Fishing permission

In 2011, the Royal Government of Cambodia suspended all fishing activities in 35 commercial fishing lots and banned seine net fishing in Tonle Sap lake (Order no. 01 of Royal Government of Cambodia). Seine net will also be used in Trammel net efficiency study for exhausting harvest in fenced area after completion of trammel net fishing; therefore, permission for using seine net in Tonle Sap lake had to be obtained from Ministry of Agriculture, Forestry and Fisheries. Obtaining a research fishing permission had to follow certain steps. Firstly, the project team leader prepared an official requesting letter to Director General of Fisheries Administration. Secondly, Fisheries Administration prepared another official letter to Ministry of Agriculture, Forestry and Fisheries. The research fishing permission had to be signed by the Minister or his representative. The duration for research fishing permission is not well defined, usually approximately 1-2 months.

2.1.2. Materials

- A panel 420 m in length and 2 m in height of 10 mm mesh-size multifilament net to fence an area of 1 ha of water level ranked between about 1.5 m;
- 200 wooden/bamboo poles of 2.5 m in height to hold the fenced multifilament net;
- Ropes to tie multifilament net with the pole;
- One local seine net, 140 m in length;
- Two sets of standard trammel nets;
- Two medium engine boats;
- One small wooden local fishing boats;
- Fourteen tubs of 40 cm diameter;
- One 10 kg unit scales ;
- One 1 kg unit scale;
- Eight Torches for early morning travel and fishing
- Batteries
- One GPS
- Data sheets
- Pencils
- One Camera
- Two field species identification keys

2.1.3. Fencing

In order to allocate a 10,000 square meters = 1 hectare area in Tonle Sap Lake, the Pythagoras Theorem $a^2 = b^2 + c^2$ was applied. The proportion will give a three dimension of a right triangle as follow: given side a and side b are 100 meters long, the hypotenuse must be 141.42 meters long (Figure 1).

$$a^2 = b^2 + c^2$$

Where:

h is the length of the hypotenuse; and

a, b are the lengths of the other two sides

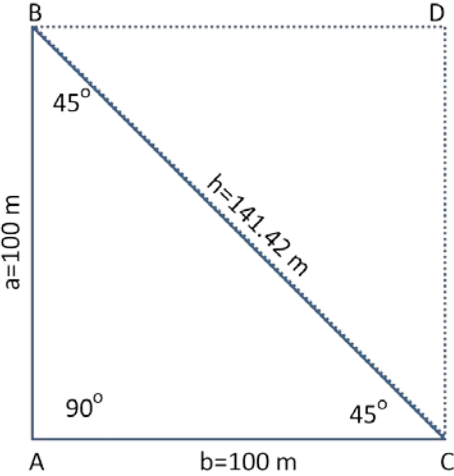


Figure 1: Calculation side of a triangle following Pythagoras proportion



Figure 2: Fencing one side of the 1 ha area in Tonle Sap Lake



Figure 3: 1 ha fenced area in Tonle Sap Lake

Three multifilament strings corresponding to side a and b, and hypotenuse of a right triangle were prepared. Side a and side b were 100 meters each (string a and string b), and the hypotenuse was 141.42 meters. Firstly, one side of string a and string b was tied together and tied it to wooden pole A. Secondly, two people, one held another side of string a and one held another side of string b walked forward to 2 different directions to form up 90 degree angle.

As total, 200 wooden/bamboo poles of 2.5 m in height stick along the rectangle border of an area of 1 ha, with a distance of 3 m from one to another to hold a panel of 400 m in length and 2 m in height of 10 mm mesh-size hard multifilament net or mosquito net resulting an area of 1 ha was fenced. Fish will be isolated from their community in the lake.

Table 3: Detail trammel net efficiency fishing activity

Day	Time	Activity
1st day	Morning	Go to Pursat, settlement
	Afternoon	Go to Kampong Luong, Krako to prepare field equipment
2nd day	Morning	Fence an area of 1 ha in the open lake
	Afternoon	Fence an area of 1 ha in the open lake, and prepare trammel net
3rd day	Morning	Trammel net fishing
	Afternoon	Prepare trammel net and seine net
4th day	Morning	Exhausting fishing
	Afternoon	Exhausting fishing
5th day	Morning	Exhausting fishing
	Afternoon	Exhausting fishing
6th day	Morning	Removing fence, and cleaning the fenced area
	Afternoon	Removing fence, and cleaning the fenced area
Restart a new fishing cycle		

2.1.3.1 Trammel net fishing

One set of trammel net was mounted. It consists of three connected panels which vary from each other by size of the mesh. Each panel is 20 m long and 2 m high. Thus, the total length was 60 m. Each panel consists of three layers, the two outside layers have the same mesh size and the inside layer has a mesh size, which is four times smaller. The first panel consists of two outside layers with 30 mm mesh size, one inside layer with 7.5 mm mesh size. The second panel consists of two outside layers with 60 mm mesh size, one inside layer with 15 mm mesh size. The third panel consists of two outside layers with 120 mm mesh size, one inside layer with 30 mm mesh size. The string of three layers is tied together. The upper string is connected to 6 buoys. The bottom string was stuck to a series of leads, which are used to keep the net vertically in water column and to spread the net to its maximum length. In this project trammel net fishing will be conducted in 1st year and 4th year of the project, hence 2 sets of net are needed, because a set of net cannot last for 2 years.



Figure 4: Three layers of the trammel net, middle layer 30mm the 2 outside layers have mash size 4 times bigger, 12mm

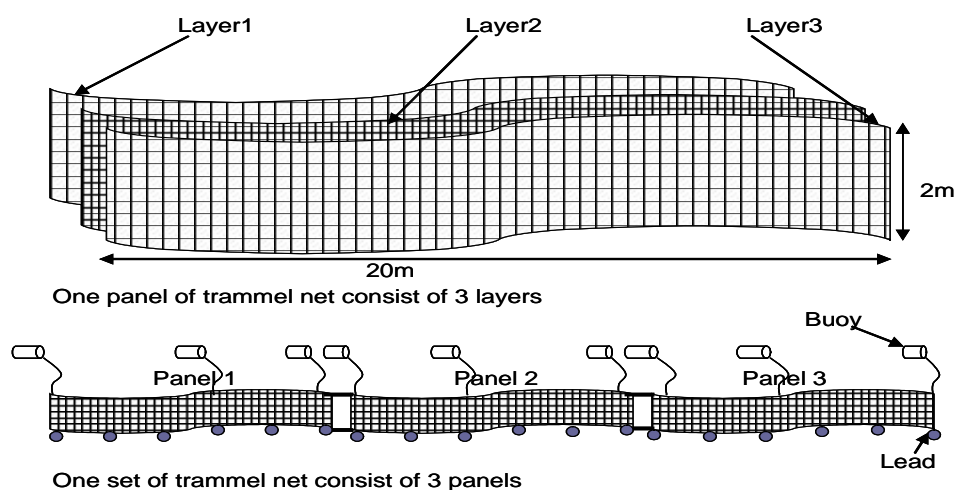


Figure 5: Drawing structure of trammel net

There is a concern about where should the net be set in the fenced area, since fish catch may vary with distance of the net to the fence and biologically fishes tend to swim along the fences. Assuming fishes swim along the fence, there will be two main scenarios regarding location of netting (1) the net is set close to the fence (Figure 2, B), because fish tend to swim along fences (principle used by the arrow head traps), and positioning the trammel net perpendicular to the fence would artificially increase the catch rate compared to a net set in open water; (2) the net is set in the middle of the fenced area (Figure 1, A), would artificially reduce the catch rate compared to a net set in open water. Hence, distance of net from the fence is the main factor that would biases catch rate from catch rate in the open water. This means that variation of catch rate in the fenced area driven by distance between the net and the fenced wall. The strength of this driver would be reduced by the enlargement of fenced area. In other word, if the fenced area is larger, the amount of fish met or swim along the fenced wall will be less. Thus the study plans to fence an area of 1 ha (100 m X 100 m), with an assumption that the amount of fish concentrated by the fenced wall is not significant compared to the amount of fish spread over the fenced area; and the trammel net will be set at the middle point of the fenced area, hence catch rate in the fenced area would be similar to catch rate in the open water of the lake (Figure 1, A).

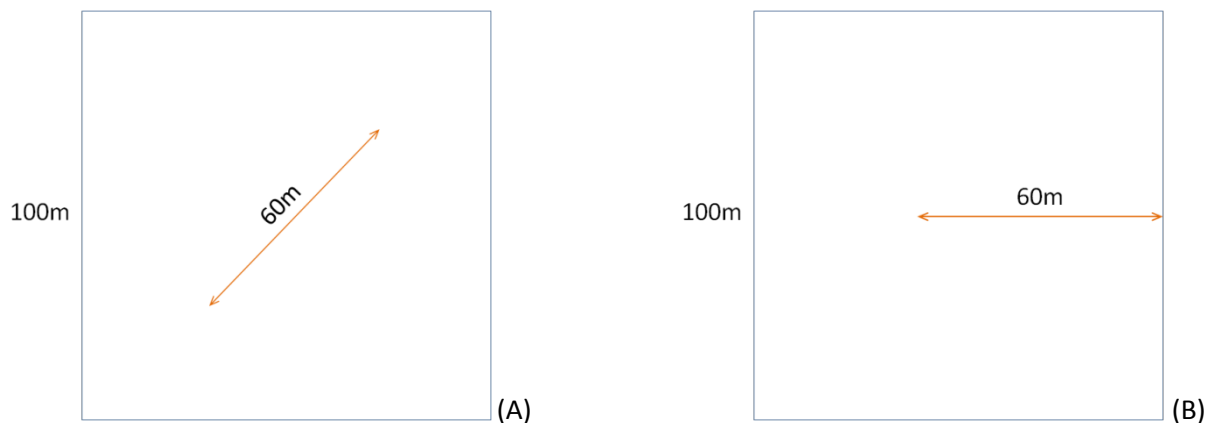


Figure 6: Position of trammel net set in the 1 ha fenced area

A trammel net was set at 5 a.m. at a middle point of 1 ha fenced area (Figure 2, A). The net was checked every one hour starting at 6 a.m. and checking stopped at 9 a.m. after checking 4 times. Fishes caught were identified, weighed and measured the total length individually, and released if fish still alive. The information for each specimen, such as name of species, weight, and total length was carefully recorded.

2.1.3.2 Exhaustion fishing in 1 ha area

At least 10 people are needed to handle the 420 meters long seine net. The fishing started right after the completion of trammel net fishing. The 420 meter seine net was placed on a small boat. The boat was moved inside the fenced area, at a fenced side about 20 m from corner. The seine was released closely along the fence and move along the fence gradually until the net completely in water. At least 2 people are needed to pull each end of the seine, and the remaining people were distribute along the net. Then, all together pull the net gradually. One seining was about 1.30 hour. In total 4-5 seining were conducted to make sure all fishes in the fenced area are caught.



Figure 7: Seining, releasing seine net along the fence from one corner to another

2.2. RESULTS OF TRAMMEL EFFICIENCY FISHING IN THE TONLE SAP LAKE

In total, 64 fish species were identified in the catch in 1 ha area in Tonle Sap lake (Figure 8). The catch per 1 ha in Tonle Sap Lake is 29.74 kg. The low diversity found here might result from limited sample area because the assessment done only in 1 area in Pursat province, and the assessment was undertaken in May 2021, i.e. at the end of the fishing season in Cambodia when the lake is almost empty. Result of the survey shows that the trammel net caught 1.7% of fish in 1 ha area in 4 hours fishing (Figure 11).



Figure 8: Species caught in 1 seine in Tonle Sap lake

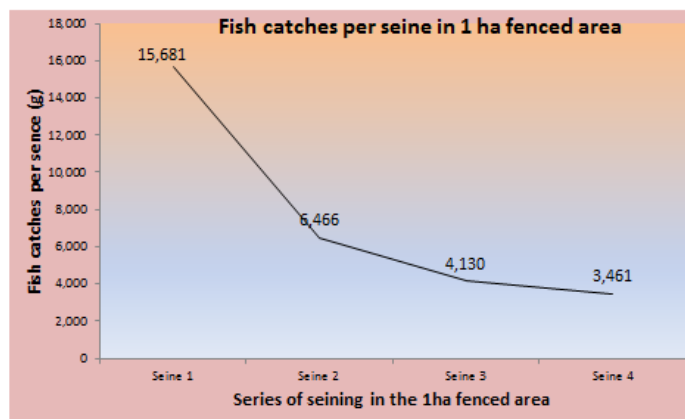


Figure 9: Average biomass per seine in Tonle Sap Lake

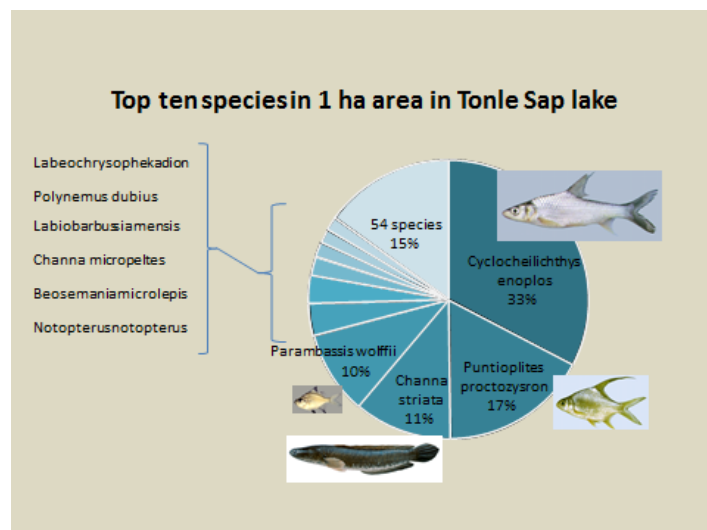


Figure 10: Species composition and ten top ten species in 1 ha in Tonle Sap Lake

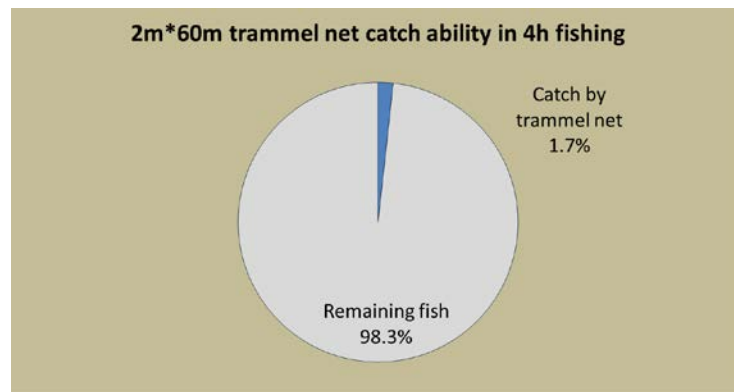


Figure 11: Trammel net catches efficiency in 4h fishing