Costs and Returns of the Commercial Fisheries in the Man-made Lakes in Surin Province, Thailand

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ABSTRACT

Three types of fisheries, *viz.* gillnets, longlines and traps, in the two irrigated man-made lakes in Surin province in the NE of Thailand, were analyzed in terms of profits Gillnets showed the highest operation cost, 8,891.2 baht per fishing season following by 5,850.3 and 4,776.4 baht per fishing season for longline- and trap- fisheries respectively. From the catch composition in each gear and the current market values of individual species, the current incomes that the fishers obtained from their fisheries were 37.4, 54.4 and 52.7 baht kg^{-1} for gillnet, longline and trap fisheries respectively. According to fishing costs per one fishing season, CpUE and number of fishing days, it was estimated that the break-even prices in the respective fisheries were 10.1, 14.8 and 10.3 baht kg^{-1}, which indicated that the fishers have made a profit. The monitoring program and community based management on lake environments and fisheries resources as well as the fish stock enhancement program are recommended to sustain the fisheries.

Key words: artisanal fisheries, gillnets, longlines, traps, break-even price

บทคัดย่อ

การศึกษาสภาวะทางการเงินในการทำการประมงพื้นบ้าน 3 ชนิด คือ การประมงข่าย เบ็ดราว และลอบในอ่างเก็บน้ำเพื่อการชลประทานในจังหวัดสุรินทร์ ตัวแทนในการศึกษาเป็นชาวประมงอาชีพ ที่ไม่มีที่ดินทำกินและหาปลาเป็นอาชีพหลัก จากการศึกษาพบว่า การทำการประมงข่ายมีค่าใช้จ่ายสูงสุดใน 1 รอบฤดูกาลประมง อยู่ที่ 8,891.2 บาท ตามมาด้วยการประมงเบ็ดราว (5,850.3 บาท) และการประมงลอบ (4,776.4 บาท) จากการประเมินองค์ประกอบผลจับและราคาสัตว์น้ำในปัจจุบัน พบว่า รายได้จากการประมงข่าย เบ็ดราว และลอบ จะอยู่ที่ 37.4, 54.4 และ 52.7 บาทต่อกิโลกรัม ในขณะราคาขายที่จะเท่าทุน ประมาณจากค่าใช้จ่ายต่อฤดูกาลประมง ปริมาณผลจับต่อหน่วยการลงแรงงาน และจำนวนวันที่ทำการประมงเท่ากับ 10.1, 14.8 และ 10.3 บาทต่อกิโลกรัม ซึ่งเห็นได้ว่าการประมงดังกล่าวยังทำกำไรให้กับชาวประมงอยู่

INTRODUCTION

Reservoirs are becoming increasingly important in the current millennium as a vital provider of animal protein and employment opportunities,

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particularly to poor sectors of the community, which also happen to be rural (De Silva, 2001). These aspects are much more crucial in the landlocked countries and the areas that far from the coastlines such as the NE of Thailand, where the freshwater fish production showed the highest proportion (40.8%) comparable to the other regions of the country (Satapornwanit and Wongrat, 2000). The nature of inland fishery, in Thailand, is usually a type of subsistence but some are professional fishers (Virapat and Mattson, 2001). Although the professional fishers (i.e. no other sources of income but fisheries) contribute a small proportion to the total number of the fishers in inland sector, their livelihood should be focused closely since the fishery is their only source of income. Moreover, it is seen elsewhere in the world that artisanal fisheries generally lack of infrastructural backing and credit facilities (Moses *et al.*, 2002). This activity almost totally depends on the fishers *per se*. So it is necessary to know the baseline information that whether or not the fishery makes a profit to fishers. Therefore, the objective of this paper was to analyze the financial status of the commercial fishery by comparing the price at the “break even” point to the current price the fishers got from their fisheries and discuss on the economic status of the commercial fishers in the man-made lakes in the NE of Thailand.

MATERIALS AND METHODS

Study area

Two irrigated man-made lakes namely “Huay Saneng” (7,392 ha) and “Um Puen” (1,248 ha) were selected as studied sites. These lakes are in Surin province, Thailand, and constructed by blocking the Saneng River channel and providing the irrigation system to the agricultural areas at least five from 13 districts of the province, which is about 8,736 ha of agricultural area (Bamrongart, 2000). There are seven and two villages locate in the vicinity of the respective lakes and the population is 13,997 (unpublished data from the frame survey of the project).

Data collections and choice of the fishers

Data collections were conducted by means of questionnaires. Project staff also went out to the field once a month with the fishers collaborating with the project to collect the field data. Data were compiled from July 2006 to June 2007. Questionnaire was tested a month before the field survey and modified to emphasize only the aspects related to the investment and expenses on fishing operation as well as the fishers’ livelihood (Table 1). Although a diverse range of gear is used depend on the nature of the fishing grounds, three main fishery gears are common in the two lakes *viz.* gillnets, longlines and traps. Therefore, the professional fishers who employed these three gears were interviewed, which accounted for 9, 7, 5 fishers for the respective fishing gears. Apart from the interview, the staff of the project went out fishing with the fishers once a month to calibrate the accuracy of the information asked in the questionnaire (e.g. variable costs, catch and effort). Prices of individual species were from the market survey (Appendix 1), freshwater fish is sold in terms of weight regardless to size variation (Bhukaswan

Table 1 Detail of data collections by mean of questionnaires

Lakes	Fishing gears	No. of interviewed fishers	No. of day visited / interviewed
Huay Saneng	gillnets	31	30
	longlines	5	5
	traps	3	2
Um Puen	gillnets	20	15
	longlines	7	3
	traps	2	1

and Chookajorn, 1987). Income was the product of the sum of proportion of individual catches multiplied by its price.

Data analysis

The price at the "break even point" is the price that no profits are made, i.e. the stage at the returns to fishers just balance the total cost of fishing (King, 1995) was calculated and compared to the current income the fishers got from their fisheries. At this equilibrium stage, price is the proportion of the costs to catches and efforts as

$$P = {(RC + FC)}/{(CpUE \times f)}$$

where RC and FC are, respective, total variable costs (i.e. operation cost such as fuel and food) and fixed costs (i.e. depreciation and maintenance costs of boats and fishing gears) (baht per fishing season); P is price (baht kg^{-1}), CpUE is catch per unit effort to all fish catches (kg day^{-1}) and f is fishing effort (days). The fishing seasons were varied according the appropriated conditions for fishing gear uses, which were about 6, 4 and 10 months for gillnet-, longline- and trap- fisheries respectively.

Variable costs were presented as a fishing days, meanwhile fixed cost were scaled on fishing season basis (i.e. number of days the fishers went out to operate the fishery). Depreciation costs were estimated as in linearity manner (i.e. equally distribute throughout the lifespan of the equipment) and salvage costs of boat and fishing gears were excluded since they were discarded when they do not function.

RESULTS AND DISCUSSION

In general, professional fishers owned various types of fishing gears and they selected the appropriate ones for the fishing grounds and period of the year. All fishers in the study area used un-motorized boats. The petrol cost showed in the calculation was for the vehicles (i.e. motorcycles) since it was a considerable distance from their residents to their fishing grounds. The reservoir area is regarded as the public zone that anyone can access to fish, except for some certain prohibited areas for the dam operation (Prompoj, 1994). In the studied lakes, it is a norm among the fishers that they shall occupy certain generally agreed fishing grounds.

Although artisanal fisheries is a labour-intensive (Moses *et al.*, 2002), no extra labour was hired, as the nature of inland fisheries that lower in yield and the fishing ground is not far from the shoreline, compared to the small scale fisheries in the coastal area in Thailand, which sometimes the supplement labour is hired (Masae *et al.*, 2002). Boat maintenance and fishing gear repair were included to the fixed cost as fixing boat and gears were done irregularly and the fishers always prepare these equipments since the start of the fishing season. Among the three gears, gillnet fishery showed the highest cost for annual operating expenses (Table 2) followed by longline (Table 3) and trap (Table 4). The great variation in number of gears used each fishing days was observed in gillnet fishery as the gillnet fishers always use a variety of mesh sizes during their operations (Jutagate *et al.*, 2001). Trap fishery showed the highest number of fishing effort because it can be operated either low or high water levels. For fishing costs, if any fishing gear's life span is less than one fishing season, it will be resulted in a higher depreciation costs comparable to the investment of the gears (Jutagate *et al.*, 2001) as can be seen in case of gillnets in this study. The variable costs varied among gears especially for others items since some fishers bought ice to pack their catches.

In terms of catch composition, it is observed that gillnets showed the highest efficiency in catching the variety of species (27; Figure 1) similar to the other fisheries in the Lower Mekong Basin (Jutagate *et al.*, 2002) followed by longlines (19; Figure 2) and traps (12; Figure 3). Not only in terms of species composition, but the highest CpUE were also obtained from the gillnet fishery (Table 5). It is seen that major fish caught were the species restocking to the lakes by the Department of Fisheries (unpublished data from the creel survey of

Table 2 Estimated costs (baht /fisher /fishing season) of gillnet fishery (± SD) at two irrigated lakes in Surin province in 2007*

Average number of gillnets used (per fisher per day)	17.2 (± 13.5)
Average fishing days per year	161.4 (± 51.3)
Initial investment	
Vessel cost	3,643.4 (± 101.7)
Gillnet cost (per net)	273.8 (± 11.1)
Fixed costs (per fishing season)	
Boat's depreciation	728.7 (± 20.3)
Gillnet's depreciation (per net)**	346.6 (± 7.7)
Boat maintenance	31.4 (± 9.1)
Gillnet repair (per net)	2.1 (± 1.3)
Total fixed costs (per fishing season)	1,108.7 (± 38.3)
Variable costs (per fishing day)	
Patrol	8.2 (± 0.3)
Food	4.2 (± 1.0)
Others***	0.9 (± 0.2)
Total variable costs (per day)	13.22 (± 1.4)
Total variable costs (per fishing season)	2,134.2 (± 222.8)
Total fishing cost (per fishing season)****	8,891.2 (± 881.9)

Note: * Number of sample was 9; ** lifespan = 0.79 year; *** included expenses for ice and cigarettes (pack); **** to calculated whole fishing season, the depreciation- and repair- costs were multiplied by the average number of gear used per day (17.2)

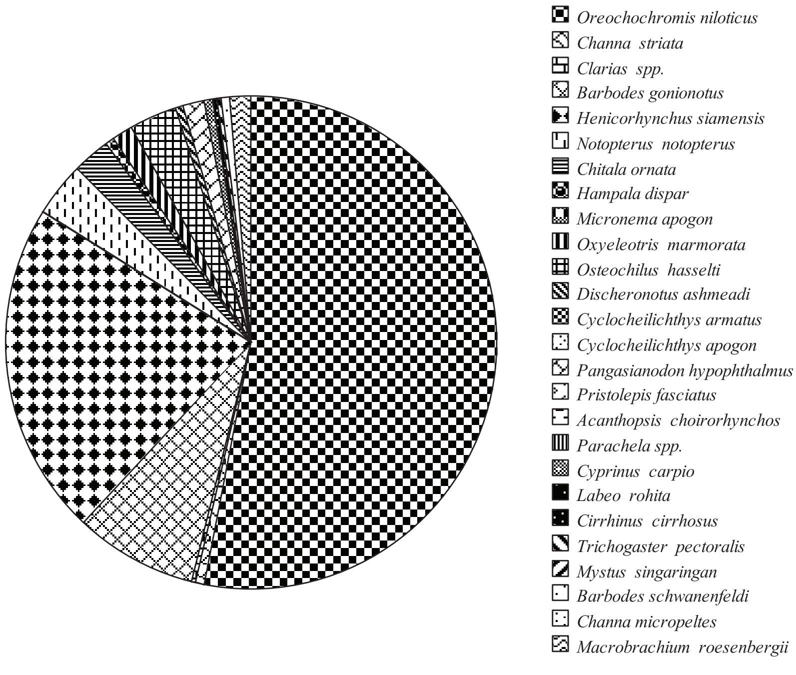

Figure 1 Catch composition from the gillnet fishery at two irrigated lakes in Surin province in 2007

Table 3 Estimated costs (baht /fisher /fishing season) of longline fishery (± SD) at two irrigated lakes in Surin province in 2007*

Average number of longlines used (per fisher per day)**	7.0 (± 3.4)
Average fishing days per year	114.4 (± 44.2)
Initial investment	
Vessel cost	3,643.4 (± 101.7)
Longline cost (per line)	101(± 4.24)
Fixed costs (per fishing season)	
Boat's depreciation	728.7 (± 20.3)
Boat maintenance	31.4 (± 9.1)
Replacement of new longlines***	2,828.0 (± 1,360.1)
Total fixed costs (per fishing season)	3,588.1 (± 1,389.4)
Variable costs (per fishing day)	
Patrol	8.0 (± 0.3)
Food	3.9 (± 0.5)
Others	1.0 (± 0.9)
Hooks****	7(± 1.4)
Total variable costs (per day)	19.8 (± 2.3)
Total variable costs (per fishing season)	2,262.3 (± 263.2)
Total fishing cost (per fishing season)*****	5,850.3 (±1,623.2)

Note: * Number of sample was 7; ** each line contained about 100 hooks; *** during the fishing season (about 4 months), the longlines were discarded and replaced on the monthly basis; **** every fishing day, the hook, that caught fish, was removed and replaced the new one; ***** to calculated whole fishing season, the depreciation- and repair- costs were multiplied by the average number of gear used per day (7)

Table 4 Estimated costs (baht /fisher /fishing season) of trap fishery (± SD) at two irrigated lakes in Surin province in 2007

Average number of traps used (per fisher per day)	3.0 (± 1.9)
Average fishing days per year	308.0 (± 37.2)
Initial investment	
Vessel cost	3,643.4 (± 101.7)
Trap cost (per trap)	308.0 (± 31.2)
Fixed costs (per fishing season)	
Boat's depreciation	728.7 (± 20.3)
Trap's depreciation (per trap)*	246.4 (± 24.9)
Boat maintenance	31.4 (± 9.1)
Trap repair (per trap)	2.5 (± 0.8)
Total fixed costs (per fishing season)	1,009.0 (± 55.1)
Variable costs (per fishing day)	
Patrol	8.4 (± 0.9)
Food	1.5 (± 0.2)
Other**	0.8 (± 0.1)
Total variable costs (per day)	10.6 (± 1.2)
Total variable costs (per fishing season)	3,277.1 (± 354.2)
Total fishing cost (per fishing season)**	4,776.4 (± 519.6)

Note: * Number of sample was 5; ** lifespan = 1.25 year; *** to calculated whole fishing season, the depreciation- and repair- costs were multiplied by the average number of gear used per day (3)

Table 5 Average CpUE (kg day^{-1}) of selected fishing gears at two irrigated lakes in Surin province

Gears	Huay Saneng	Um Puen	Average
Gillnets	6.36	4.5	5.43
Longlines	4.55	2.37	3.46
Traps	1.5	1.5	1.5

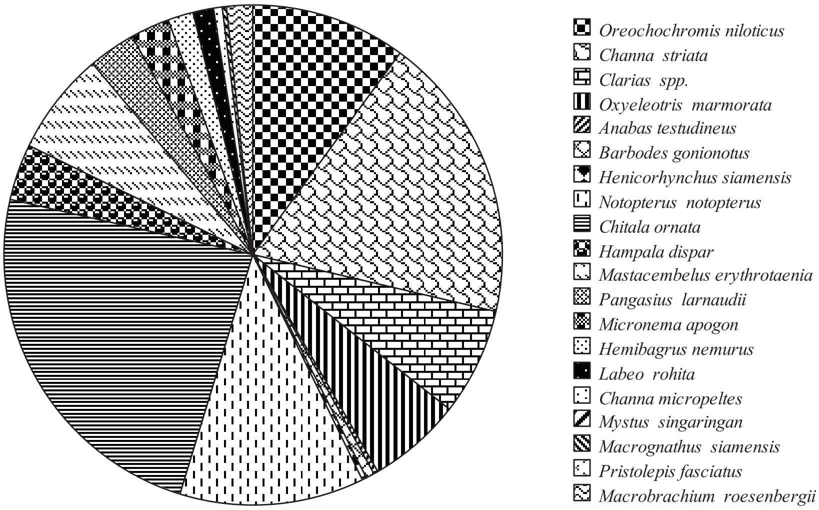

Figure 2 Catch composition from the longline fishery at two irrigated lakes in Surin province in 2007

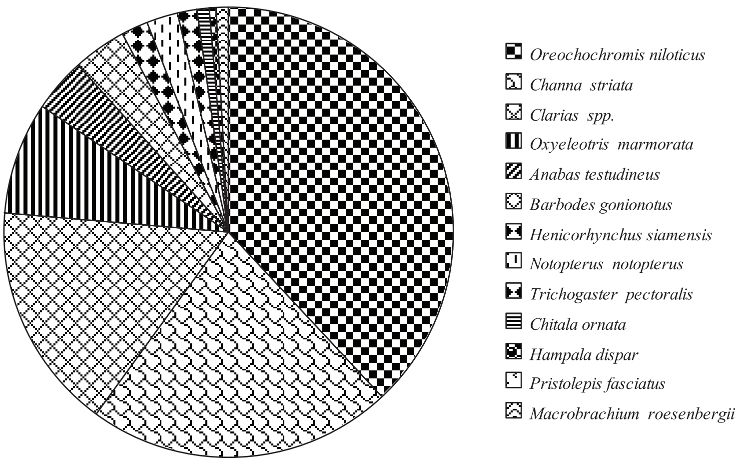

Figure 3 Catch composition from the trap fishery at two irrigated lakes in Surin province in 2007

the project), such as Nile tilapia *Oreochromis niloticus*, silver barb *Barbonymus gonionotus*, Siamese mud carp *Henicorhynchus siamensis*, common carp *Cyprinus carpio*, and giant freshwater prawn *Macrobrachium rosenbergii.* This evidence showed the importance and degree of success of the stock enhancement in inland water bodies in the NE of Thailand (De Silva and Funge-Smith, 2005; Garaway *et al*., 2006).

The highest market price species were *M. rosenbergii* (280 baht kg^{-1}) followed by catfishes *Mystus singaringan*, *Hemibagrus nemurus*, peacock eel *Macrognathus siamensis* and sheathfish *Micronema apogon*, all of which are the same price, 100 baht kg^{-1}. According to the price of individual species and its proportion to the catches, the estimated incomes the fisheries were 37.4, 54.4 and 52.7 baht kg^{-1}, for gillnet, longline and trap fisheries, respectively. Based on the average CpUE of each gear (Table 5), the price at the equilibrium stage of the three fisheries, were estimated at 10.1, 14.8, and 10.3 baht kg^{-1}. Therefore the highest profit (42.4 baht kg^{-1}) can be obtained from the trap fishery followed by longline (39.6) and gillnet (27.3) (Figure 4).

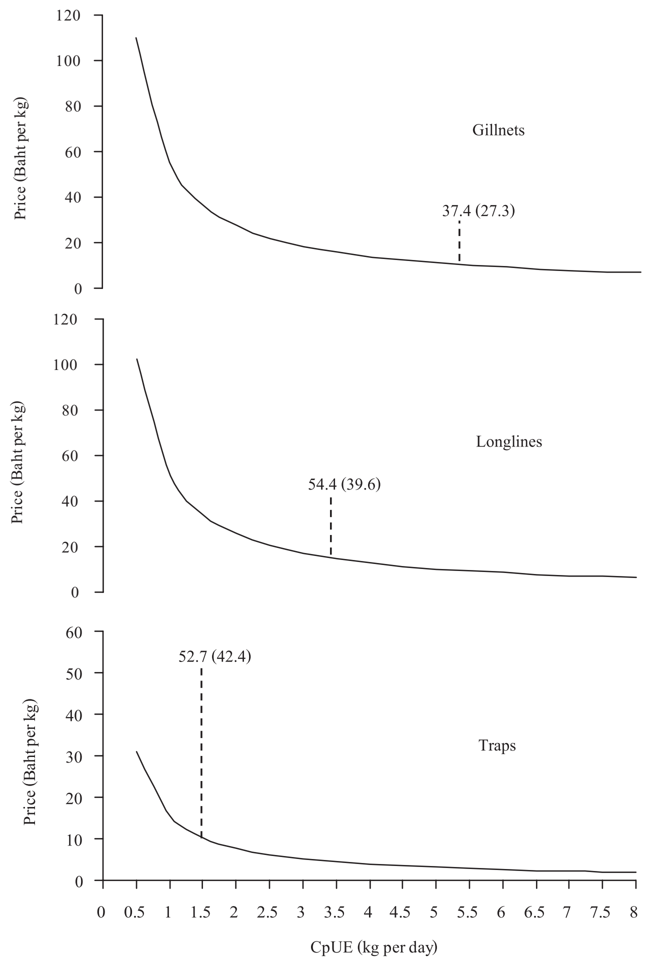

Figure 4 Break-even curves of the selected fisheries in the man-made lakes in Surin province

Note The dash lines indicate the current situations of CpUE and prices of each fisheries. Numbers in parentheses are the profit values

Appendix 1 Current market prices of individual fish species at Surin province in the year 2007

Common name	Scientific Name	Price (Bath kg^{-1})
Nile tlapia	*Oreochochromis niloticus*	40
Stripped snakehead fish	*Channa striata*	80
Walking catfish	*Clarias* spp.	50
Thai silver barb	*Barbonymus gonionotus*	35
Jullien's mud carb	*Henicorhynchus siamensis*	25
Giant feather back	*Notopterus notopterus*	25
Spotted knife fish	*Chitala ornata*	25
Spotted shark	*Hampala dispar*	30
Sheat-fish	*Micronema apogon*	100
Sand goby	*Oxyeleotris marmorata*	60
Bony-lipped barb	*Osteochilus hasselti*	25
Redtail barb	*Discheronotus ashmeadi*	35
Barb	*Cyclocheilichthys armatus*	25
Indian river barb	*Cyclocheilichthys apogon*	25
Stripped Catfish	*Pangasianodon hypophthalmus*	40
Striped tiger nandid	*Pristolepis fasciatus*	35
Long-nose loaches	*Acanthopsis choirorhynchos*	50
Siamese river abramine	*Parachela* spp.	50
Common carp	*Cyprinus carpio*	50
Rohu	*Labeo rohita*	50
Mrigal	*Cirrhinus cirrhosus*	50
Snake skin gourami	*Trichogaster pectoralis*	50
Long-fatty finned mystus	*Mystus singaringan*	100
Tinfoil barb	*Barbodes schwanenfeldi*	40
Red snake head fish	*Channa micropeltes*	50
Climbing perch	*Anabas testudineus*	30
Spiny eel	*Macrognathus semiocellatus*	100
Peacock eel	*Mastacembelus favus*	100
Black ear catfish	*Pangasius larnaudii*	40
Yellow mystus	*Hemibagrus nemurus*	100
Giant freshwater prawn	*Macrobrachium roesenbergii*	280

CONCLUSION AND RECOMMENDATION

It can be concluded that all the selected fisheries made the profit to the fishers and attracted the fishers to run these activities unless there is any adverse conditions to their catch rate and the environment. Therefore monitoring program on the integrity of the lake system and fisheries resources should be done regularly. Moreover, the awareness and co-operation to conserve the lake environment should be set among the resource users, especially the fishers, in both lakes. It is necessary for the government agencies such as Department of Fisheries and Department of Irrigation to encourage and strengthen the community based management for the wise and sustained uses of the resources. There are many lessons learnt on how to success the fisheries co-management in the region to be imitated (e.g. Nilsson *et al.*, 2001). Stock enhancement program should be focused and implemented as the mean to increase yield and the study on the actual outcome from the program should be analyzed for further development (Garaway *et al.*, 2006). Alternative occupations to support the income of the fisher households are also recommended (Allison and Ellis, 2001)

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