The Socio-economic Impacts from the Environmental Changes after the Construction of Sirikit Dam

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Abstract:

It is certain that a construction of a big dam with a large reservoir will have impacts on both the environment and peoples' ways of life. The construction of Sirikit Dam on the Nan River in Northern Thailand 35 years ago have changed both the natural environment of the river, the area around the reservoir and on ways of life of those people who have been living in the area. This research utilized both historical secondary data and primary data from survey to analyze the environmental changes on fishes which impact socio-economic of people who live in the reservoir.

It found that the change from the flowing river to a large reservoir have some significant changes on the fishes. Comparing the results from several previous surveys to the current data, it found that the number of species of fish decreased. Currently, vegetarian fishes are more dominance. These fishes, however, has more economic values and become source of income for people in the area. Economically, fishing in the reservoir has become career for many peoples who were relocated after the construction of Sirikit Dam. They are the second generation of the family who now lack cultivation land and the reservoir provide a ground for their earning. On the average, these peoples have a net income about 68,000 Bath annually. In addition, it contributes about 29 millions Baht annually to the local economy. These have significantly improved their quality of live.

Keywords: Socio-economic impacts,

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1. Introduction

It is certain that a construction of a big dam with a large reservoir will have impacts on both the environment and peoples' ways of life. The construction of Sirikit Dam on the Nan River in northern Thailand 35 years ago, that created a large reservoir covering the area about 190 square kilometers, have changed both the natural environment of the river and the area around the reservoir and on ways of life of those people who have been living in the area. This research utilized both historical secondary data and primary data from survey to analyze the environmental changes on the changes on the fishes that have impact on socio-economic of people who live in the area.

2. Changes in fishes

The data presented in this section are compiled from historical secondary data and from primary survey data. The purpose is to longitudinally trace the changes in the dominance of fish species prior to the construction of Sirikit dam and after the construction. The data are from the year 1968 to 2007. Table 1 presents the exiting of types of fishes in that period.

Table 1: Nan River Fish Surveys, 1968-2002

Survey Year	Types of fishes found (Number / Type)
1968	21 / Catfish , Black-Spot Long Tom, Spotted Feather back, Smith Barb, Striped Snake-Head Fish, Rasboa, Silver Rasbora, Batrachian Walking Catfish, Soldier River Barb, Golden Belly Barb, Barb, Siamese Glassfish, Solder croaker , Long-Nosed Loach, Indian River Barb, Common Climbing Perch, Loach, Swamp Eel
1969	23 / Catfish , Black-Spot Long Tom, Spotted Feather back, Striped Croaking Gouramim, Spiny-Eel, Transverse-Bar Barb, Siamese Rock Catfish, Striped Snake-Head Fish, Rasboa, Silver Rasbora, Batrachian Walking Catfish, Golden Belly Barb, Green Blowfish, Siamese River Abramine, Long-Nosed Loach, Grey Feather Back, Jullien's Mud Carp, Red-Finned Black Shark, Stripped Tiger Nandid, Macrognathus Siamensis, Swamp Eel
1973	44 / Catfish , Black-Spot Long Tom, Spotted Feather back, Siamese Glass Fish, Three-Spot Gourami, Spiny-Eel, Smith Barb, Transverse-Bar Barb, Greater Black Shark, Glass Catfish, Red-Cheek Barb, Indian River Barb, Great White Spearfish, Striped Snake-Head Fish, Giant Snake-Heas Fish, Rasboa, Batrachian Walking Catfish, Rasboa, Batrachian Walking Catfish, Whisker Sheatfish, Soldier River Barb, Jawa, Barb, Jawa, Barb, Mud Carp, Sleeper, Green Blowfish, Siamese Glassfish, Solder croaker, Jullien's Golden-Price Carp, Hard-Lipped Bard, Grey Feather Back, Striped Catfish, Jullien's Mud Carp, Red-Finned Black Shark, Common Archer Fish, Sumatran Tiger Barb, Indian River Barb, Stripped Tiger Nandid, Common Climbing Perch, Loach, Swamp Eel, Siamese Gyrinochellid

Table 1: Nan River Fish Surveys, 1968-2002 (Continue)

1974	53 / Catfish , Black-Spot Long Tom, Spotted Feather back, Spotted Feather back, Striped Croaking Gouramim, Siamese Glass Fish, Spiny-Eel, Smith Barb, Transverse-Bar Barb, Greater Black Shark, Red-Finned Black Shark, Red-Cheek Barb, Glass Catfish, Indian River Barb, Long-Fatty Finned Mystus, Siamese Rock Catfish, Great White Spearfish, Giant Snake-Heas Fish, Barb, Rasboa, Batrachian Walking Catfish, Whisker Sheatfish, Soldier River Barb, Golden Belly Barb, Jawa, Barb, Mud Carp, Hoeven's Slejnder Carp, Sleeper, Green Blowfish, Siamese Glassfish, Striped Snake-Head Fish Siamese River Abramine, Solder croaker , Rohu, Long-Nosed Loach, Hard-Lipped Bard, Grey Feather Back, Striped Catfish, Jullien's Mud Carp, Common Archer Fish, Sumatran Tiger Barb, Indian River Barb, Stripped Tiger Nandid, Common Climbing Perch, Loach, Macrognathus Siamensis, Swamp Eel, Siamese Gyrinochellid
1975	38 / Catfish, Spotted Feather back, Three-Spot Gourami, Spiny-Eel, Smith Barb, Transverse-Bar Barb, Greater Black Shark, Red-Finned Black Shark, Red-Cheek Barb, Indian River Barb, Long-Fatty Finned Mystus, Great White Spearfish, Striped Snake-Head Fish Batrachian Walking Catfish, Whisker Sheatfish, Soldier River Barb, Golden Belly Barb, Jawa, Tinfoil Barb, Hoeven's Slejnder Carp, Sleeper, Twisted-Jaw Sheatfish, Green Blowfish, Siamese Glassfish, Jullien's Golden-Price Carp, Rohu, Giant Gourami, Hard-Lipped Bard, Grey Feather Back, Striped Catfish, Common Archer Fish, Indian River Barb, Stripped Tiger Nandid, Common Climbing Perch, Loach, Macrognathus Siamensis, Swamp Eel
1979	18 / Catfish , Spotted Feather back, Three-Spot Gourami, Spiny-Eel, Smith Barb, Transverse-Bar Barb, Striped Snake-Head Fish, Batrachian Walking Catfish, Whisker Sheatfish, Soldier River Barb, Jawa Sleeper, Green Blowfish, Siamese Glassfish, Rohu, Giant Gourami, Grey Feather Back
1980	14 /Catfish , Spiny-Eel, Transverse-Bar Barb, Indian River Barb, Striped Snake-Head Fish, Soldier River Barb, Jawa, Sleeper, Green Blowfish, Siamese Glassfish, Rohu, Giant Gourami, Grey Feather Back
1981	32 / Catfish , Moonlight Gourami, Black-Spot Long Tom, Schwanenfeld' s Tinfoil Barb, Spotted Feather back, Three-Spot Gourami, Spiny-Eel, Transverse-Bar Barb, Spiny-Eel, Transverse-Bar Barb, Long-Fatty Finned Mystus, Striped Snake-Head Fish Rasboa, Batrachian Walking Catfish, Whisker Sheatfish, Soldier River Barb, Jawa, Mud Carp, Cilcled, Hoeven's Slejnder Carp, Twisted-Jaw Sheatfish, Green Blowfish, Solder croaker , Rohu, Hard-Lipped Bard, Grey Feather Back, Jullien's Mud Carp, Sumatran Tiger Barb, Loach, Macrognathus Siamensis
1999	33 / Catfish , Black-Spot Long Tom, Schwanenfeld' s Tinfoil Barb, Spotted Feather back,Three-Spot Gourami, Smith Barb, Transverse-Bar Barb, Greater Black Shark, Red-Finned Black Shark, Red-Cheek Barb, Whisker Sheatfish, Soldier River Barb, Jawa, Barb, Tinfoil Barb, Mud Carp, Cilcled, Coolic Loach, Green Blowfish, Siamese Glassfish, Solder croaker , Rohu, Long-Nosed Loach, Hard-Lipped Bard, Grey Feather Back, Striped Catfish, Jullien's Mud Carp, Sumatran Tiger Barb, Loach, Macrognathus Siamensis, Swamp Eel, Siamese Gyrinochellid

Table 1: Nan River Fish Surveys, 1968-2002 (Continue)

2000	34 /Catfish , Black-Spot Long Tom, Schwanenfeld' s Tinfoil Barb, Spotted Feather back, Three-Spot Gourami, Spiny-Eel, Smith Barb, Transverse-Bar Barb, Greater Black Shark, Red-Cheek Barb, Rasboa, Whisker Sheatfish, Soldier River Barb, Barb, Mud Carp, Cilcled, Coolic Loach, Green Blowfish, Siamese Glassfish, Siamese River Abramine, Solder croaker , Rohu, Long-Nosed Loach, Giant Gourami, Hard-Lipped Bard, Grey Feather Back, Striped Catfish, Jullien's Mud Carp, Common Archer Fish, Sumatran Tiger Barb, Indian River Barb, Common Climbing Perch, Loach, Macrognathus Siamensis
2002	48 /Catfish , Black-Spot Long Tom, Schwanenfeld' s Tinfoil Barb, Spotted Feather back, Three-Spot Gourami, Spiny-Eel, Smith Barb, Transverse-Bar Barb, Greater Black Shark, Red-Cheek Barb, Long-Fatty Finned Mystus, Great White Spearfish, Striped Snake-Head Fish, Giant Snake-Heas Fish, Barb, Whisker Sheatfish, Soldier River Barb, Jawa, Barb, Tinfoil Barb, Mud Carp, Cilcled, Mekong Giant Catfish, Sleeper, Coolic Loach, Green Blowfish, Siamese Glassfish, Siamese River Abramine, Solder croaker, Jullien's Golden-Price Carp, Rohu, Giant Gourami, Hard-Lipped Bard, Grey Feather Back, Striped Catfish, Jullien's Mud Carp, Common Archer Fish, Sumatran Tiger Barb, Indian River Barb, Rohu, Long-Nosed Loach, Stripped Tiger Nandid, Common Climbing Perch, Loach, Macrognathus Siamensis,

During these times, there were 11 surveys conducted with the first survey in 1968 prior to the construction of Sirikit Dam and the last one, conducted by the author with assistance from the Provincial Fisheries Department in 2002. They can be divided into 4 distinct periods:

1. From 1968 to 1972 which was the period before the start of the reservoir. There were 2 surveys in this period.
2. From 1973 to 1977 was the period that the reservoir was being filled. Three surveys were conducted.
3. From 1978 to 1998 when the dam is in full operation. There were three surveys in this period
4. From 1999 to the present which is the period after 20 years of the existing of the new environment. Three surveys were conducted.

In total there were 69 types of fishes found in the surveys. It was during the second period that has the most diversity. After the construction of the dam, however, the number of fishes found in the reservoir decrease dramatically. The surveys conducted prior to the full level of the reservoir found more than 40 types of fishes in the river. The number decrease to 18 and 14 from the 1979 and 1980 surveys. The surveys after 1999, however, shown a steady increase in the type of fishes found in the reservoir. The last survey in 2002 found 48 types of fishes in the reservoir.

The changes in the availability of types of fish are expected theoretically. It is, however, within the ability of man to help nature adjust to the new environment. Such is the case at Sirikit Dam. Electricity Generating Authority of Thailand (EGAT) that is responsible in the operation of Sirikit Dam has continuously release new type of fishes that are more appropriate to the new environment and are economically value into the reservoir. On the average, they released about 2 millions fishes annually.

3. Economic values of fishery

The changes in the environment and species of fishes gave rise to the new economy in the area. People who were living in this area prior to the construction of Sirikit Dam were mainly farmers. Majority of them were relocated to the new area where each family received 2.5 Hectares of land for farming. These land, however, were not enough for all their children. Several of them turn to fishery to earn their living. The registration records for all floating barges in the reservoir shows that 81.1% have their household registration in the resettlement area and have been living in the reservoir for more than 10 years (Sittiwong et all: 2004, 55). Table 2 shows the amount and values of fishes caught from the reservoir. This data are presented graphically in Figure 1.

Table 2: Amount of Catches and Monetary Values, 2003-2007

Year	Total Catches (Tons)	Total Values (1,000 Baht)
2003	609.0	25,069.5
2004	698.5	29,676.8
2005	688.9	31,383.5
2006	735.8	33,967.9
2007	907.9	39,342.4
Total	3640.1	159,440.2

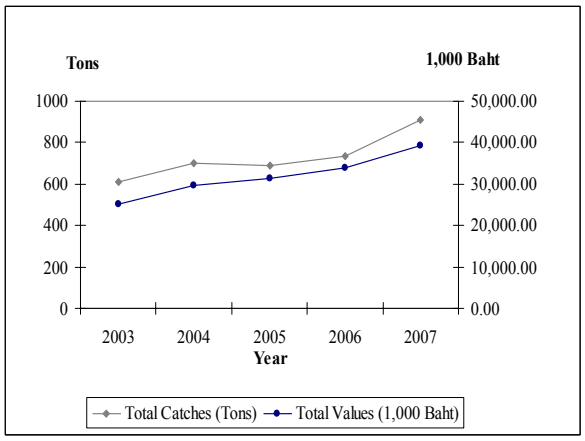

Figure 1: Total amount of annual catches and monetary values, 2003 – 2007

The data shown in Table 2 cover the major type of fishes that were caught from the reservoir in the last 5 year from 2002 to 2007. The data cover 31 types of fishes that are dominant in the reservoir. The total amount of catches in the five years periods were 3,640.1 tons with the total monetary value (at the 2003 constant price) of 159,440,202 Baht. The annual average catch is 726,079 kilogram which contributes about 30.7 millions Baht annually to the local economy. Figure 1 shows the total annual catches and total amount of money which depict a steady increase both the total catches and total value. This probably suggests an increase in the economic value of the reservoir to both residents and the communities.

The top five types of fishes in term of values are Soldier River Barb, Rasboa, Yellow Mystus, Smith Barb, and Grey Feather Back. They combined about 1/5 of the total values of catches from the reservoirs. Table 3 provides data on their annual catches and their economic values. These are fishes that are on the increase in population, in particular, the Soldier River Barb and Rasbao are native fishes that flourish with the reservoir as shown in figure 2.

Table 3: Five Major Types of Fishes of Sirikit Dam, 2003 – 2007.

Fishes	Year	Total	
		Catches (Tons)	Values (1,000 Baht)
1. Soldier River Barb	2003	73.4	5,144.3
	2004	85.7	6,001.8
	2005	90.3	6,322.0
	2006	114.7	8,030.6
	2007	127.6	8,935.5
2. Rasboa	2003	186.5	2,797.9
	2004	171.0	2,565.3
	2005	130.7	1,960.2
	2006	102.6	1,538.6
	2007	178.3	2,674.5
3. Yellow Mystus	2003	18.5	1,111.1
	2004	31.6	1,896.2
	2005	22.9	1,373.2
	2006	27.5	1,922.7
	2007	29.0	2,029.8
4. Smith Barb	2003	59.6	893.3
	2004	68.8	1,031.3
	2005	87.4	1,748.4
	2006	81.7	1,633.6
	2007	139.6	2,792.0
5. Grey Feather Back	2003	24.4	1,097.4
	2004	25.8	1,162.4
	2005	29.3	1,316.9
	2006	31.3	1,408.7
	2007	31.8	1,430.6

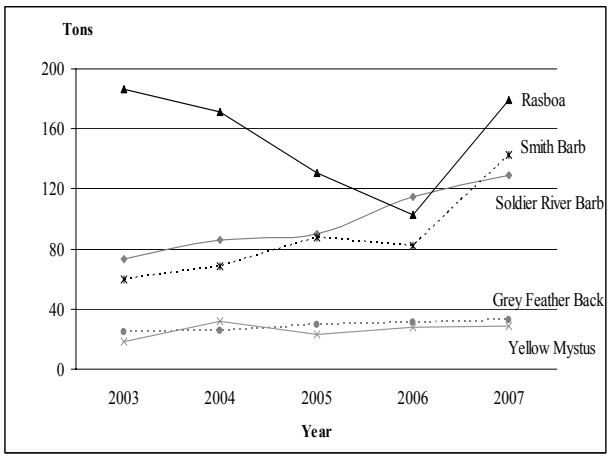

Figure 2: Total catches for the 5 major types, 2003-2007.

Sirikit Dam Lake number one fish is Soldier River Barb (*Cyclocheilichthys enoplos*)

(Picture 1). They are vegetable eating fish and can live and breed in the lake very well. They live in the range of 10-20 meters of depth. Hence, the lake gives them an ideal breeding ground for them.

Picture 1: Soldier River Barb

4. Fishermen's Socio-Economic background

The socio-economic background of the fishermen living in Sirikit Dam reservoir data were collected from the survey conducted in 2007. The samples of 175 households were drawn from the population of 621 households living in various locations throughout the reservoir using multi-stages random sampling method. Table 3 shows their households data.

Table 3: Household socio-economic data

Household data	N	%
1. Previous domicile		
- Nakornsawan Prov.	1	0.6
- Pichit Prov.	10	6.3
- Pisanulok Prov.	22	12.6
- Uttaradit Prov.	142	81.1
Total	**175**	**100.0**
2. Number of years living in the reservoir		
- 10 yrs. or less	15	8.6
- 11-25 yrs.	15	8.6
- More than 25 yrs.	7	4.0
- Original location	138	78.9
Total	**175**	**100.0**
Average = 14.5 yrs.		
3. Number of person in the household.		
- 4 persons or less	122	69.7
- 5-8 persons	49	28.0
- More than 8 persons	4	2.3
Total	**175**	**100.0**
4. Age of household master		
- 40 yrs. old or less	48	27.4
- 41 – 50 yrs. old	64	36.6
- 51 – 60 yrs. old	46	26.3
- More than 60 yrs. old	17	9.7
Total	**175**	**100.0**

From Table we found that majority of Sirikit Dam fishermen (81.1%) are local residents who grew up in the resettlement area that was set up by government for relocated peoples after the construction of Sirikit Dam. They received a plot of land for their farming. As the family grew, however, the families do not have enough land for all family members. Some of them, in particular second generation children decided to taking up fishing to earn their living as can be seen in Table 4 that 63.6% of them were farmers. Majority of them learned fishing by self practice (55.4%) or from friend (26.9%) and have been practicing this for 5 years or less (58.3%) while only about 10 percent are veteran fishermen who have been fishing in the lake for more than 10 years. Table 4 presents their occupation and income data.

Table 4: Household Occupation and Income

	N	**%**
1. Previous occupation		
- Fishing as a first career	81	27.8
- Headsman	17	5.8
- Trades	7	2.4
- Farmers	185	63.6
- Labor	1	0.3
Total	**291**	**100.0**
Note: Some of them had more than 1 occupation.		
2. Occupational training		
- Family tradition	25	14.3
- Friends	47	26.9
- Self practice	97	55.4
- Formal training	6	3.4
Total	**175**	**100.0**
3. Years of experience		
- 5 yrs or less	102	58.3
- 6-10 yrs.	40	22.9
- 11-20 yrs.	20	11.4
- More than 20 yrs.	13	7.4
Total	**175**	**100.0**

Table 4: Household Occupation and Income (Continue)

4. Monthly cost for fishing		
- Less than 2,000 Baht	45	25.7
- 2,001-3,000 Baht	109	62.3
- 3,001-4,000 Baht	11	6.3
- More than 4,000 Baht	10	5.7
Total	**175**	**100.0**
Average = 2,433 Baht		
5. Monthly earning from fishing		
- Less than 4,000 Baht	11	6.3
- 4,000-7,500 Baht	125	71.4
- 7,501-10,000 Baht	12	6.9
- More than 10,000 Baht	27	10
Total	**175**	**100.0**
Average = 7,936 Baht		
6. Monthly net income from fishing		
- Less than 3,500 Baht	38	21.7
- 3501-7,500 Baht	107	61.1
- 75,01-10,000 Baht	13	7.4
- More than 10,000 Baht	17	9.7
Total	**175**	**100.0**
Average = 5,728 Baht		
7. Sources of supplemental income		
- None	60	34.2
- Livestock	36	20.6
- Trade	5	2.9
- Farming	53	30.3
- Fish farm	21	12.0
Total	**175**	**100.0**
8. Annual net income from supplemental income		
- Less than 5,000 Baht	101	57.7
- 5001-10,00 Baht	24	13.7
- More than 10,000 Baht	50	28.6
Total	**175**	**100.0**
Average = 4,634 Baht		

In addition to their occupation data, table 4 also provides their income and earning data. Majority of them earn about 4,000 to 7,500 Baht (about U.S. $120-220) with the average of 7,936 Baht per month. This average is about double the minimum wage for the province or equivalence with monthly salary for new college graduate. They, however, incurred about 2,433 Baht per month for fishing supplies that make their average net monthly income from fishing equal to 5,728 Baht. In addition, most of them have supplemental income from other activities such as farming, livestock, or fish farm. Their average monthly supplemental income is 4,634 Baht.

5. Summary

The environmental changes that occurred as a result of building a large dam can have negative impacts on peoples' ways of life. A careful and well plan reconstruction of the environment can turn the new environment to economic benefit of the people. This was the case at Sirikit Dam where after 25 years of construction. The large man made lake becomes the source of income for peoples in the area. Fishing activities from the lake contributed more than 29 million Baht to local economy. This experience can be used as guide line to develop other reservoir in order to make the dam more valuable

References:

All References material are in Thai Language and are available from author upon requested.