CHAPTER 5

FISHERY

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5.1 Fishery

5.1.1 Role of Fishery in the Economy of NBR

(1) General

In 1996, total fish production in NBR was about 16,364 million tons (refer to Table 5.1), which was worth about 490 million baht, or 3.24% of agricultural production.

Even though the fish production contributes to only about 0.73% of GDP, its value to the farmers is quite significant in terms of income generation, employment, and nutrition.

Table 5.1 Fish Production in NBR (MT)

Provinces	1992	1993	1994	1995	1996
Mukdahan	962	1,286	1,129	1,112	1,184
Nakhon Phanom	2,581	3,400	2,664	3,286	4,680
Sakon Nakhon	10,140	13,533	7,899	6,119	5,450
Kalasin	5,021	6,170	6,351	5,453	5,050
Total	18,641	24,389	18,034	15,970	16,364
% increment	00.00	30.8	(2.62)	(13.7)	(11.6)

Note: MT means million tons.
Source: DOF, Statistics 1996

(2) Fish Consumption and Nutrition

Since ancient time, fish has been a main source of animal protein of the people in NBR. Currently, the contribution of fish to the diet of people in the Study Area is supposedly about 5.3 kg/caput/year. All freshwater fish production in the area is

consumed locally. Since marine fish and freshwater fish from the central region are currently increasingly available and there are fish catch that are unrecorded, the amount of fish consumption may be much higher. In general, the protein intake of people in the study area is about 50 gm/day, of which fish contributes about 14.5 gm/day (Inland Fisheries Division, personal communication).

However, an FAO report in 1982 indicated that the protein deficiency rate in the northeastern region was about 43.8%, which may apply even now, though the percentage likely is lower. Due to high quality of fish protein and mineral contents of fish, fish consumption will undoubtedly increase and improve the nutrition of people in the Study Area.

(3) Employment

Among the 3,079,683 population in the Study Area, the work force (13-60 year old) number 2,120,000, of which 219,189, 469850, 753,009 and 678,321 are from Mukdahan, Nakhon Phanom, Sakon Nakhon and Kalasin, respectively (Ministry of Interior, 1998, Multimedia CD Rom). The full-time fishing population is statistically unknown but current estimation reveals that at least one household member in the rural area is engaged in fishing. It means that the fishery sector absorbs part-time employment of at least 600,000 people, or 28%, in the Study Area. If we convert this part-time fishing into fulltime equivalent, assuming part-time is about 1/8 of fulltime, the sub-sector can accommodate at least 75,000 persons/year, or about 3.54% of the total work force in the study area.

So, 3.54% of the work force produces 0.73% of GPP, comparing to agriculture where 60.7% of the work force produces about 23.25 % of the GPP.

5.1.2 Fishery in the Study Area

(1) Fish Catch

The trend of production is a constant fluctuation, from 18,641 MT in 1992 to 24,389 MT in 1913 and 16,364 MT in 1996. Among the four provinces, the highest contribution is from Sakon Nakhon, 5,450 MT, and the lowest is from Mukdahan, 1,184 MT. Taking the average increment from the year 1992 into account, the increment was about 0.72%/year, due to the high increment in 1993.

The fish is obtained from two activities; fish catch in natural and man-made waters, and fish culture. The breakdown of production from each portion in 1966 is shown in Table 5.2.

Table 5.2 Volume of Fish Catch and Fish Culture in the Study Area (MT)

Parameters	Mukdahan	Nakhon Phanom	Sakon Nakhon	Kalasin	Total
Fish Capture, 1996	675	2,047	3,854	2,425	9,001
Fish Culture, 1996	509	2,633	1,596	2,625	7,363
Total	1,184	4,680	5,450	5,050	21,861

Source: DOF, fishery statistic, 1996

The number of main fishing grounds in the Study Area is 368, 704, 939 and 498 in Mukdahan, Nakhon Phanom, Sakon Nakhon and Kalasin respectively. This account is only for natural water, such as rivers, canals and swamps. Apart from the grounds in natural water bodies, there are also many reservoirs constructed by Royal Irrigation Department, numbering 98 projects (85.9 mil. M^3), 158 projects (90.18 mil.M^3), 252 projects (695.03 mil.M^3) and 196 projects (144.7 mil.M^3) in the respective provinces (Ministry of Interior, Multimedia CD Rom). Table 5.3 shows the main fishing grounds of each province.

Table 5.3 Major Fishing Grounds in the Study Area

Provinces	Fishing Grounds	Districts	Area (Rai)
Mukdahan	Huay Muk Reservoir	Khamcha-ee	1,500
	Huay Kee Lek	Nikon Khamsoi	3,000
	Huya Pai Reservoir	Dong Luang	2,500
Nakhon Phanom	Mekong	Thatphanom, Muang, Ban Pang. Thatphanom, Nakae.	(283 Km)
	Nam Kam	Ta-uten, Srisongkram.	
	Nam Songkram		
Sakon Nakhon	Nong Han	Thatcherngchum, Muang.	77,016
	Nam Un	Pangkon	53,000
	Nam Pung	Phu Phan	12,800
Kalasin	Lam Pao Reservoir	Muang	180,000
	Huay Satod Reservoir	Huay Pueng	3,875
	Huay Phueng	Huay Pueng	2,078

Source: DOF, Fisheries Stations and Provincial Fisheries Offices

(2) Aquaculture

In 1996, fish production from aquaculture produced about 7,363 MT in the Study Area. The production is from ponds, paddy fields, and ditches. Cage culture exists but only at small quantities. The volume of production by aquaculture is shown in Table 5.4.

Table 5.4 Aquaculture Production in the Study Area in 1966 (MT)

Provinces	Pond Culture	Paddy-field culture	Ditch Culture	Cage Culture
Mukdahan	508	0.99	0.00	0.00
Nakhon Phanom	2,436	197	0.00	0.00
Sakon Nakhon	1,592	3.81	0.00	0.00
Kalasin	2,300	326	0.00	0.00

Source: DOF, Freshwater fish-farm production statistic, 1996

The species cultivated comprise 23 kinds. Popular species are confined to Nile Tilapia, common Carp, Silver Barb, Sepat Siam, Chinese Carps, Walking Catfish, Striped Snakehead and Catfish. Moreover, freshwater prawn (*Macrobrachium rosenbergii*) culture is widely distributed in the area, being the highest valued aquaculture product.

5.1.3 Institutional Framework

(1) Public Sector

There are a number of public sector organizations that are involved with fisheries development in Thailand, but the Department of Fisheries (DOF) is the major player. It is responsible for fishery regulations, extension service, research and development. The DOF works under the policy-making agency, the National Fishery Policy Committee, who sets up the guideline on fishery development in the country.

The DOF is composed of 24 divisions and 6 institutes. What is relevant to the Study Area is, firstly, the Inland Fisheries Division, which handles the provincial fisheries station. It functions as the seed production center with freshwater fish production program, volunteer program, community fish pond program, Thai fish rehabilitation program, stocking in natural water and selling to aqua-farmers for price controlling program and station recurring fund in the NBR. The provincial fishery stations accommodate altogether a 10-member technical staff and 177 non-technical employees. The details of each component such as manpower and seed production and utilization are shown in Table 5.5.

Table 5.5 DOF Manpower and Seed Production and Utilization in the Study Area

Station	Technical Manpower	Non-technical Manpower	Seed Production (Mill.)	Utilization, [1,2,3,4,5] (Mill.)
Mukdahan	3	36	22.1	1. = 15.2 2. = 0.9 3. = 0.3 4. = 2.2 5. = 1.5
Nakhon Phanom	3	37	21.1	1.= 20.0 2.= 3.6 3.= 0.4 4.= 0.0 5.= 2.1
Sakon Nakhon	2	63	45.0	1.= 28.0 2.= 0.9 3.= 0.3 4.= 0.5 5.= 0.0
Kalasin	2	41	34.0	1 = 26.5 2. = 0.9 3.= 0.25 4.= 0.00 5.= 6.3
Total	10	177	122.2	

Source: Inland Fisheries Division and Fisheries Stations of the respective provinces.

1 Freshwater fish production program
2 People volunteer and community fish pond program
3 Thai fish rehabilitation
4 Stocking in natural waters
5 Recurring fund

Second to the DOF, in terms of playing an active role in the Study Area, are the respective provincial fishery offices. These offices handle law enforcement as well as aquaculture extension. The numbers of personnel working in the respective provincial fishery offices at Mukdahan, Nakhon Phanom, Sakon Nakhon and Kalasin are 13, 24, 9 and 18.

In addition, there are the Fish Marketing Organization, Cold Storage Organization, Bank of Agriculture and Cooperatives and Department of Cooperative Promotion, who carry out tasks indicated by their titles.

(2) Private Sector

Among the many groups and associations of the private sector that are engaged in fisheries, the agricultural cooperatives have the most significant role. They support the fishermen and aqua-farmers by providing credit. In the Study Area, there are at least 188 agricultural cooperatives with a total membership of 290,700.

Table 5.6 Number of Agricultural Cooperatives and Members in the Study Area

Provinces	Number of Agricultural Cooperatives	Number of Members
Mukdahan	45	45,528
Nakhon Phanom	53	53,729
Sakon Nakhon	42	103,071
Kalasin	48	88,408
Total	188	290,736

Source: Ministry of Interior, Multimedia CD Rom

5.1.4 Support Services

(1) Researches and Extension

Overall, a number of researches regarding inland fisheries have been conducted on both catch and aquaculture fisheries. The institutes who have conducted such research are Kasetsart University (Faculty of Fisheries) and Khon Kaen University. The Department of Fisheries has their own research institutes, such as the National Inland Fisheries Institute, Research Institute for Ornamental Fish and Aquatic Plant, Research Institute of Fish Genetics, and Research Institute of Freshwater Fish.

Some researches have also been conducted in the fisheries stations in the Study Area. Table 5.7 describes some research topics carried out from the respective stations.

Table 5.7 Some Topics of Research Conducted in Fishery Stations in the Study Area

Fishery Station	Research Topics
Mukdahan	• Comparative production of fingerlings of Tilapia in cement tanks • Age Effect of spawners of Platapian Sai in Spawning • Cage Culture of Pla Krai • Biology of Pla Kang Buen in the Mekong
Nakhon Phanom	• Studies on Biology of Thread fish in the Mekong and its tributaries • Studies on Biology of Pla Tapak in the Mekong and its tributaries.
Sakon Nakhon	• Experiment on inorganic fertilizer applications for julian mud carp culture in ponds, • Cage culture of Tilapia in Nam Un on different frequency of feeding • Transfer of fish larvae to pond by PVC pipe • Fishery Biology of Pla Kasub Jud in Nong Han • Efficiency of Fishing Gears in Nong Han
Kalasin	• Density Effect of Culture of Pla Kaho • Nursing of Fingerlimg of Pla Rad in Cage, • Protein requirement of Pla Prom Fingerling.

Source: Inland Fisheries Division, DOF.

The extension service in fisheries is a task of the Provincial Fisheries Office. Each office has allocated two extension officers, whose tasks are registering the aqua-farmers, providing technical knowledge to farmers, training farmers and monitoring and following-up activities on fish culture.

(2) Education and Training

For undergraduate level, Khon Kaen University teaches a course in aquaculture, while there are few colleges providing diploma course in the NBR. Table 5.8 gives the names of the institutions in the respective provinces.

Table 5.8 Institutes Offering Courses in the Study Area

Province	Name of the Institutes
Mukdahan	none
Nakhon Phanom	none
Sakon Nakhon	Rajapat Institute
Kalasin	Rajmongkol Institute

Apart from such formal education, the Fisheries Stations also conduct short courses for the farmers in the area. In 1999, 50 courses have been organized to train 584 fish farmers in the study area. Among them, 3 courses (84 participants), 40 courses (350 participants), 3 courses (10 participants) and 4 courses (140 participants) were held in Mukdahan, Nakhon Phanom, Sakon Nakhon and Kalasin respectively.

5.1.5 Fishery Development and Trend

The average fish production has been decreasing continuously from 18,641 MT in 1992 to 16,364 MT in 1996, at a rate of 16.3% per year. The major increment is from aquaculture, while fish catch has remained constant for the past five years.

The decrease may be due to over fishing, particularly for subsistence. The Department of Fisheries, however, has exerted efforts to control any drastic decrease of fish production by providing seed stock to supplement the wild seed in the natural water bodies, such as flood plains, developed reservoirs and rivers.

But it is quite clear that to increase fish production from wild fish is difficult. This is due to high fishing intensity, deforestation, and water control that affect water regime and fish migration, and pollution from industrial chemicals and agricultural pesticides.

The contribution of aquaculture to fish production in the area was more or less 50% in 1996. The future development trend will chiefly be confined to aquaculture promotion. Intensive culture will inevitably be required to sustain the previous increment of fish production.

Fish handling and processing facilities in the area and its adjacent areas are quite adequate. There are some ice plants for preserving some high value species. The local villagers also carry out traditional fish processing, such as salting, smoking and fermenting. Among these, fermenting is the most popular in the area.

Majority of fish production is consumed in the area because the supply does not yet satisfy the demand. A large volume of fish is brought somewhere in central Thailand.

5.1.6 Future Fish Demand

(1) Consumption Trend

Data from the National Statistical Office reveals that Thai people in general spend about 40% of their total expenditure on food. The composition of food consumption is shown in Table 5.9.

Table 5.9 Composition and Percentage of Household Food Consumption

Composition	Percentage
Cereal Products	20.6
Meat and Poultry	15.0
Fish	12.8
Fruit and vegetables	11.2
Spices and seasonings	5.5
Eggs and dairy products	5.4
Oils and fats	2.0
Sugar and sweets	1.8
Prepare meals	25.6

Source: National Statistical Office

Fish are one of the major protein sources of the Thais. The Inland Fisheries Division, Department of Fisheries (personal communication), has estimated fish demand to increase about 3-4% per year, depending on the oil price variations.

Considering this trend into account, the demand of fishes from internal production in the Study Area will increase to as much as 2,886.3 MT in the year 2015, i.e. total demand will be about 19,250.29 MT. Detailed demand increase of five-year intervals is shown in Table 5.10.

Table 5.10 Estimated Fish Demand Increase in the Study Area up to Year 2015

Provinces	1996	2000	2005	2010	2015
Mukdahan	1,184	177.60	204.24	208.24	208.83
Nakhon Phanom	4,680	702.00	807.30	823.10	825.46
Sakon Nakhon	5,450	817.50	825.46	958.52	961.28
Kalasin	5,050	757.50	871.13	888.17	890.72
Total	16,364	2,454.60	2708.13	2,878.03	2,886.29

Source: JICA Study estimates

(2) Cross National Trade

The NBR is located near Lao PDR, where import of any kind of freshwater fishes, both fingerlings and grow-outs, is restricted. Even though smuggling of fishes is going on to a certain extent, a massive export is still impossible to accomplish. It is not only because of restriction from Lao PDR but also from the domestic production itself, which is insufficient even for the NBR.

5.1.7 Potential Development and Constrains

(1) Fish Catch

Even though there are huge fishing grounds in the Study Area that provide spawning, nursery, and growing grounds for wild fish, the production cannot be expected to increase further because the favorable environment for fish is threatened by agricultural and industrial pollution. Death of natural fishes in the rivers has been frequently reported in the media.

Accordingly, efforts to maintain and to increase the production of natural stock are very important. Large number of people, particularly the poorer segments of the population, take refuge on inland catch for both cash income and nutrition. To increase production in natural waters, catch fisheries must be inevitably encouraged.

(2) Aquaculture

Fragmented data available from Nakhon Phanom, Sakon Nakhon and Kalasin suggested that the number of fish farms have consistently increased during the last five years, as shown in Table 5.11.

Table 5.11 Number of Fish Farms in the Study Area

Provinces	1992	1993	1994	1995	1996
Mukdahan	n. a.	n. a.	n. a.	n. a.	n. a.
Nakhon Phanom	1,021	1,648	3,527	3,582	6,980
Sakon Nakhon	1,610	1,672	1,662	1,543	3,545
Kalasin	1,628	1,624	1,582	1,479	3,590

Source: DOF, freshwater fish farm production, 1996.

Even though there is a need to undertake more scientific surveys about the number and performance of private hatcheries, it can be assumed from the field observation and interviews that the fry production from both private and government hatcheries is not a problem in grow-out development.

Although the production from freshwater fish culture in the Study Area has been increasing every year during the last five years, the production increase is not significant enough to meet the increasing demand in the area. There is accordingly more potential to increase the production. To this end, the National Committee of Fisheries Policies has identified the major constraints in general: lack of marketing efficiency and insufficiency of infrastructure, and water management for freshwater fish culture.

Specifically, the constraint in the Study Area are pointed out as follows:

- Insufficient farm capital and technical knowledge, and infrastructure;
- Inadequate infrastructure such as water quality, power, and roads;
- Pollution from industry, households, and agriculture, which negatively affects aquaculture development;
- Inadequate manipulation of genetic improvement of culture fish in both present culture species and future potential species; and
- Lack of information system to the farmers, particularly about fish prices, demand and competition.

Through interviews of chiefs of fishery stations and provincial fishery officers, the following constraints regarding fishery development are clarified as summarized in Table 5.12.

Table 5.12 Constraints of Fishery Development Identified by Local DOF Officers

Respondents	Mukdahan	Nakhon Phanom	Sakon Nakhon	Kalasin
Fishery Station	Pond deterioration	Insufficient labor, budget, and scientific equipment	Pond deterioration, water quality at the beginning of rainy season.	Lack of aquaculture model for poor farmers, insufficient supply of freshwater prawn seeds, over production of Tilapia from cage culture.
Provincial Fishery Officer	Delay of delivery of all source, in turn not matching production season	Insufficient manpower, budget and vehicles for extension work	Insufficient manpower and vehicles for extension work.	Too high feed price Too limited extension result
Fish farmers	Lack of technical Knowledge	Lack of knowledge and market information.	Lack of knowledge and capital	No response

5.1.8 Fishery Development and Policy

The policy of fishery development, other than the management of natural water bodies, should be focused on:

- development techniques and method of aquaculture in order to increase the production;
- environmental protection to keep water quality for enabling aquaculture production; and
- encouragement and giving full support to aquaculture research.

For the technical development, first, the strategy should aim at lower production cost as well as increase of the production. Second, new species that have potential for

aquaculture and species already accepted as high value fish should be experimented upon both for propagation and grow-out. Third, the private hatcheries of high quality must be standardized and certified by the Department of Fisheries by providing technical and financial support. Fourth, appropriate breeding and nursing methods of high value wild species for stocking in natural water for commercial purpose and filling up an ecological niche should be taken into immediate consideration.

For environmental protection, first, law and enforcement in pollution control from both agricultural and industrial operation should be attended to immediately. Second, monitoring of water quality in sensitive areas for aquaculture should be given attention. Third, in the area that could be developed into an aquaculture estate, wastewater treatment from aquaculture must be incorporated and standard of discharging water should be promulgated. Fourth, control of chemical use either as feed ingredient or applied alone should be licensed. Fifth, newly established and large aqua-farms should be required to carry out an EIA.

For aquaculture researches, first, priority should be taken into account for the proper completion of the production cycle, such as breeding, nursing grow-out, feeds, diseases, and marketing. Second, upgrading a fishery station in the Study Area to be a research center for aquaculture. Third, freshwater prawn culture should be included as a first priority research theme.

5.1.9 Proposed Development Program

From the potentials and constraints, the following two programs are proposed in this study. The first program is to set up an aquaculture estate with full facilities. The second is freshwater prawn culture.

(1) Acquaculture Estate

Aquaculture estate aims at promoting an integrated freshwater fish culture with adequate environmental protection. The site and detailed activities will be elaborated through further studies. Accumulated knowledge of species to be cultivated, method of cultivation and marketing by DOF are indispensable to formulate the project.

(2) Promotion of Freshwater Prawn Culture

Freshwater prawn (*Macrobrachium rosenbergii*) has the highest potential for promotion in the NBR among the potential species, because of its high value in both domestic and foreign markets. However it requires a relatively large initial investment.

To promote the freshwater prawn culture in the NBR, the following should be taken into consideration:

- It is necessary to create a man-made hatchery to produce more young prawns. Freshwater prawn is spawned in brackish water with a salinity of about 13-15 ppt. The hatchery requires high technology of closed re-circulation system of brackish water originally carried from the sea and diluted at site to the required salinity. The hatchery will have to incorporate the efficient system of removal of suspended solids and harmful dissolved substances, disinfections, and balance of environment, such as pH and other parameters, for larval rearing; and
- The system of cultivation should also be developed to meet pond culture, ditch culture or paddy field culture.