# Pak Mun Dam Revisited

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As part of a report by the World Commission on Dams (WCD)[1] on dams and their impact on societies worldwide, the Thailand Development Research Institute (TDRI) undertook – under given terms of reference – to re-examine the economic premises of Thailand's Pak Mun hydroelectric project which was selected as one of WCD's case studies. The construction of Pak Mun dam by the Electricity Generating Authority of Thailand (EGAT) began in 1990. As a flagship state enterprise, EGAT has had long-standing acknowledged record of generously compensating and providing exemplary aftercare community welfare for people dislocated by its projects. According to the baseline survey, about 250 households needed to be re-settled representing 20 percent of the total households in 11 villages directly affected by the risen water level upstream of the dam in the dry season. The dam's structures and installations were completed in 1994 and Pak Mun was fully commissioned in 1995 to produce electricity, regulated by floodgates, from the flows of the Mun river in Thailand's northeast.

In re-assessing Pak Mun as a power project, TDRI's report[2] concluded that the economic case *a priori* for the dam as presented by EGAT's project feasibility study[3] was dubious. The report found the assumptions of the EGAT study exceptional and the project's re-calculable net benefit at best marginal. The decision of the Council of Ministers (the Cabinet) to approve Pak Mun's construction, and the World Bank's subsequent endorsement of the project's justification[4] in agreeing to finance it, rested on EGAT's claims of benefits in terms of the dam's peak load energy output.

It is not unusual in cost-benefit analyses of power projects to solve for the least-cost investment solution to a given load forecast scenario. The feasibility of a proposed project is then decided by the difference in its costs in comparison to the next-best alternative investment yielding similar benefits. In the case of Pak Mun, EGAT assumed for comparable alternative investment a gas turbine plant of 150 MW capacity. But Pak Mun's run-of-the-river design depends on the characteristics of the Mun's flows to generate energy load under pre-set operating rules. Such flows predictably vary with the hours of the day, the months, and in particular with the seasons: the dry season between January to May and the rainy season thereafter. The dam's dependable capacity for energy output – estimated at 75 MW in the feasibility study – was a calculated balance between regulated run-offs and the Mun's daily and seasonal flows. The power generation regime was programmed for energy production within set water level limits upstream of 105 meters and 108 meters MSL respectively for the dry and the rainy seasons. Energy output under the operating regime, estimated at 280 GWh annually, together with the dam's restricted height of 17 meters and its selected location 5.5 kilometers from the point of confluence of the Mun with the Mekong, were designed to minimize the need to relocate households on the riverbanks affected by the water level. A higher elevation of the dam structure at any point further upstream, or any higher peak load output under a different power generation regime with less restrictive water level limits, would have added to the project's financial costs in compensations resettlements of households and to the economic costs of dislocations and environmental impacts. But within the parameters of the given design and restrictive operating rules, EGAT's project document nonetheless confidently rested the dam's economic case squarely on the value added in peak load electricity production, and included no supplementary benefits in irrigation (or the associated necessary costs) in its calculations.

As it turned out, the project's cost overruns were considerable. The financial costs of the dam and its installations were 63 percent above the original estimates as first presented to the Council of Ministers. Overruns of the compensations, resettlement and environmental components were very significantly higher. At the closing of project accounts in 1995, the accumulated payments for compensation, resettlement, and environmental impact mitigation totalling over 800 million baht were 3.5 times over the feasibility study's estimate of 230 million baht. Nonetheless compensations continued to be paid out by EGAT to a sum total of over 1,100 million baht thereafter to 1998. The continuing compensation payments, on the government's instructions, were made under rulings not foreseen nor provided for in the project's feasibility study. They related to claims of lost livelihoods in fishery, which were extended to those of households in villages outside the core project area and to some which were downstream of the dam. The compensation process was a protracted, public

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and serial affair, not without political dimensions. The negotiations on behalf of the villagers were organized, punctuated and brokered by NGO's.

More importantly, it was also becoming evident in the few years following the dam's commission that neither the operating rules nor the actual water flows supported the level of sustained peak load energy output and management as envisaged in the feasibility study. TDRI's report noted the study's questionable conceptual relationship between the dam's rated dependable capacity of 75 MW, and the 150 MW capacity of the gas turbine alternative power plant used in proxy to estimate the dam's economic benefits. The difference in the respective capacities was crucial to EGAT's method of analysis, for if the capacity and the costs of the alternative power plant were overstated, so also would be the project's benefits which were assumed to be the net difference in costs avoided by *not* investing in the alternative. The point is further reinforced when Pak Mun's peak and off-peak power outputs cannot be differentiated from accessible operational records, but available hydrological data suggest that only a fraction of the dam's total annual energy output can be put to peak load demand. The economic benefits *a posteriori* of Pak Mun as a power project therefore remain questionable and unproven, whereas the environmental costs of the impact on the Mun's fish population – particularly the migratory species – and the difference that the dam's operating rules make on fishery in the long term, are self-evident although unmonitored. By way of mitigating the dam's impact on fish spawning grounds upstream, a concrete fish ladder had been added to the dam structure. But it was in the nature of an afterthought. The ladder's design was untested for the purpose and its intended benefits with respect to each migratory species of fish and on the varieties of the Mun's riverine life cycle were undetermined.

Environmental impacts of the dam – mainly on the fish species – certainly added to the project's real costs, but were either unquantified or understated in the feasibility study. Re-examination of the cost-benefit premises and of the facts at hand suggests that the dam's transparent failure to deliver the expected load output is enough to undo the calculation of net benefits over costs assumed in the feasibility study. The balance of evidence *against* Pak Mun as an economically feasible investment stands on the diminished benefits of its peak load output, without weighing in the added costs on the environment. In deciding whether to accept or reject the project's economic case as appraised, costs to the environment are moot. On EGAT's own terms of project feasibility based on energy output alone, the project's costs already outweigh the benefits.

It does not necessarily follow however that in failing the test of good investment, Pak Mun should now be closed down. In the post-construction phase, resources that have been invested in the dam and its installations become 'sunk costs'. No value is assigned in project analysis for sunk costs, which are in effect written off the project's balance sheet. Cost-benefit analysis can then be conducted under a timeframe put forward. The current and future benefits if any of an ongoing project are then tested against whatever may remain of its ongoing costs. Such a test corresponds to the shift in focus from project re-assessment, looking back to the previously assumed premises, to the justification of continuing operations. It addresses the issue of the dam's ongoing power generation, the question of whether or not the project should terminate, and if some or all of Pak Mun's flood-gates should be to be opened and the barrage lifted for some or all periods of the year. In particular, it addresses the future stream of costs in which sunk costs do not figure, and measures them against the future stream of benefits.

This was the context of the recently-completed report commissioned by the government to investigate the dam's latent impact and to recommend an acceptable solution for the future.[5] From the perspective of cost-benefit analysis, interest was focused on estimated income losses from fishing on the Mun as a livelihood since the dam's construction, and on the gains that could be expected from re-opening the floodgates and turning back the environmental clock.

The economic value of fishing as livelihood was a neglected variable in the Pak Mun feasibility study, despite EGAT's commissioning of an environmental impact study to establish local socio-economic benchmarks prior to the dam's construction. Compensations had first been conceived primarily as payments for land and material properties affected by the dam's construction and the water level, not for lost or reduced livelihoods. By the time it became necessary to compensate the villagers against claims of lost income from fishery, it was also necessary to reconstruct the pre-project benchmarks with belated *ad hoc* surveys. The circumstances of the reconstructions were however not ideal for the collection of uncorroborated income data spanning periods before and after an event over which the authorities were seen to be giving ground – on the terms and scale of the compensations. The respondents to such survey questionnaires were largely confined to the population of eligible villages. Generally there has been no verifiable information elicited on the unit prices, quantities, and the kinds of indigenous fish caught and sold for the declared cash incomes.

Over the period of January to July 1994 EGAT and the Department of Fisheries (DOF)[6] recorded the species, numbers, and the respective weights of fish caught by beach seine in the Mun and downstream Mekong river in the vicinity of the dam site. The ten most abundant species are listed in Table 1 in italics. Their relative percentages by number and weight are shown against the prices in baht per kilogram as compiled in a study by the Southeast Asia Rivers Network (SEARIN)[7] activist research team on the Mun fish population based on interviews with local villagers. For every 100 kilogram catch weight, these ten most abundant species can be expected to account for 51 kgs. based on the frequency distributions by weight of catches as recorded by EGAT and DOF, with a combined current

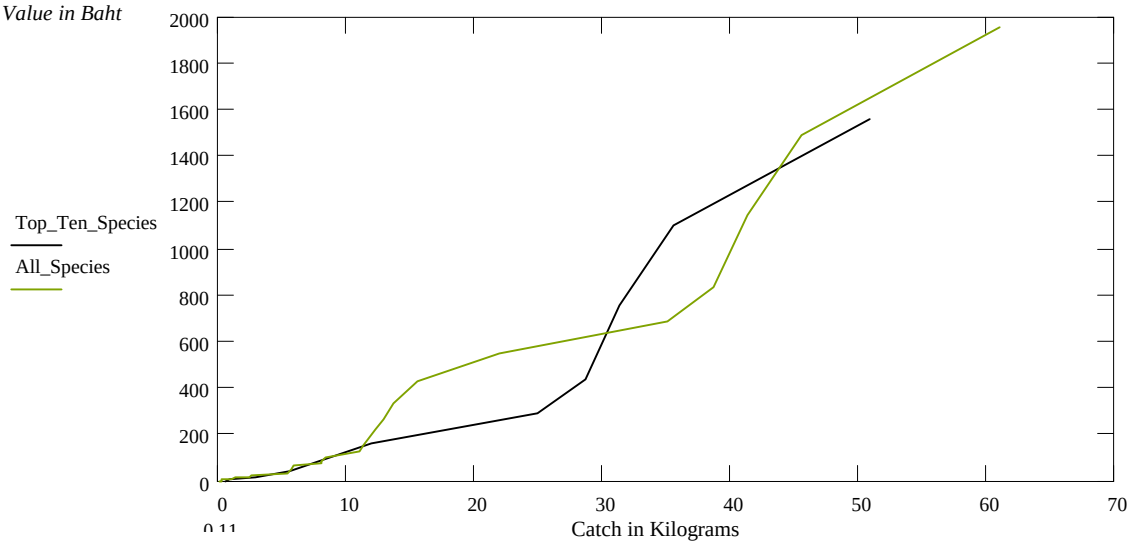
value of 1,564 baht based on the estimated unit prices of the respective species. The less abundant species below the top ten are also shown in Table 1 corresponding to the SEARIN research group's compilation of species and known prices. These relatively less common species can be expected to add 10 kgs. to the weight and 530 baht to the value, making a total saleable weight of 61 kgs. and cash value of 1,953 baht for every 100 kgs. of catch weight as shown in comparative X-Y plots of values against weights in Figure 1.

**Table 1 Listing of the Mun's Fish Species by Relative Abundance with Known Market Values**

| Scientific Name | Common Name | Local Thai Name | % Number | % Weight | Baht/Kg |
|---|---|---|---|---|---|
| *Sikukia gudgeri* | *sikukin barb* | *ปลาบักมัง* | *20.82%* | *13.07%* | *10* |
| *Paralaubuca riveroi* | *glassfish* | *ปลาแตบ* | *8.38%* | *2.64%* | *8* |
| *Henicorhynchus sp.* | *barb* | *ปลาสร้อย* | *7.30%* | *15.36%* | *30* |
| *Hampala dispar* | *eye-spot barb* | *ปลาสูดจุด* | *6.23%* | *6.34%* | *20** |
| *Mystacoleucus greenwayi* | *yellow-fin carp* | *ปลาเกเกาะ* | *6.14%* | *2.09%* | *5** |
| *Pangasius macronema* | *Siamensis pangasius* | *ปลายอนหยวก* | *5.65%* | *4.27%* | *80* |
| *Parambassis notatus* | *glassfish* | *ปลาค้บของ* | *4.86%* | *0.68%* | *5* |
| *Puntioplites proctozysron* | *smith barb* | *ปลาสกางแปร* | *4.10%* | *3.65%* | *40* |
| *Clupeichthys aesarnensis* | *Thai river sprat* | *ปลาแก้ว* | *3.84%* | *0.25%* | *20* |
| *Cyclocheilichthys enoplos* | *soldier river barb* | *ปลาโจก* | *2.91%* | *2.65%* | *120* |
| Acanthopsis choirorhyclus | thorn-eye, loach | ปลารากกล้วย | 2.30% | 2.00% | 45 |
| Pangasius pleurotaenia | catfish | ปลายอนตาโล | 2.25% | 0.53% | 70 |
| Cyclocheilichthys apogon | Indian river barb | ปลาดอกงิ้ว | 1.07% | 1.16% | 5 |
| Osteochilus hasselti | bony lipped barb | ปลาอีไท่ | 1.03% | 2.82% | 3 |
| Probarbus labeamajor,(julienni) | golden-price carp | ปลาเอิน | 0.57% | 0.61% | 80 |
| Tenualosa thibaudeaui | Laotian shad | ปลาหมากผาง | 0.46% | 0.11% | 5 |
| ***Oxyeleotris marmorata*** | sand goby | ปลาบู่ | 0.18% | 0.35% | 80 |
| Raiamas guttatus | carp | ปลาสะนาก | 0.17% | 0.23% | 5 |
| Pangasius larnaudii | black-ear catfish | ปลาปึ่ง | 0.14% | 0.68% | 100 |
| Macrognathus siamensis | spiny eel | ปลาหลดนา | 0.12% | 0.25% | 70 |
| Cirrhinus sinensis | mud carp | ปลาแกง | 0.07% | 0.07% | 40 |
| Mystus cavasius | long fatty-finned mystus | ปลากะแยงขาว | 0.05% | 0.22% | 45 |
| Kryptopterus apogon | common sheatfish | ปลาน้ำเงิน | 0.04% | 0.11% | 80 |
| Kryptopterus bleekeri | sheatfish | ปลานาง | 0.03% | 0.09% | 120 |
| ***Osteochilus melanopleura*** | greather bony lipped barb | ปลานกเขา | 0.02% | 0.24% | 40 |
| Mystus nemurus, Hemibagrus nemurus | yellow mystus | ปลากดเหลือง | 0.02% | 0.08% | 80 |
| Mastacembelus armatus | armed spiny eel | ปลาหลาด | 0.02% | 0.45% | 70 |
| Chilata blanci | striped featherback | ปลาตองลาย | 0.01% | 0.01% | 70 |
| Kryptopterus cryptopterus | sheatfish | ปลาปึกไก่ | 0.01% | 0.02% | 50 |
| Cirrhinus microlepis | small-scale mud carp | ปลาพอน | 0.01% | 0.01% | 60 |
| ***Total*** | | | **78.80%** | **61.06%** | |

Note: Prices with asterisks (*) are estimates for the top ten most abundant species with no known market prices. All others are the reported local market values from SEARIN study, from which are also taken the local Thai names for the species.

**Figure 1 Fish Catch Value from the Mun and Weight Sampling Data 1994 at Current Prices**



The most abundant species are not the most marketable. The more valuable species make up a very small proportion of the catch. The data in Table 1 suggest that the ten most abundant species of fish account for 70.2 percent of the total number of all species caught, and for 80 percent of the known cash value at current prices, with a mean of 19.53 baht per kilogram of catch. The crucial variables which underlie typical household fishing incomes are the frequency distributions of the species population, their respective catch weights and the market values. The sampling catch data collected by EGAT and DOF in 1994 therefore provided one yardstick in relation to which any estimate of past or future incomes derived from fishing on the Mun and in the vicinity of the Pak Mun dam should be calibrated, and against which the basis for fishery income claims should be checked.

Table 2 reproduces the average annual catch weights and net household fishery income figures from the results of past surveys from 1982 to 1999[8] which were cited in the WCD report on Pak Mun,[9] to which were added the results of the latest survey by Ubon Ratchathani University in 2000. The catch weights and income figures are shown in phases: for the pre-dam years, for the period of construction, and for post-dam years, listed by the year of publication of the survey findings. The income value per kilogram of catch in each case is calculated from the given catch weight and the given income figure where both are available.

The widely varying ranges of the surveyed incomes from fishery spanning the different phases – from as early as 1982 to 2000 – as tabulated in Table 2 appear far from being conclusive, particularly with regard to the order of magnitude of the differences between the mean pre-dam fishery incomes recollected by affected householders and the much-reduced mean incomes for the post-dam phase. In the particular case of the Ubon Ratchathani University survey in 2000,[10] the reported difference between 1990 pre-dam net income (25,742 baht) and 2000 post-dam (3,045 baht) is eight-fold. More significantly, the highest mean income per household for the pre-dam phase in one survey (69,035 baht) which was undertaken specifically for the WCD in 1999, varies by as much as twelve-fold over the lowest (5,577 baht) from another study undertaken prior to the dam's construction in 1991.[8] The differences in the findings which are summarized in Table 2 raise the basic and pertinent questions of supporting evidence going beyond recollected past income figures regarding the underlying and corresponding catch weights, fish species, and market prices.

**Table 2 Pak Mun: Average Annual Fish Catch and Fishery Net Income Per Household**

| Phase | Kgs | | Baht | | Baht per Kg | | *Author / Institution* |
|---|---|---|---|---|---|---|---|
| | upstream or unspecified | down-stream | upstream or unspecified | down-stream | upstream or unspecified | down-stream | |
| Pre-Dam | 1,171 | 688 | 13,872 | 9,146 | 11.85 | 13.29 | *Kasetsart University*[1] |
| Pre-Dam | | | 5,577 | | | | *Thongkam et al., EGAT*[2] |
| Pre-Dam | 7,590 | | 69,035 | | 9.10 | | *S.Choowaew, Mahidol University*[3] |
| Pre-Dam | | | 25,742 | | | | *Ubon Ratchathani University*[4] |
| Construction | | | 5,500 | | | | *P.Subsakul, AIT (M.Sc. thesis)*[5] |
| Construction | 652 | | 13,428 | | 20.60 | | *Khon Kaen University*[6] |
| Post-Dam | | | 8,758 | | | | *S.Phupaiboon, NIDA (M.A. thesis)*[7] |
| Post-Dam | 763 | | 19,047 | | 24.96 | | *Department of Fisheries, MOAC*[8] |
| Post-Dam | 422 | | 8,695 | | 20.60 | | *Khon Kaen University*[9] |
| Post-Dam | 507 | | 6,422 | | 12.67 | | *S.Choowaew, Mahidol University*[3] |
| Post-Dam | | | 3,045 | | | | *Ubon Ratchathani University*[4] |

References:
1 Kasetsart University. Faculty of Fisheries. Fishery Resources in the Pak Mun River Basin, Ubon Ratchathani Province. Bangkok, 1982.
2 Thongkam et al. Fisheries Resources and Socio-Economic Study in the Lower Mun River. Fishery and Weed Control Section, Technical and Chemical Analysis Division, EGAT, 1991.
3 Sansanee Choowaew. Social Aspects of Fisheries, Mekong River Basin / Pak Mun Dam Case Study for WCD. March 2000, from 63 cases surveyed in October 1999.
4 Ubon Ratchathani University. Project to Study Approaches to Restoration of the Ecology, Livelihood, and Communities Receiving Impacts from Construction of Pak Mun Dam. Ubon Ratchathani, September 2002.
5 P. Subsakul. Socio-economic Impact of Resettlement due to Dam Construction: the Case of Evacuees of Pak Mun Dam. M.Sc. thesis, Asian Institute of Technology. December 1994.
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7 S. Phupaiboon. The Economic and Social Impact Study of the Pak Mun Evacuees. Master Thesis (Social Development), NIDA. 1995.
8 Department of Fisheries. Report of Research Project on Fundamental Data of Fisheries Resources and Migratory Behaviours of Fisheries in Pak Mun Project Area. In Co-operation with EGAT, Phase 1 June 1995, Phase 2 September 1995.
9 Khon Kaen University. Monitoring Environmental Impact Changes: Socioeconomics of Relocated People of Pak Mun Project, Final Report. For EGAT. 1997.

Since the completion of TDRI's report on Pak Mun for WCD in early 2000, the bi-annual National Rural Development Committee (NRDC) village census results for the years 1999 and 2001 have become available. These additions to the NRDC database complement the series from 1990 to 1996 on household incomes and other census variables indicative of rural livelihoods and welfare which were used in TDRI's report to analyze the social and economic impact of the dam. Figure 2 shows the household annual incomes from fishery of villages in the Pak Mun project area, for all the years of the NRDC census from 1990 to 2001, in percentiles and in baht value. The villages that make up the project area are defined as those in the core project area whose householders' land or properties have been affected by the construction of the dam or by its reservoir water level, and other villages whose householders have otherwise been compensated for losses in fishery livelihoods.

The NRDC database shows that in all the census years but one from 1990 to 2001, the median annual incomes from fishery in the project area villages have secularly risen, from 3,000 baht per household in 1990 and 1992 up to 8,000 baht in 2001. Only the 1994 census recorded a decline to 2,000 baht. This is represented in Figure 2 as a rightward shift, except for 1994, in the income percentile schedules, in which the median household fishery income for any year is the point at which the respective schedule crosses the 50$^{th}$ percentile line. With reference to the surveyed income figures in Table 2, a post-dam annual fishery income of 3,045 baht would place a household well below the observed median, at a point between the 18$^{th}$ - 19$^{th}$ percentiles, in the 2001 NRDC census, whereas a pre-dam income of 25,742 baht would put a household well above the highest observed typical income per household from fishery in all the villages in the project area as recorded in the 1990,1992, and 1994 NRDC census data.

The additional census data for the years 1999 and 2001 do not detract from the conclusions of TDRI's report on Pak Mun which were drawn from the NRDC database up to the year 1996.[11] The added data indeed reinforce the report's analysis of the quantitative evidence from the database which suggested that financial compensations actually paid out against claims of reduced livelihoods in fishery on the Mun had been generous, and that the villages in the project area had become absolutely and relatively better off in terms of known incomes and other observable indicators of economic opportunities and welfare. From the database, Table 3 compares the household incomes from fishery and from paddy – the production of which has always been the principal means of rural livelihood – of villages in the Pak Mun project area as against other villages in the rest of the northeast and in all others in the country. The comparative figures show that although the median household fishery incomes of villages in the project area are consistently higher than elsewhere in the northeast, as well as in all other rural villages in the rest of the country except for 1994, such incomes do not exceed the median household incomes deriving from paddy production. Fishery incomes do not constitute the main livelihoods except for rare cases at the higher extremes of the percentile range, although they are significant supplementary cash income sources of villages in the project area relative to the rest of the northeast and the rest of the country.

**Figure 2 Annual Household Fishing Income in Pak Mun Project Area**

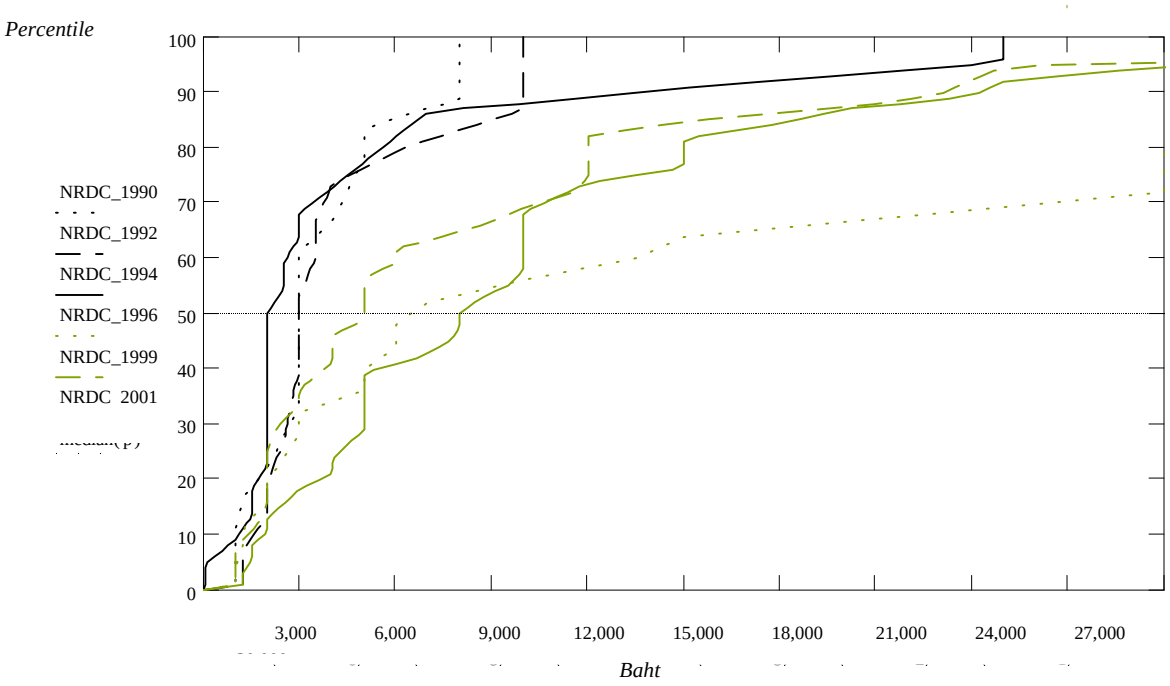


**Table 3 Rural Household Annual Incomes from Fishery and from Paddy Production Compared**

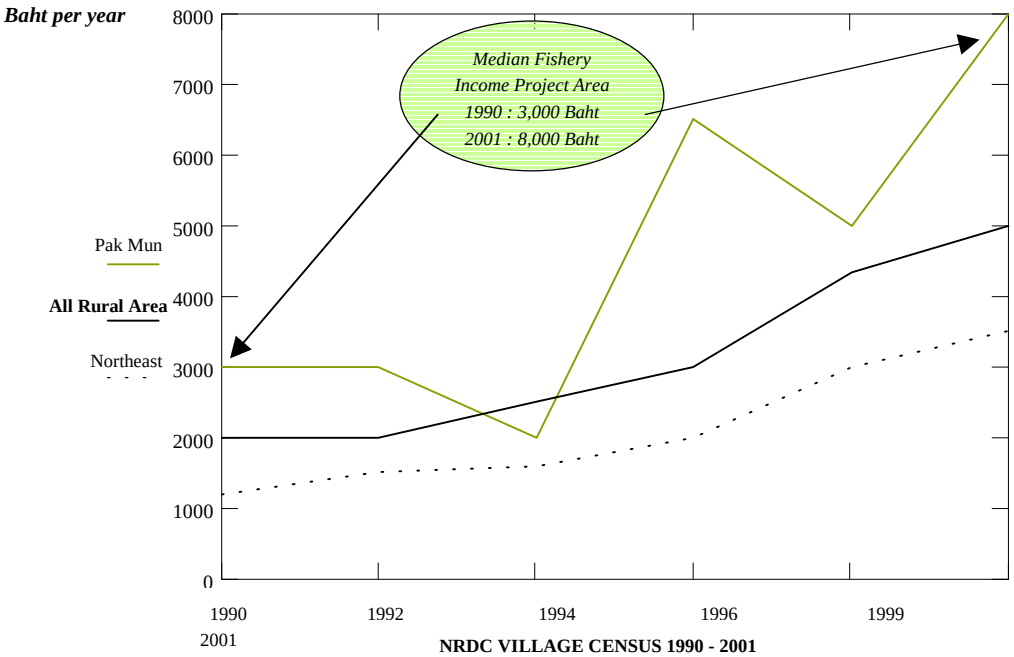
*Unit: Baht*

| | NRDC 2001 | NRDC 1999 | NRDC 1996 | NRDC 1994 | NRDC 1992 | NRDC 1990 |
|---|---|---|---|---|---|---|
| ***A. Fishery Income*** | | | | | | |
| *1. Project Area Villages* | | | | | | |
| *Samples* | 37 | 38 | 24 | 21 | 14 | 17 |
| *Mean* | 10,130 | 8,298 | 14,180 | 4,335 | 4,050 | 3,541 |
| *Standard Deviation* | 8,618 | 9,410 | 13,710 | 5,681 | 2,781 | 2,073 |
| *Median* | 8,000 | 5,000 | 6,500 | 2,000 | 3,000 | 3,000 |
| *2. Northeast Villages* | | | | | | |
| *Samples* | 3,513 | 3,241 | 2,660 | 2,799 | 3,570 | 3,970 |
| *Mean* | 6,972 | 6,324 | 5,710 | 4,241 | 3,329 | 2,568 |
| *Standard Deviation* | 10,800 | 11,230 | 40,570 | 38,380 | 11,440 | 6,475 |
| *Median* | 3,500 | 3,000 | 2,000 | 1,600 | 1,500 | 1,200 |
| *3. All Rural Villages* | | | | | | |
| *Samples* | 6,660 | 5,904 | 4,641 | 4,955 | 5,939 | 6,567 |
| *Mean* | 12,050 | 14,090 | 12,300 | 9,978 | 7,973 | 6,378 |
| *Standard Deviation* | 27,760 | 123,000 | 55,000 | 48,770 | 27,490 | 35,800 |
| *Median* | 5,000 | 4,338 | 3,000 | 2,500 | 2,000 | 2,000 |
| **B. Paddy Income** | | | | | | |
| *1. Project Area Villages* | | | | | | |
| *Samples* | 20 | 11 | 30 | 32 | 36 | |
| *Mean* | 24,020 | 27,550 | 22,330 | 20,030 | 15,060 | |
| *Standard Deviation* | 11,360 | 4,569 | 9,164 | 9,156 | 4,706 | |
| *Median* | 24,000 | 28,000 | 21,250 | 22,000 | 15,000 | |
| *2. Northeast Villages* | | | | | | |
| *Samples* | 12,950 | 12,750 | 11,670 | 11,490 | 11,100 | |
| *Mean* | 29,210 | 29,390 | 19,200 | 16,110 | 14,860 | |
| *Standard Deviation* | 88,280 | 158,800 | 17,010 | 16,250 | 20,570 | |
| *Median* | 20,000 | 20,000 | 15,000 | 13,000 | 12,000 | |
| *3. All Rural Villages* | | | | | | |
| *Samples* | 25,170 | 24,380 | 22,900 | 22,990 | 22,750 | |
| *Mean* | 37,590 | 35,870 | 24,490 | 21,720 | 20,940 | |
| *Standard Deviation* | 94,570 | 125,300 | 21,340 | 22,720 | 22,900 | |
| *Median* | 27,000 | 25,000 | 20,000 | 16,700 | 15,000 | |

Note: NRDC 1990 data on household income from paddy production are not available.

Figure 3 represents graphically the median household incomes from fishery of villages in Pak Mun project area for the years 1990-2001 as shown in Table 3 in comparison with villages in the rest of the northeast and the rest of the country. The economic justification for Pak Mun dam as advanced by EGAT and as supported by the World Bank rests on doubtful grounds, and the project may in time be proven a misjudgement of catastrophic proportions in ecological terms, but the primary case against the dam and its continuing operations cannot reasonably be mounted on lost fishery incomes or unfair compensations for reduced livelihoods from fishery.

**Figure 3 Median Income per Household from Freshwater Fishery (Baht @ 50th Percentile)**



The higher values of median incomes derived from fishery in Pak Mun area as indicated in the census data are consistent with the higher median percentages of households in the project area engaging in fishery as livelihood. Table 4 shows the total number of households in villages reporting activity in freshwater fishery, the number of the respective village's households so occupied, and the median percentages of fishery households in the total number, for villages in Pak Mun project area, in the rest of the northeast, and in all other rural villages in the country.

The comparative median percentages of households engaged in fishery for the different classifications of villages by area are represented in Figure 4. Fishery households in Pak Mun area rises from 36 percent of all households in 1990 to a high of 82 percent in 1996, settling down to 68 percent in 2001. In contrast, the median percentages of fishery households for villages in the rest of the northeast are relatively stable at 21-24 percent throughout the period, spanning back to the pre-dam census years of 1990 and 1992, and similarly for villages in the rest of the country at 13-15 percent of all households.

The percentiles of household fishery incomes for Pak Mun villages compared with the rest of the northeast and the rest of the country in 2001 are shown in Figure 5, which represents an approximation of the current situation pending the results of the next village census in 2003.

**Table 4 Proportions of Fishery Households Engaged in Fishery as Livelihood**

| NRDC | TOTAL NUMBER OF HOUSEHOLDS | | | FRESHWATER FISHERY HOUSEHOLDS | | | *Median % of Fishery Households* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *All Rural Area* | *Northeast* | *Pak Mun* | *All Rural Area* | *Northeast* | *Pak Mun* | *All Rural Area* | *Northeast* | *Pak Mun* |
| 2001 | 868,891 | 401,459 | 5,379 | 164,019 | 111,693 | 2,780 | 13.9% | 21.9% | 35.7% |
| 1999 | 746,407 | 371,124 | 3,782 | 140,929 | 99,887 | 1,877 | 14.3% | 22.2% | 48.2% |
| 1996 | 557,435 | 293,578 | 2,907 | 120,417 | 85,444 | 2,142 | 14.4% | 24.1% | 40.6% |
| 1994 | 587,069 | 297,530 | 2,128 | 127,881 | 94,222 | 839 | 15.1% | 21.8% | 81.5% |
| 1992 | 674,305 | 375,089 | 1,351 | 157,593 | 118,444 | 589 | 13.2% | 20.5% | 67.2% |
| 1990 | 752,061 | 430,276 | 1,774 | 184,415 | 138,921 | 587 | 12.7% | 20.7% | 68.2% |

Note: Selected data from villages reporting total households, freshwater fishery households, and fishery income per household.

**Figure 4 % Households in Fishery**

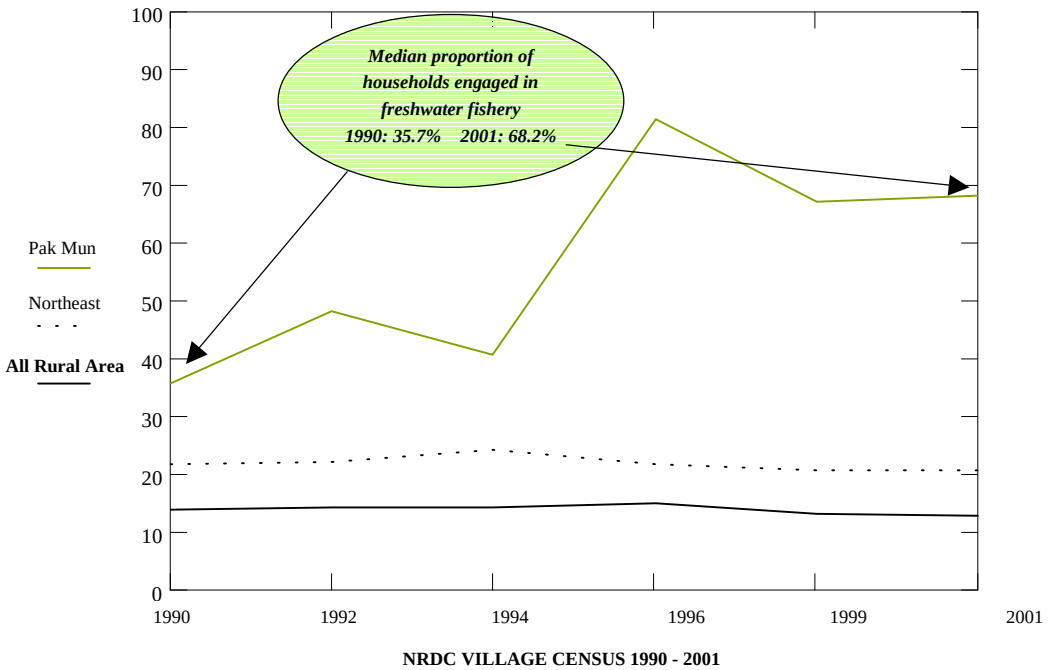
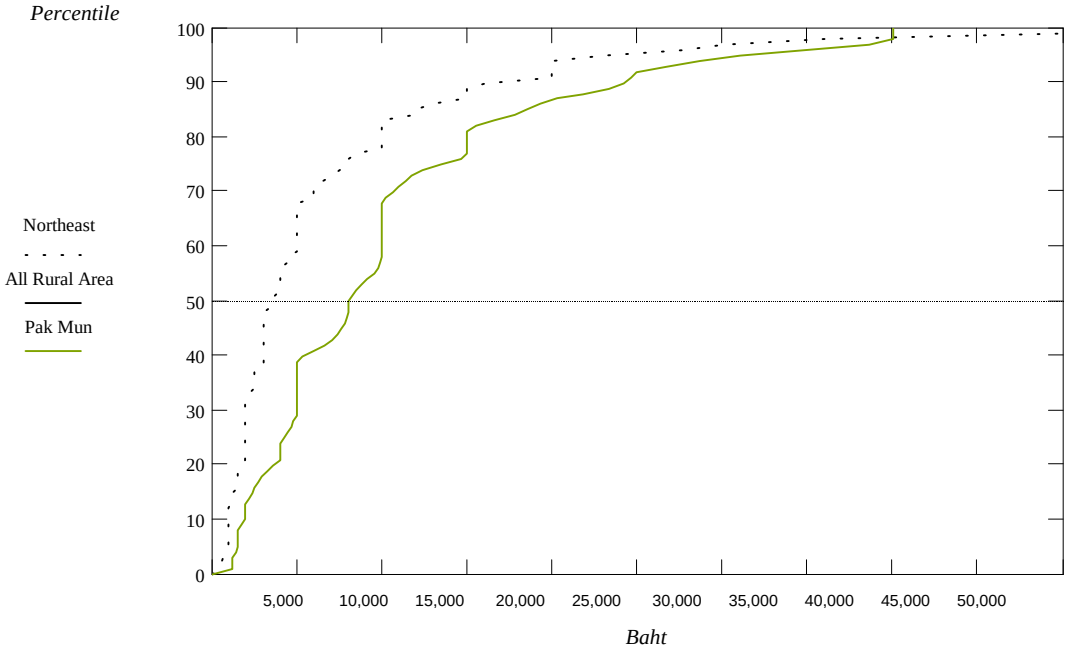


**Figure 5 Annual Household Freshwater Fishery Incomes**




Despite recognized shortcomings, the NRDC data series exhibit an evident degree of consistency and continuity in absolute as well as in relative terms, to which past *ad hoc* surveys of local incomes should at least have given a passing nod of acknowledgement or qualification, and to which future studies might be expected to address. Pending definitive and quantitative evidence to the contrary, the NRDC village census data show not only that Pak Mun fishing householders are not worse off than before in the pre-dam years in absolute terms, but also that they yet remain relatively better off, more of them deriving more incomes from fishery than elsewhere.

## ENDNOTES

1 Following the completion of the World Commission on Dam's terms of reference with the publication of its report, WCD Secretariat's functions are re-assigned to and continue under Dams and Development Project of the United Nations Environment Programme (UNEP).

2 TDRI, *Pak Mun Dam Case Study*, for the World Commission on Dams, March 2000.

3 EGAT, Hydropower Engineering Department, *Summary Report: Pak Mun Multipurpose Development Project*, March 1988 (Report No. 31100-3103).

4 World Bank, *Thailand: Third Power System Development Project – Staff Appraisal Report*, Report No. 9173-TH, July 29,1991.

5 Ubon Ratchathani University, *Project to Study Approaches to Restoration of the Ecology, Livelihood, and Communities Receiving Impacts from Construction of Pak Mun Dam*, September 2002.

6 Department of Fisheries, *Report of Research Project on Fundamental Data of Fisheries Resources and Migratory Behaviours of Fisheries in Pak Mun Project Area*, In Co-operation with EGAT. Phase 2, September 1995, Table 14, p. 41.

7 SEARIN (Thailand), Mun River: The Return of the Fisherman (เครือข่ายแม่น้ำเอเชียตะวันออกเฉียงใต้ (ประเทศไทย), แม่มูน การกลับมาของคนหาปลา บทสรุป และความรู้เรื่องปลาของคนปากมูน / งานวิจัยไทบ้าน). October 2002, pp. 25-62.

8 Sansanee Choowaew, *Social Aspects of Fisheries, Mekong River Basin / Pak Mun Dam Case Study for WCD*. Faculty of Environment and Resource Studies, Mahidol University, March 2000, Table 8, p. 9.

9 World Commission on Dams, The Pak Mun Dam in Mekong River Basin, Thailand. Final Draft, October 2000 Section 4.6 Impact of Pak Mun Project – Social Aspects, Tables 28, 30, pp.52-53.

10 Ubon Ratchathani University, *Project to Study Approaches to Restoration of the Ecology, Livelihood, and Communities Receiving Impacts from Construction of Pak Mun Dam*, September 2002, p. 6 – 7.

11 World Commission on Dams, Pak Mun Dam Mekong River Basin Thailand, Draft Report for Discussion at the Stakeholder Meeting on 23rd February 2000, Pak Mun Dam Case Study by TDRI, pp.12-17.