AN INTEGRATED ASSESSMENT OF INDONESIAN RIVER FISHERY RESERVES. PART 4. SOCIO-ECONOMIC STUDIES AND THE DISTRIBUTION OF FISHERIES COSTS AND BENEFITS.

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ABSTRACT

This paper describes the socio-economic studies undertaken by the DFID-funded 'River Fisheries Reserves' project (see Part 1 paper for introduction and study design). Complementing the biological studies of reserves and fished study sites (Part 3), this paper looks at fishers' catch rates, the economic surplus of fishing, and its distribution in selected study villages. Such socio-economic indices are more dependent on the wider management arrangements and fishing practices used in the villages and require the most integrated and holistic analysis. The catch rates estimated here from household and leaseholder surveys were broadly correlated with fish abundances estimated from the biological studies (Part 3). Scaled by the unit areas of the sites, both average village catch rates and average economic surpluses were mostly higher in those villages using reserves than in those villages not using them (i.e. Meliau in W. Kalimantan; Danau Lamo in Jambi; and Pedamaran in S. Sumatra). Detailed outcomes were determined by the interaction of catch rates, fish prices, effort levels and gear use patterns, with the distribution of benefits being most dependent on the fishing access arrangements. These features confirm that management arrangements (e.g. for any new reserves) need to be well adapted to specific local circumstances, and that different approaches may be needed in different provinces and different villages. Locally appropriate adaptations to the water body auction system in S. Sumatra are discussed.

Keywords: floodplain river fisheries, fishing costs, economic surplus, access control, auctions, lotteries

INTRODUCTION

This paper describes the socio-economic studies undertaken by the DFID-funded 'River Fisheries Reserves' project (see Part 1 companion paper, for introduction and study design). As shown in the companion papers, harvest reserves are only one part of the fisheries management systems operated in each of the different study sites. In addition, there are numerous rules relating to fishing access and activities outside the reserves that affect pressure on local stocks and the distribution of the proceeds from fishing activities. While some of these rules, such as the ban on the use of poisons, are nationally applicable, there are many local differences.

The socio-economic studies described in this paper were designed to complement those of the biological monitoring programme (see Part 3). While the biological studies investigated

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the state of fish stocks inside the reserves and the fished 'control' water bodies, the socio-economic studies look at the overall performance of the fisheries, in each village as a whole. Socio-economic indices such as the economic surplus and its distribution between stakeholders, as estimated in this part of the study, may be influenced by reserves, but are far more dependent on the wider management arrangements and fishing practices used in the villages. The annual water body auction systems used in S. Sumatra and Jambi and the fortnightly lotteries used to allocate gear positions in West Kalimantan (see Part 2) directly influence the distribution of costs and benefits. These studies are thus intended to further examine the qualitative impacts of reserves, but also to give insights about who benefits from different types of fishing activity, the effect of different sets of allocation rules, and the likely winners and losers from possible changes in the management regime. These insights are critical to developing any dialogue with fishing communities - the essential first step to co-management.

MATERIALS AND METHODS

The Socio-Economic Monitoring Programme (SEMP) was designed to estimate fishing effort levels (measured as fishing days), fish catch rates and the costs and benefits of fishing at each study site. Economic data were used to estimate the rates of economic surplus (the profitability of fishing), and its distribution between stakeholders.

Due to differences in fishing access arrangements between the study sites, different survey procedures were required to capture the above information. At the Jambi and S. Sumatra study sites, the best fishing locations are leased annually to the highest bidder (see Part 2). Such leaseholders fish their water body using 'group' fishing gears such as barrier traps and fish drives (see Hoggarth and Utomo, 1994). Some leaseholders in these provinces also sub-licence 'individual' fishers to operate in their waters for a set fee using certain restricted gears. In W. Kalimantan, rights to fishing positions are instead allocated by public lotteries, repeated every fortnight. In W. Kalimantan province, all fishers are thus 'individuals' and benefits are more evenly spread between households.

The SEMP then included:

- weekly household surveys of fish production and income of individual fishers;
- daily self-monitoring by fishing groups, whose activities were more intermittent but occasionally very profitable, in Jambi and S. Sumatra; and
- one-off surveys of occasional fishing costs.

At each of the Jambi and S. Sumatran study sites, auction water bodies were first identified and local fishers questioned about their leasing and licensing arrangements and cost/benefit flows. For each site, a sampling frame was established by allocating each auction unit to a water body category (river channel sections, floodplain areas, lakes etc). Samples of units were then chosen at random from each category to be included in the monitoring of fishing groups. For these water bodies, leaseholders were asked to record all catches taken by each gear type.

For study sites where individual fishers were also sub-licensed to use small gears, and in the W. Kalimantan sites, catches of individuals were recorded by a weekly household survey. For this survey, a list of all the households fishing in each village was first prepared in consultation with village representatives. Households with water body leases were set aside and the sample of open access/independent fishers was then drawn from the remainder. These were then questioned on their fishing activities on a weekly basis.

Information on the regular, operational costs of fishing was collected during the household surveys. Additional one-off surveys were conducted at each site about the payment of irregular fishing costs, such as for major gear components and licence fees. Since some gears last more than a year, such costs might have been missed out by a simple weekly household survey. For the large gears, used by groups fishing on behalf of leaseholders, construction can be an extended and complex process requiring significant inputs of labour to gather and assemble materials. Costs of such fishing may be incurred well in advance of the period when the fish are caught. Upon analysis of the data, it was evident that these cost surveys did *not* fully capture the detailed information needed to cost the large leaseholder gears. Estimates of economic surplus in Pedamaran may be overestimated as a result.

Socio-economic indices were standardised to enable comparisons between study villages. Total catch estimates were thus divided by the estimated numbers of fishing days, fishing households, and fishing areas (high water flooded areas) for each study site.

Rates of economic surplus (ES) were calculated as total fishing revenues minus total costs. Costs were estimated from the average costs of the gears used and the opportunity costs of labour. Lease or license fees are strictly transfer payments and so were not deducted from the economic surplus at this stage. The opportunity cost of labour was taken to be the wage paid to fishing labourers in Pedamaran – this may have exaggerated the costs for the more remote W. Kalimantan sites. The economic surplus *rate* (i.e. ES divided by any of the variables used to allow inter-village comparisons – fishing days, number of households or flooded area) is thus a function of catch rate and any of these additional variables.

SEMP data were collected as requested in most villages, but all data sets displayed occasional anomalies. These were corrected where possible. In two villages, the problems persisted or appeared to be more than routine. In Sekolat, where the enumerator changed during the course of monitoring, subsequent errors in data recording could not be corrected because of the remote location of the village and the civil unrest in W. Kalimantan. The Sekolat data set was thus rejected from the analysis. In Arang Arang, members of leaseholder groups were omitted from the weekly monitoring and self-monitoring by leaseholders was not undertaken. The results from this village are therefore partial.

RESULTS

The intensity of fishing varied both between seasons (as expected for a floodplain fishery), and between villages (Table 1). Fishing days per household were particularly high for Tengkidap and Pedamaran, the two temporary fishing villages/camps. In both these sites, fishers are there simply to fish, many being away from their main homesteads, where their wives and families remained. The very high total for Tengkidap also reflected the practice of members of the same team to share accommodation within the village. With fewer alternative livelihood activities to distract them, they fished almost continuously while on site. In Meliau, with an average of only 118 days fishing per household (Table 1), fishing was a supplementary activity designed to meet household cash needs. Days fished relative to flooded area show low intensities in the more deeply flooded areas, W. Kalimantan and Pedamaran, and higher intensities in the smaller floodplains of the Jambi villages.

Average catch rates by season, and standardised by numbers of households and floodplain areas, are given in Table 2. In principle, these should provide the closest point of comparison with the results of the BMP and would be the factor most directly affected by a functioning reserve. Any comparison must, however, also allow for the differences between villages in the combinations of gears used and in the hours fished per gear per fishing day.

The SEMP catch rates do broadly support the results of the BMP. In W. Kalimantan, the highest SEMP daily catch rates were found in Meliau village and the highest household catch rates were found in Tengkidap village (Table 2). The lowest catch rates per hectare were found in the poison-fished Pulau Majang site. In both Tengkidap and Pulau Majang, catches rose with the 1999 flood, probably reflecting the immigration of whitefish into the system. The deviation of Meliau from the seasonal pattern apparent in the two other W.Kalimantan villages (Table 2) remains unexplained.

In Jambi, catch rates were higher in Danau Lamo than in Arang Arang, though it must be remembered that leaseholder catches were not estimated at the latter site. In Danau Lamo, catches per day of those fishing in open access areas were a seventh of their local leaseholders (but still more than twice those in Arang Arang).

In S. Sumatra, daily and household catch rates around the Teluk Rasau reserve near Pedamaran were higher than those in the fished Lebak Nilang, while catches per hectare were similar at both sites (Table 2).

Fish price varied significantly between villages (Table 3), with the annual average in Tengkidap less than half that of Lebak Nilang. Seasonal variations were even larger. Differences between villages can be seen as a function of access to markets. Villages obtaining high prices were Meliau, which had a contract with the local oil palm estate, and the villages in Jambi and S. Sumatra, the more densely populated provinces. Differences between seasons vary with catch rates. The high fish catches in the 1999 rising flood season in Tengkidap and Pulau Majang thus resulted in exceptionally low prices.

Where high catch rates coincide with high prices (Danau Lamo, Meliau and Pedamaran) total revenue is also high. The other villages all had either low catch rates or low prices (Tables 2 and 3). Since costs were largely similar per fishing day between sites, economic surpluses were also highest in Danau Lamo, Meliau and Pedamaran (Table 4). The average contribution of fishing to livelihoods (as measured by total ES per household) was greatest for fishermen in Pedamaran (Rp 5.2m/year; Table 4). The daily ES was highest for Meliau (Rp. 36,565 / fishing day). Danau Lamo produced by far the highest ES per hectare flooded (Rp 3.2m / ha).

In W. Kalimantan, lotteries were used to determine who positioned their traps first. With all fishing households having equal chances of success, fishery benefits were evenly distributed between all fishing households. In S. Sumatra and Jambi, on the other hand, the use of leases was expected to have an important influence on distribution. Table 5 provides a breakdown of catches, revenues and returns to different types of fishing operations in the three villages where data on leased units were collected. The data for Pedamaran are subdivided by lease units.

These results are subject to some important qualifications. First, there are no data on the benefits of illegal fishing. Second, the fishing season in Pedamaran was known to be a poor one for leaseholders, due to extended flooding[4]. Third, and most importantly from a methodological perspective, the absence of detailed cost information on the large leaseholder gears must cause the economic surplus to be overestimated for leaseholder groups in S. Sumatra.

[4] Catches on the gears that would have been less affected by flood timing were also considerably lower than expected from reports in more informal interviews. This raised the suspicion that under-reporting may have taken place, perhaps due to the sensitivity of the issue.

In Lebak Nilang group fishers working on behalf of the leaseholder took only 10% of the catch but, due to the higher catch rates, took 17% of the economic surplus. Similar per capita catches were translated into per capita economic surplus that was over twice as high for the group fishers. In the leased units in Pedamaran the situation was rather different. Group fishers operating the large static gears and using the highly orchestrated fish drives had per capita catch rates that were exceeded by the individuals licensed to operate within the same area using small mobile gears. After access payments, per capita economic surplus was substantially lower for the group fishers. In Danau Lamo, results were more in line with expectations, with leaseholders generating a per capita surplus of Rp 16.2m from an average catch of 2,703 kg. This high economic surplus was partly due to the high catch rates taken when the connecting channels to the floodplain were blocked during the falling flood or drawdown season (Table 2).

The revenues generated for local or provincial government by leasing were much higher in Pedamaran than in Danau Lamo, whether this is measured against total value of catch or total economic surplus generated (bottom rows of Table 5). The relative overall distribution of economic surplus for the two provinces is shown in Figure 1. In Danau Lamo, where auctions are restricted to village members, the revenue is so small relative to the overall surplus (0.8%) that it is not visible on the graph. Leaseholders appear to be the principal beneficiaries of this system. In Pedamaran a smaller proportion of catch and surplus accrued to leaseholders (at least in this poor flood year) and government revenues were proportionately higher. Whether these figures provide an adequate reflection of the true average flows within this system must remain an open question.

DISCUSSION

Scaled by the unit areas of the sites, both average village catch rates (Table 2) and average economic surpluses (Table 4) were mostly higher in those villages using reserves than in those villages not using them (i.e. Danau Lamo compared to Arang Arang in Jambi; Pedamaran compared to Lebak Nilang in S. Sumatra; and Meliau and Tengkidap compared to Pulau Majang in W. Kalimantan). These differences may suggest that reserves have socio-economic as well as biological benefits. As with the BMP comparisons (see discussion to Part 3), however, they may also be at least partly due to a wide range of other different factors.

Economic surplus (ES) was thus found to be influenced by revenues but the way in which fishing was undertaken was also important. High catches do not automatically result in high revenues: a good market is also important. ES in Danau Lamo was certainly boosted by the leasing system that allowed a few individuals to make very high catches with relatively little effort. The distribution of the surplus was, however, distorted at the same time.

The qualifications over the data from Pedamaran (S. Sumatra) make reliable conclusions on the impact of its lease-holding system difficult to draw. If the catch data are correct, the results emphasise that the returns to leaseholders can be very low (and might even have been negative in an analysis that took account of the full costs of the large static gears)[5]. However, the much higher levels of catches reported in informal interviews for previous years suggests that there can be significant benefits for leaseholders as well as for government revenues and the individual fishers who get the opportunity to fish. Those denied the chance to fish by such tight controls should not be forgotten, however.

[5] The uncertainty of such catches was noted by Hoggarth and Utomo (1994).

The use of lotteries as an access control system in W. Kalimanatan, can be a useful mechanism for equalising the benefits from the fishery between different community members. This is desirable from a social perspective and may also serve to encourage adherence and support for local management rules. With advantages and disadvantages to each access control system, the choice in different local fisheries must be a local decision. First, because it is the ecological and hydrological features of the local system that, together with comparative advantage of different gear technologies, will determine the trade-offs involved. Second, because the relative need for economic surplus, government revenue or improved equity is a value judgement and should reflect the preferences of those most affected.

With strong provincial variation in existing institutional design, it is thus recommended that any new fisheries management approaches should also be allowed to vary between different Indonesian provinces. With the new Regional Autonomy Act, provincial government institutions have greater prospects of adapting any co-management programmes to local circumstances. The institutional analysis in Part 2 of this paper showed that Jambi and W. Kalimantan provinces are currently in a better position to promote co-management strategies than S. Sumatra. Strong possibilities also exist, however, for useful changes in the S. Sumatra regime.

The current district-based water-body auction system in S. Sumatra raises more than 50% of local government revenues and effectively prevents conflicts between fishers, but provides no real incentives for conservation. The auction system is also largely responsible for the lack of local community-based management capacity in S. Sumatra. While the auctions and lotteries in W. Kalimantan and Jambi are operated by villagers within their own administrative boundaries, the S. Sumatran systems are operated by government at a district level, promoting competition between villages and raising lease prices. While this management approach has, up to now, been effective in raising funds for government, it has also limited the development of permanent settled communities around S. Sumatran water-bodies and prevented the application of local management skills in the fishery system. The S. Sumatran external policy environment thus does not acknowledge the fishers' rights of self-governance, and is likely to be more prone to local institutional fragility or failure, as observed with the non-compliance of rules at Teluk Rasau reserve (see Part 2).

In the case of S. Sumatra, then, local government authorities have a strong stake in maintaining the income from the auction system. They are also, however, well aware of the need to improve the conservation aspects of management, e.g. using reserves or other measures. To achieve both goals, it may be possible to initially introduce a co-management approach (possibly leading to effective reserves) into only a few of the auction units. Such introduction would require more permanent and exclusive use rights to be allocated, to give the necessary incentives for conservative management for long-term local benefits. Depending on the outcome in these 'pilot' sites and on the overall state of the fishery, further co-management could be introduced in other auction units, while the remainder stay in the auction system to generate revenue.

REFERENCES

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Table 1. Fishing effort levels (fishing days) by season.

Village	D98	RF98	W	FF	D99	RF99	Total	Days/HH	Days/Ha
Arang Arang	2 842	3 205	5 365	3 806	921	290	16 429	166	110
Danau Lamo	2 428	1 679	3 163	3 573	749	134	11 699	152	117
Meliau	-	-	1 627	1 478	773	367	4 246	118	15
Pulau Majang	-	-	8 225	10 654	6 014	3 224	28 117	181	5
Tengkidap	-	-	5 295	5 940	3 655	2 024	16 914	384	25
Lebak Nilang	1 914	923	3 631	1 771	429	-	8 669	155	58
Pedamaran	1 019	1 171	4 744	4 820	1 912	-	13 667	291	16

Note: D98 = 1998 Dry season; RF98 = 1998 Rising flood; W = Wet season; FF = falling flood; D99 = 1999 Dry season; RF99 = 1999 Rising flood; HH = household; Ha = Hectare.

Table 2. Catch rates per season (kg / fishing day), and standardised per day ('All' seasons), per household and per hectare.

Village	D98	RF98	W	FF	D99	RF99	All	Kg/HH	Kg/Ha
Arang Arang	3.4	2.1	1.9	2.3	1.7	3.8	2.3	385	254
Danau Lamo	4.8		6.0	9.9	5.7	8.2	6.8	1 030	793
Meliau	-	-	11.0	10.9	10.7	9.9	10.8	1 274	161
Pulau Majang	-	-	5.3	5.8	8.2	13.4	7.0	1 275	38
Tengkidap	-	-	5.1	6.1	6.0	12.4	6.5	2 500	159
Lebak Nilang	2.8	3.0	2.5	2.0	1.8	-	2.5	387	144
Pedamaran	8.2	7.6	7.0	7.9	7.2	-	7.5	2 172	122

Table 3. Average value of fish sold (Rp / kg) in each season and over the full sampling period (All).

Village	D98	RF98	W	FF	D99	RF99	All
Arang Arang	4 755	4 011	4 586	3 467	1 964	2 677	3 965
Danau Lamo	3 899	4 801	5 625	5 663	4 817	3 100	5 083
Meliau	-	-	3 992	4 777	4 987	5 000	4 552
Pulau Majang	-	-	3 718	3 097	1 658	821	2 736
Tengkidap	-	-	2 624	2 482	1 913	834	2 274
Lebak Nilang	4 888	5 296	5 775	5 312	5 192	-	5 399
Pedamaran	3 439	3 927	3 942	2 995	3 889	-	3 547

Table 4. Rates of Economic Surplus (Rp. / fishing day)

Village	D98	RF98	W	FF	D99	RF99	All	Rp/HH ('000)	Rp/Ha ('000)
Arang Arang	8 660	1 033	1 586	4 136	1 105	7 148	3 364	558	368
Danau Lamo	11 970	18 818	23 368	47 168	18 111	7 510	27 100	4 118	3 170
Meliau	-	-	35 609	39 112	36 646	30 381	36 565	4 313	545
Pulau Majang	-	-	15 631	8 410	3 578	-2 640	8 222	1 491	44
Tengkidap	-	-	5 426	5 811	4 985	1 589	5 007	1 925	123
Lebak Nilang	4 526	6 739	4 136	2 142	1 366	-	3 955	612	229
Pedamaran	21 022	21 383	17 874	16 367	17 310	-	17 799	5 176	290

Table 5. Total Economic Surplus and its Distribution in S. Sumatra and Jambi.

		South Sumatra										Jambi [1]	
		Lebak Nilang		Pedamaran								Danau Lamo	
				Sungai Aur				Laut Sekampung		Pulau Benawo			
				Leb. Sungai Aur		Lebung Kumpai		B. Illir	Lebak				
		Group	Individ.	Group	Individ.	Group	Individ.	Group	Individ.	Group	Individ.	Lessee	Free
Number of Fishers		4	52	6	1	3	8	5	14	3	7	6	67
Total catch	Kg	2 216	19 456	6 869	1 747	7 253	22 200	3 913	40 709	2 304	17 097	16 219	63 075
Revenue	Rp. m	7.2	84.4	29.8	10.3	19.3	74.1	15.2	120.8	7.1	53.2	102.8	290.2
Fishing costs													
Gear costs [2]	Rp. m	--	11.2	--	1.1	--	5.1	--	7.3	--	4.8	0.3	11.2
Operating costs [3]	Rp. m	1.8	--	8.5	--	2.8	--	2.8	--	1.8	--	--	--
Wages (labourers)	Rp. m	0.2	--	--	--	0.7	--	--	--	--	--	--	--
Labour costs (imputed)	Rp. m	--	44.3	--	1.8	--	13.5	--	24.3	--	12.0	2.5	61.8
Fishing Surplus / Deficit	Rp. m	5.2	28.9	21.3	7.5	15.8	55.4	12.4	89.2	5.3	36.4	100.0	217.1
License payment	Rp. m	[4]	--	--	0.3	--	3.2	--	5.6	--	1.4	--	--
License income	Rp. m	[4]	--	0.3	--	3.2	--	5.6	--	1.4	--	--	--
Lease payment	Rp. m	[4]	--	4.0	--	13.0	--	4.0	--	2.6	--	2.6	--
Net Income	Rp. m	5.2	28.9	17.6	7.2	6.0	52.2	14.0	83.6	4.1	35.0	97.4	217.1
Catch per fisher	Kg	368	374	734	1 747	2 200	2 775	446	2 908	618	2 442	2 703	941
Per Capita Surplus	Rp. m	1.3	0.5	2.9	7.2	2.0	6.5	2.8	6.0	1.4	5.0	16.2	3.2
Total Surplus Distribution													
Individual fishers	Rp. m	24.9	--	7.2	--	52.2	--	83.6	--	35.0	--	217.1	--
Group fishers / Leaseholder	Rp. m	5.2	--	17.6	--	6.0	--	14.0	--	4.1	--	97.7	--
Community / government	Rp. m	[4]	--	4.0	--	13.0	--	4.0	--	2.6	--	2.6	--
Revenue as % Total Value		[4]	--	10.0%	--	13.9%	--	2.9%	--	4.3%	--	0.7%	--
Revenue as % Total Surplus		[4]	--	16.1%	--	24.0%	--	4.1%	--	6.7%	--	0.8%	--

[1] Information on leaseholders in Arang-Arang not collected
[2] Gear costs only available for individual fishers
[3] Operatonal costs, including cigarettes, food, parafin
[4] Status of revenue payments uncertain for Lebak Nilang

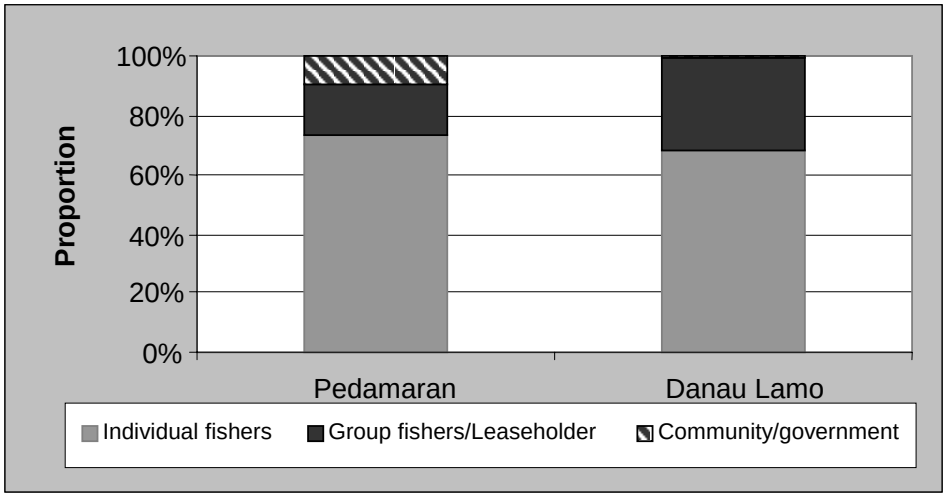

Figure 1. Overall distribution of economic surplus in study sites using leasing.