



## Livelihood Features of Small Scale Fishing Communities: A Case from Singkarak Lake, West Sumatra, Indonesia

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**Abstract** While millions of poor still depend on small scale freshwater fisheries to earn a meager living, the sector shows overall decline in catches over recent years throughout South East Asia. Among few other causes, overfishing is often pointed out as a main issue. Little research is done regarding the socio-economic and technical diversity among the fishing communities, being both the victims of the problem and its possible cause. This research aims to characterize fishing communities in Singkarak Lake (West Sumatra, Indonesia) by exploring their socio-economic and fishing characteristics and also identifying the problems, constraints confronted by those communities as the entry point for policy formulation in an effort to support small-scale fishermen and to address fisheries related problem appropriately. Results show that fishing communities in Singkarak Lake have high level of homogeneity in terms of their fishing activities which represents the highest in cash households' income, but extreme diversity in portfolio of livelihood activities. Combination of fishing and farming widely practiced by fishers in addition to other income supplements either seasonal or permanent. Income generating activities employed by the fishers become more diverse in conjunction to the decrease of fish production and some other factors such as degraded environmental condition, construction of Hydro Electric Power Plant (HEPP) and fishing practiced itself. Fishing labor productivity is found to be lower than construction works and nearly same as farming labor productivity. However, fishers keep fishing because it can secure their daily food needs. The choice of diversification strategies is also based on the assets owned by the households and on higher labor productivity offered by alternative activities out of fishing.

**Keywords** small-scale fisheries, Singkarak Lake, socio-economic, fishing characteristics

### INTRODUCTION

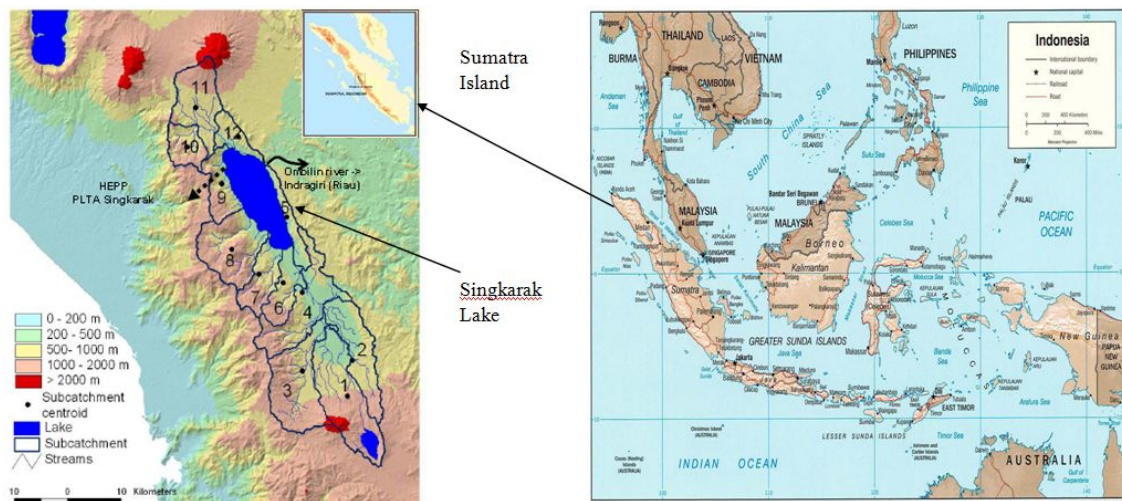
Small-scale fisheries play important roles in food security, poverty reduction and sustainable development in some areas over the world (Kent 1997, FAO, 2005, Thorpe et al., 2005). However, small-scale fisheries are often neglected in development planning because their contributions do not take into account social, economic and political influence (Thorpe et al., 2005). In addition, small-scale fisheries are scattered hence they are not very well recognized and most of their products are not commercialized (Bene et al., 2009) due to limited skills and knowledge about commercialization, lack of access to information and credit as startup capital to develop fishing small enterprises (Isaac, 2006). Small-scale fishers engage in fishing with low level of capital and technology (Sowman, 2006), low fishing potential as they use smaller, non-motorized fishing vessels (Kuperan and Abdullah, 1994; Kent 1997; FAO, 2005) and labor-intensive practices. In view of such situation, some scholars state that “fishermen are the poorest among the poor” and “fishing is the activity of the last resort” (e.g. Smith, 1979; Panayotou, 1982; Bailey et al., 1986; Bailey and Jentoft, 1990 cited in Bene et al., 2009). At the same time small-scale fishers are confronted with the decline of catches in most freshwater

resources. Wide-spread water pollution and fish habitat destruction affect freshwater ecosystem and fish population, and ultimately fishing-based livelihoods. Yet, overfishing and ill-fishing practices seem to be also fairly common, including non-selective fishing gears, ghost fishing, the use of dynamite and poisons. All of this jeopardizes the sustainability of both fish habitat and fishers' livelihood themselves. Our aim is to characterize fishing communities in Singkarak Lake by exploring their socio-economic, fishing characteristics and identifying the problems, constraints confronted by those communities. The relevance of this study lies in the need of incorporating socio-economic characteristics of small scale fishers and the challenges they face as the entry points for policy formulation. Lots of management initiatives on fisheries fail because they often overlooked on socio-economic needs and fishers' concerns (Bene, 2003). Likewise, there are still limited numbers of scientific literature available and there is lack of reliable data on small-scale fisheries (Bene et al., 2009).

## METHODOLOGY

### Singkarak Lake - source of living

Singkarak Lake is located in West Sumatra, Indonesia (Fig. 1). It spans over two districts: Tanah Datar (Batipuh and Rambatan sub district) and Solok (X koto Singkarak and Junjung Sirih sub district). There are 13 nagari (name of the traditional village, pre-colonial political units of Minangkabau political organization (Benda-Beckmann and Von, 2001) which are directly attached to the lake; some of the Nagari are the central of fishing activities. The size of the lake is about 13,665 Ha, with 160 m in deep, 21 km long and 16 km wide (Arifin, 2005). There are three major rivers drain into the lake, Sumpur, Paninggahan and Sumani River. One of the outflows of the lake is Ombilin River, which is the source of water for irrigation at the downstream districts area including Tanah Datar, Padang Pariaman, Solok and Sawahlunto Sijunjung. Another main function of the lake is to supply water for hydroelectric power plant called PLTA Singkarak which has been operated since 1998.



**Fig.1 Map of Singkarak Lake showing sub catchment in the Singkarak Basin**

Source: World Agroforestry center (ICRAF) in Farida et al., 2005

Singkarak Lake has complex land use pattern that plays important role for the people's livelihood particularly for those living around the lake. There are more than 400,000 people living in its slope and shores (Arifin, 2005). Fishing and agriculture are the main economics activities of 77 % of these people. People are benefiting from the services provided by Singkarak Lake, for subsistence or economic benefit through irrigation, fishing, navigation, water supply, HEPP and tourism.

## Data collection

The study analyzes extended households that take into account members who are away from home. Six focus group discussions were conducted to obtain information about social, economic, fishing characteristics and institutional background. In-depth interviews were also carried out with some informants including Head of Nagari, elder respected person, official of government agencies, NGO representative and selected fishermen. Two hundred fishermen were surveyed in four selected Nagari surrounding the Lake (Muaro Pingai, Paninggahan, Guguak Malalo and Sumpur). The questionnaire was structured into semi open and closed type of questions. It aimed to collect more detailed information on socio-economic data (e.g. family structure, education level, household's income, house construction), characteristics of fishing activities (e.g. fishing assets including boat and gear type, value and costs of fishing, type and work division of fishing related activities). The question also covered the perception of fishermen on current fisheries condition compare to years before, and their concerns, problems encountered and also fish marketing, existing arrangement between fishermen and traders.

## RESULTS AND DISCUSSION

### Socioeconomic profile

Most nagari that border the lake are highly dependent on fishing as their livelihood, with 1220 number of fishermen. Number of fishermen has recently decreased compared to 2003, 1762 fishermen (Forum komunikasi masyarakat dan nelayan selingkar danau Singkarak, 2003). Such decrease is potentially caused by the decline of fish resources in this area that makes people choose other income sources through migration to city or more intense farming. Most of the fishermen (92.96%) surveyed originate from the area (born and stay in the same nagari), only few of them come from other nagari or other towns but still within the same district (5.03%) and very few (2.01%) originate from other province (because of marriage).

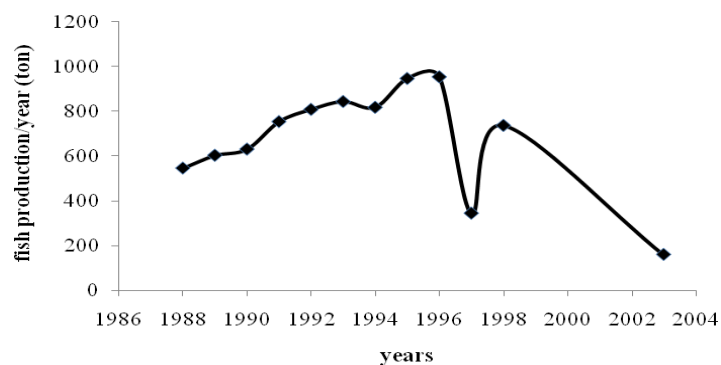
**Table 1 Socio-economic profile of fishermen in Singkarak lake area**

Average of years worked in fisheries (standard deviation)	25.62 (10.85)
Average number of family members (standard deviation)	5.54 (2.28)
Education level (% of respondents)	
Illiterate	9.5
Elementary school	54.0
Junior high school	18.5
Senior high school and higher	10.5
Others	7.5

Fishing has been practiced by the fishermen for 25 years on average (Table 1) and their age ranging from 41 - 50 years. Most of them started fishing with their father when they were very young (8 - 15 years old). Our family was poor, we prefer go fishing with our father or even sometimes alone hence we could earn money for our own expenses and we could also help our parents (FGD, April 2009). Therefore, level of educational attainment of the respondents is low; more than half of them (54%) graduated elementary school and some are illiterate (9.5%). 7.5% of respondents failed to complete elementary school. Fishermen admitted that fish were abundant during the 1960s and 1970s and needed more labor to do fishing activities. During that time government put less attention to education, rural development still lagged far behind and most of rural communities did not realize the importance of education. Such situation has been described in South Indian Lagoon by Coulthard (2008) describe this condition as 'a missed education' and seems common in small-scale fisheries.

### Current resource condition and fishing characteristics

Fishermen do fishing for consumption and selling purposes, so fisheries provides cash income and secure family's food supply. Such dual contribution is facing great challenge of the decrease of fish catch (Fig. 3). Figure 3 shows the dynamic of bilih fish production over 1988-2003 periods. Significant decrease of fish catch occurs from 1996, with a plunge between 1998 and 2003 from 736.46 ton to 149.47 ton respectively. Syandri (2004) stated that the decrease of fish production is mainly caused by the use of fishing gear with small net size and overexploitation. Moreover, natural calamity called bangai often occurs which the upwelling deep lake water is containing sulphuric acid causing massive death of fish. The last bangai was recorded in January 1999. Also, fishermen confirm that there is huge decline in fish production particularly during the last five years. Vast number of fishermen (94%) perceives that their income has decreased due to the decline of resource condition. Likewise, fluctuation on resource abundance is another problem faced by fishing communities although they realize that it has been occurred some years before. *“Life is getting complicated now, it's so hard to get even 2 liters (Fishermen use a measured cup equal to 1 liter volume; 1 liter = 0.8 kg (for fresh bilih fish) of fish per day, before we even can spend whole day to take out the fish from the nets and need more workers and we can identify which month of the years we got less catch and time when we could get abundance fish but now it is very difficult to predict”* (Agus, interview, August 2009). There are various reasons described by the fishermen as the cause of fisheries resource condition including construction of HEPP, water quality and quantity decline, the use of destructive fishing gears (small net size, explosive and poisonous materials), lack of coordination, law enforcement and the absence of fish trading agency. They confirmed that construction HEPP has significantly changed condition of the lake such as more sediment deposited in the lake because weir construction which obstruct the rubbish flowing out of the lake. As the consequence, water quality is depleted which disturb the habitat of bilih fish. It is supported by a fishery study that found negative relationship between turbidity and growth of bilih (Juita, 1995). Although some other studies found possible significant impact on fisheries at downstream area, these impacts are considered less important in the Summary Environmental Impact Assessment (SEIA) of the HEPP (ADB, 1999). Fishermen also claim that their income has decreased for about 97,081,000 IDR since HEPP operation (Forum komunikasi masyarakat dan nelayan selingkar danau singkarak, 2003).



**Fig. 3 Fish production during 1988 - 1998 to 2003 (ton)**

Source: Bureau Statistics of Tanah Datar and Solok District;  
Provincial Marine and Fisheries Department

Fishing activities are done everyday throughout the year. The main catches involve endemic species called bilih (*Mystacoleucus padangensis*), others are in small number including belingka (*Puntius belingka*), turik (*Cycloscheilichtys*) and sasau (*Hampala macrolepidota*). Fishing communities in Singkarak Lake show a large degree of homogeneity in fishing practices. It is mostly concentrated within 500 m - 2 km of the lake shore and also at the meeting point of inlet river and the lake. There are two types of boat used, both are small boats made of wood called biduk. The difference is in size and source of power. Boats with paddle as power source have 3.5 m long and 0.5 m wide. Boats with outboard power source are a bit bigger, 4 m long and 0.75 m wide. Most of the

fishermen use paddle boat (71.43%) and few of them use boat with outboard because of higher capital and operational costs. Fishermen embark on short trips, 4 - 6 hours/day, usually they embark without crew. Men usually go for fishing and women contribute to fishing related-activities such as collecting fish from the net, fish processing and marketing.

**Table 2 Fishing characteristics**

Fishermen and boat ownership (% of respondents)		Types of fishing gear (% of respondents)	
Own the boat	76.4	Set gill net (anchored)	39.90
Rent in the boat	0.5	Cast net	29.74
Don't have boat	19.1	Gill net (sasau)	14.24
Others	4.0	Gill net (turik)	7.43
		Dragnet	5.97
		Alahan	2.09
		Others	0.62

Type of gear used does not vary much among fishermen, set gill net (3/4, 1 inch of mesh size), cast net (1/2, 3/4 and 1 inch), fish trap, Alahan (Trapping the fish near the meeting point of the lake and rivers drained into the lake by using woven wood fibers as the traps. It is stretch along width of the river). Type of fishing gear in Table 2 shows the composition of fishing gears used. The most popular method is the use of set gill nets; these nets are fixed into the bottom or at certain distance above it by using anchors or ballasts. Fishing is a family business (Bene et al., 2009; Wagenaar 2007), at least two family members involve in fishing activities, husband and wife. Children also take part in the activities sometimes, during school break or weekend but some of them help their parents regularly as they drop out of school. Fishermen who only use gill nets would spend for about 6 hours a day on average for fishing and fishing related activities (Table 3). Fishermen fix the gill net during afternoon and take out from the waters the next day, early in the morning.

**Table 3 Daily fishing activities using gill nets and time allocation**

Activities	Duration (hours/person/day)	Who does the task	
		Men	Women
Preparing gear and fixing the nets at the certain distance	2	√	
Take out the nets from the lake	2	√	√
Harvesting the fish	2	√	√
Scaling, selling	1		√
Fish processing (if any), marketing	4		√

Fishing activities as shown in table 3 only include routine activities for fishermen who use gill nets (langli), excluding maintenance of the gear, attending meeting with fishing community. Some of the families do fish processing at the household, which is mainly done by women (wives) and supported by children (usually girls but sometimes boys also take part). Fishermen used to do other activities such as continue fishing by casting, farming or others. One of the Nagari surveyed, the fishermen are not allowed to use gill nets (nagari rules) that have been practiced from their ancestors, mostly they use casting net for fishing. Time allocation for this group of fishermen is also different; they divide groups based on time slot allocation because there will be lots of fishermen casting at the same time (20 – 50 fishermen, depend on area of fishing ground). The fishermen would take turn for casting without any written schedule. “We believe that the lake is sacred place, if we make quarrel or dispute, the fish is getting scarce and tend to be away from us” (Sahril Ketua, interview, November 2009).

### Fishing productivity and livelihood diversification

Vast majority of fishermen have other source of income such as rice field cultivation, crops, fish processing and trading, livestock and construction works. Among those, rice field farming is commonly practiced, compared to other income generating activities. It confirms that fishers have

higher occupational diversity but they prefer to do fishing as livelihoods option (Cinner et al., 2010), thus the notion of fishing being the last resort for fishers due to lack of alternative does not necessarily apply to fishing communities in Singkarak Lake. More than 55% of the fishermen own land for rice farming most of which are inherited to female (wife). Most of fishing households in Singkarak Lake diversify their income as one of the important livelihood strategies. It is estimated that 88% of the respondents involve in combination of fishing and other income generating activities either fishing or non fishing (Table 4). Only few households (12%) solely depend on fishing as the unique income source, including selling the catches to the brokers or market. Table 4 represents the extent of occupational diversification within the surveyed households. There are ten types of combination of income diversification performed by the households, both fishing (fish processing and trading) and non fishing income related activities (farming, rearing livestock, merchant, etc).

**Table 4 Occupational diversification within fishing communities' households**

No	Income source	No of households
1	Fishing only	24
2	Fishing, farming	45
3	Fishing, rearing livestock	14
4	Fishing, fish processing and trading	17
5	Fishing, motorcycle rent/construction workers/private enterprise/small shop /agricultural worker	8
6	Fishing, farming, fish processing and trading	9
7	Fishing, farming, rearing livestock	39
8	Fishing, farming, motorcycle rent/construction workers/private enterprise/small shop	17
9	Fishing, farming, rearing livestock, fish processing and trading /motorcycle rent	11
10	Fishing, farming, rearing livestock, motorcycle rent/small shop/construction workers/merchant	10
11	Fishing, rearing livestock, fish processing and trading /motorcycle rent	6
Total		200

Numerous studies found that diversification contributes to livelihood security particularly for the rural communities (Ellis, 2000; IMM, 2008; Allison, 2001; Marschke, 2005). This is verified when level of revenue and labor productivity rise with alternative activities. In the case of Singkarak Lake, the question remains whether household members adopt livelihood diversification strategy because of low productivity with poor prospect in fishing or desperation due to environmental degradation, declining fish catch or crop yields, etc (Ghosh and Bharadwaj, 1992, cited in Ellis, 2000). Labor productivity is quantified in order to measure how efficiently resources are used (Palmer, 2000). Fishing efficiency index can be defined by dividing annual income with total days of fishing as implemented by Tzanatos (2006) to analyze different categories of fishermen.

**Table 5 Total amount of annual households' income from different sources**

Income source	Amount of income/year $\pm$ Standard deviation	% Contribution
Fishing	8,850,000 $\pm$ 6,466,862	41.14
Agriculture	5,470,000 $\pm$ 4,724,397	25.43
Non-agriculture	7,190,000 $\pm$ 17,410,000	33.43

Productivity discussed in this study refers to single factor productivity (it only considers labor as one of the main important inputs in fishing). Labor productivity is simply defined as the output per labor-hour work or output per labor inputs. In this context, output refers to the value of the fish catch calculated from the average catch per day multiply by the market price of the fish. Average value of fish catch per day is 48,740 IDR. Total hour/person-day is quantified by dividing duration of hours of each fishing activity by standard total working hours/day (assuming that total standard working hours

per day is 8 hours); the value is 1.375 /man-day. Labor productivity for fishing is calculated in price terms by comparing average value of fish catch/day and total working hours/person-day. Based on that calculation, fishing labor productivity is 35,447.27 IDR/person-day. This amount is nearly same with the productivity from construction works which is 45,000 IDR/person-day and 35,000 IDR/person-day for agricultural works. The analysis does not consider work division by man or woman; it describes the labor productivity for the working hours as a whole. The hours include the hours of self-employed and nonpaid workers (such as family members).

Although fishing activities require more times than other livelihood options and its productivity is nearly the same as agricultural works and lower than construction works, fishing is still being the primary production activities in the households. It represents 41.14 % of their cash income (table 5). “I can get money directly from fishing, no matter how much I got, at least I have some amount of money to buy foods and stipend for my children of the day. While you have to wait until certain period of time to get income from crops and rice field cultivation” (Kuni, interview, September 2009). Fishermen consider fishing as the ‘savior’ of their family life as it secures the food and money on daily basis. For that reason they keep fishing although they suffer from the decline and fluctuation of fish catch. This confirms observation of Berry (1989) that diversification may be seen as a way to maintain livelihoods through the flexibility among income sources when the primary activity fails to support their needs. Most of fishers do farming to diversify their income and the productivity of both activities is nearly equal. In this case, the choice of farming activities is influenced by the capital assets owned by the households. Some households do farming because they have access to land while some others might want to do farming but they are landless. As the consequence they choose other possible income generating activities such as construction works, which has higher productivity compare to fishing and farming. Other households may choose other alternative income considering the amount of income derived and time spend for the activities. So far the local government has promoted strategies for the improvement of labor productivity through training and subsidies but the implementation still lacks consistency and monitoring. It is just a one-time solution to deal with fisheries problem. In order to achieve the sustainability of fishermen livelihood, productivity improvement program should be demand-driven and needs-led (Palmer, 2008).

## **CONCLUSION**

Fishing communities in Singkarak Lake have high level of homogeneity in terms of their fishing activities but vary in livelihoods strategy performed by the households out of fishing. Fishing represents the highest in cash households’ income and has become a tradition in family. Moreover, fishing is as savior of their livelihoods securing basic needs for foods and supporting children’s education. This research does not confirm that small-scale fisheries come as the last resort solution for resource poor communities. On the contrary, most diversity livelihood while keeping fishing as the pivotal activity. This seems to be a response to the decline in catches. The sustainability of fishing resources in Singkarak Lake is under threats due to huge decrease of fish production and some factors associated such as degraded environmental condition, construction of HEPP and fishing practiced by the fishermen itself. Some important factors need to be considered for policy implications. First, dealing with fish resource degradation problems must also take into account socio-economic condition of the fishermen realizing that there is close interrelationship of socio-economic (the livelihood of fishermen) and ecological system (the decline of fish production and degraded environment). Either social or ecological problems cannot be resolved separately. Accordingly, an array of policy implication is suggested, such regulation include ways to mitigate fish decline through restriction of net size, prohibition of explosive and poisonous materials and provide financial, technical support to backup their households’ finances. Moreover, effective monitoring system should also implement to ensure rules enforcement through cooperation with the lowest level of governance such as Nagari. Second, promoting program for increasing productivity and improve livelihood of small-scale fishermen in adjacent to other livelihood strategies. This can be done through skill development such as fish processing technology to increase the value of the catch. At the same time this efforts enable to build up and strengthen a wide portfolio of existing or newly adopted livelihood activities.

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