Socio-Economic Assessment and Fishers' Perceptions of Fisheries Management in the Freshwater Fishing Area of the Pak Phanang River Basin (PPRB), Nakhon Si Thammarat Province, Thailand

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ABSTRACT

Most government projects are implemented with little input and participation from the local people. The objective of this study was to assess the fishers' socio-economic status, their perceptions on the aquatic resources and fisheries management, and their recommendations for improvement of fisheries management in the freshwater fishing area of the Pak Phanang River basin (PPRB), Nakhon Si Thammarat province, southern Thailand. An in-depth semi-structured questionnaire was used to collect data from 161 fishers' households. The findings of the study showed that most fishers had an annual income from fishing only (80%) that was below the poverty line. Based on the fishers' perceptions, the aquatic resources were declining due to the deterioration of water quality, increased aquatic weed growth, declining fish stock, and sometimes fish death which all affected their fishing income. The fishers were highly appreciative of the role of the Department of Fisheries and local government units in fisheries management but they had a negative perception of farmers who use chemicals in agriculture because these chemicals were washed into the river, causing fish deaths. They agreed with some activities and measures such as not fishing during the spawning season and in spawning grounds, and not using illegal gear, but they disagreed with some measures such as controlling the quantity of fish caught and ruling on the number of fishers and times for fishing because these would affect their fishing income. The fishers mainly recommended that they should be more involved in fisheries management, particularly in the planning and decision-making steps.

Keywords: socio-economic, assessment, fishers' perceptions, fisheries management, Pak Phanang River basin (PPRB)

บทคัดย่อ

วัตถุประสงค์ของการศึกษาครั้งนี้เพื่อประเมินสภาวะเศรษฐกิจสังคมของชาวประมง การยอมรับของชาวประมงในสถานภาพของแหล่งน้ำและการจัดการประมง รวมถึงข้อคิดเห็นและข้อเสนอแนะของชาวประมงในการจัดการประมง ในพื้นที่ประมงน้ำจืดของลุ่มน้ำปากพนังจังหวัดนครศรีธรรมราช ใช้

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แบบสอบถามกึ่งโครงสร้างในเชิงลึกในการเก็บรวบรวมข้อมูลจากชาวประมงจำนวน 161 ครัวเรือน ผลการศึกษาแสดงให้เห็นว่ารายได้จากการทำประมงในพื้นที่ส่วนใหญ่ (80%) อยู่ใต้เส้นความยากจน การรับรู้ของชาวประมงในสถานภาพของแหล่งน้ำคือทรัพยากรประมงเสื่อมโทรมลงเนื่องจากคุณภาพน้ำที่ต่ำลง การเจริญเติบโตของวัชพืชน้ำเพิ่มมากขึ้น สัตว์น้ำมีจำนวนลดลง และบางครั้งสัตว์น้ำตายจากน้ำเน่าเสีย จากสาเหตุดังกล่าวทำให้รายได้ของชาวประมงลดลง ในแง่ของการจัดการประมง ชาวประมงยอมรับบทบาทของกรมประมงและหน่วยงานรัฐบาลท้องถิ่นในการจัดการประมง นอกจากนี้ ชาวประมงจะยอมรับในมาตรการการจัดการประมงบางมาตรการเท่านั้น เช่น การห้ามทำการประมงในพื้นที่และฤดูวางไข่ การไม่ใช้เครื่องมือผิดกฎหมาย แต่ชาวประมงไม่เห็นด้วยกับมาตรการการควบคุมปริมาณของสัตว์น้ำที่จับได้ การควบคุมจำนวนชาวประมง และการจำกัดช่วงเวลาทำการประมง เพราะจะส่งผลกระทบต่อรายได้ของพวกเขาให้ลดลง สำหรับกระบวนการจัดการประมงที่สำคัญในอนาคต ชาวประมงส่วนใหญ่เสนอแนะว่า ชาวประมงและผู้มีส่วนได้ส่วนเสียควรจะมีส่วนร่วมมากขึ้นในการจัดการประมงโดยเฉพาะอย่างยิ่งในขั้นตอนการวางแผนและการตัดสินใจ

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INTRODUCTION

Socio-economic information is a significant component in developing effective fisheries management as such information shows fishery managers the linkages between the way a community uses its fisheries resources and the socio-economic context of the community (Bowen & Riley, 2003). It can provide an understanding of the social, economic, and political characteristics and conditions of households, organizations, and communities (Bunce, Townsley, Pomeroy, & Pollnac, 2000). Also, this information can help fishery managers clarify potential problems and identify management priorities accordingly (Propst & Gavislis, 1987; Gordon, Stafford-Smith, & Haberkorn, 2001). The information is useful and important to fishery managers to determine appropriate management methods (Bunce et al., 2000).

The Pak Phanang River basin (PPRB) is located along the southeastern seashore of Thailand (Figure 1). It covers an area of approximately 3,183 square kilometers. The *Utok Wiphat Prasit* Sluice Gate was constructed in 1999 in Hu Long sub-district, Pak Phanang district, Nakhon Si Thammarat province as a Royal Project in an effort to provide freshwater for agricultural and household purposes, and to prevent saltwater intrusion into agricultural areas. However, since the dam began operating, some fish species have disappeared, particularly brackish water and marine species. The dam has disturbed fish breeding by blocking their migration route to the critical spawning grounds, and also reducing biodiversity and production (Prabnarong & Kaewrat, 2006). Because of these problems, the dam is affecting local people's livelihood, especially those dependent on fisheries for their income and food consumption (Thammachat, Mikuso, Boonsuaykhwane, & Poopaka, 2004). Furthermore, those adversely affected by the dam's construction are located in the freshwater fishing area of the basin, about 100 km upstream from the dam site (Walailak University, 2004). Consequently, the aim of this study was to assess the socio-economic status of fishers in the PPRB including demographic characteristics, fisheries activities, the fishers' perceptions of fisheries resources and management, and their recommendations to improve fisheries management in the area.

METHODOLOGY

Data collection

An in-depth, semi-structured interview with fishers was conducted using a questionnaire on the fishers' socio-economic status, perception of fisheries resources and current management, and their suggestions for future fisheries management. The total population of 199 fisher households along the PPRB was considered for the survey. However, we could collect returns from only 161 fisher households (81%) consisting of 41 households downstream, 63 households midstream and 57 households in the upstream area (Figure 1).

Data analysis

Frequency distribution and percentage were used to describe the various indicators of socio-economic conditions. A weighted average index (WAI) was used to determine: fishers' perceptions of fisheries resources conditions; their awareness of fisheries resources value; their perception of fisheries management agencies, measures, and other stakeholders; their participation levels in fisheries management; and their opinions on fisheries management issues and future fisheries management measures. The index was computed using Equation 1:

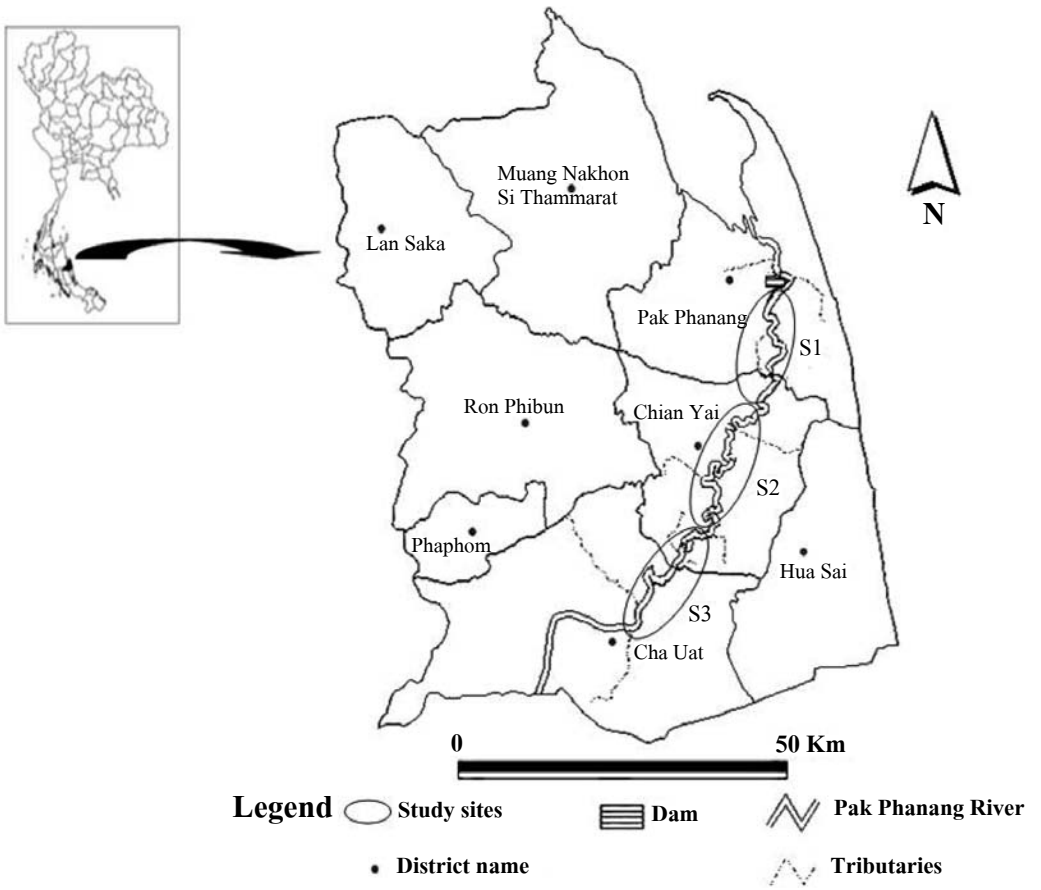

Figure 1 Socio-economic survey sites in the freshwater fishing area of Pak Phanang River basin (S1 = Downstream area, S2 = Midstream area, S3 = Upstream area)

$$WAI = \Sigma(fi*wi)/\Sigma fi$$

Where WAI = Weighted average index of attitude
fi = Frequency, and
wi = Weight applied

RESULTS AND DISCUSSION

Socio-economic status

The socio-economic study (Table 1) shows that about one half of the fishers in the area were older than 50 years (52.2%), followed by 36-50 years old (38.5%). This indicates that few new fishers replace old fishers, most likely due to the lack of fisheries resources in the area and better job opportunities in cities or other places. Furthermore, the older fishers in the PPRB might not be willing to change their occupation and might not be receptive to new programs. As stated by Bunce and Pomeroy (2003), age can be a predictor of receptivity to new ideas.

The majority of respondents in the area were male (77.6%), and they played an important role in fishing at all study sites. This could be an important indicator of likely participation in management. Therefore, it should be a top priority to involve these people in any fisheries management activity. The rest of respondents were female (22.4%) who spoke for their husbands or fathers. There are also fish processors in the area. Bunce and Pomeroy (2003) stated that gender can be an important indicator for participation. If women are not directly engaged in fisheries activities, it may be more difficult to actively involve them in management.

The average household size was four which is indicative of a medium-sized family. More than half (64.6%) of the respondents' households had between two and four members, and 31.1 percent had five to seven people. The family members were usually children and the elderly. Most of the fishers (81%) had primary school education only. Since education is also a predictor of receptivity to new ideas (Bunce & Pomeroy, 2003), it may not be easy to introduce new programs to the fishers, so fisheries management programs and promotions involving them should be developed based on visual images rather than text.

The main sources of family income for fishers (59%) in the area, apart from fishing, are agriculture and employment. Only 41 percent of fishers depended on fisheries income. For an occupation to be considered a primary source of income more than 80 percent of the people should rely on it (Bunce & Pomeroy, 2003); thus, in the PPRB, fishing is a secondary or supplementary source of income. This indicates that the fishers' livelihoods have low reliance on fisheries resources, most likely due to limitations to the resources. Since the dam's operation, brackish water and marine fish species can no longer migrate to the Pak Phanang River. This is the main cause of the negative effects on fish catches and family incomes. Consequently, many fishers have given up fishing as their main occupation to engage in other occupations.

Income and the material type of fishers' homes are indicators of the relative social status within a community and are often used as an indicator of economic status or wealth (Bunce & Pomeroy, 2003). Most of the households (64%) have an annual income (24,824.9 baht per capita on average) above the poverty line of Nakhon Si Thammarat province (16,728.0 baht per capita). However, this income is not only generated by fishing. Looking at their fisheries income only, the majority (80%) was found to be below the poverty line (11,823.0 baht per capita on average), indicating that full-time fishers in this area are in the poorer part of its population. The main house construction material of fishers was mostly wood, further indicating their lack of wealth. Income levels and main construction material types can also be indicators of management effectiveness in the area. If a management program has a positive impact, the gains in incomes should be reflected in the construction materials used, shifting toward higher quality and price levels, e.g. from wood to cement (Bunce & Pomeroy, 2003).

Table 1 Fishers' socio-economic status within the freshwater fishing area of the PPRB

Item	Downstream		Midstream		Upstream		Total	
	N=41	%	N=63	%	N=57	%	N=161	%
Age								
36-50 years	23	56.1	23	35.5	16	28.1	62	38.5
> 50 years	16	39.0	34	54.0	34	59.6	84	52.2
Gender								
Male	33	80.5	43	68.3	49	86.0	125	77.6
Female	8	19.5	20	31.7	8	14.0	36	22.4
Family size								
2-4 people	26	63.4	43	68.3	35	61.4	104	64.6
5-7 people	14	34.1	16	25.4	20	35.1	50	31.1
Education								
Primary school	34	82.9	50	79.4	47	82.5	131	81.4
Fishing occupations								
Fishing as major	26	63.4	20	31.7	20	35.1	66	41.0
Fishing as minor	15	36.6	40	63.5	37	64.9	92	59.0
House material styles (roof)								
Tile	41	25.5	59	36.6	56	34.8	156	96.9
House material styles (wall)								
Concrete	8	5.0	23	14.3	28	17.4	59	36.6
Wood	32	19.9	38	23.6	27	16.8	97	60.2
House material styles (windows)								
Wood	38	23.6	59	36.6	55	34.2	152	94.4
House material styles (floor)								
Wood	30	18.6	35	21.7	29	18.0	94	58.4
Cement	8	5.0	22	13.7	24	14.9	54	33.5

Fishers' perceptions of fisheries resources

Based on the interviews, the main threats to fisheries resources in the area are related to two aspects. The first aspect concerns environmental problems such as deteriorating water quality and the proliferation of aquatic weeds. The second relates to biological problems like fish decline and sometimes fish deaths (Table 2). These problems were also mentioned by Thammachat et al. (2004) who reported that aquatic animal abundance was drastically reduced in terms of fish catch because of the lack of water flow from the sea into the Pak Phanang River, aquatic weeds blocking the waterways, stagnant and smelly water in various areas, and pollution from chemicals and shrimp farming.

Summarizing the results of fishers' perception of fisheries resource conditions, the respondents complained that the fish stock had been in severe decline since the dam began operating, especially brackish water species such as *Scylla serata* and *Mugil sp*. This decline had affected their fisheries income. One half of the respondents complained that their income from fishing had decreased sharply following the dam's construction, while the other half had felt little impact, maybe because they have other income sources. Although the decline affects their livelihood, most of them

break even in their fishing activities, at least at the household consumption level. However, the opinions of fishers at the midstream and upstream sites on the whole picture indicate that the aquatic environmental and animal status were both good, whereas it was bad at the downstream site (Table 3).

The fishers were highly aware of fisheries laws and regulations, and receive information from government officials and friends, while, in their opinion, fishers from outside often use illegal gear. Moreover, the fishers greatly appreciated the value of their fisheries resources and wished them to be sustainably used. To maintain the resources, the respondents suggested that restocking should be the top priority, followed by removing knotweeds and addressing poor water quality.

Fishers' perception of current fisheries management

The respondents greatly appreciated the Department of Fisheries (DOF) and the tambon administrative organizations (TAOs), as well as the fisher groups or communities (Table 4). The DOF was seen as the primary responsible organization in the fisheries management of the area, through increasing fish production by restocking, regulating fishing activities, and promoting aquaculture. These activities have led to improvements in fishers' livelihoods. The respondents also recorded their strong support for local groups (TAOs, fisher groups, and communities) because they felt these groups could negotiate with the Royal Irrigation Department (RID) about opening the gates in a timely manner, bargain with middlemen, and understood the problems well and could solve them appropriately. The respondents were also appreciative of the Pollution Control Department (PCD), the RID, and the Coastal Resource Institute (CORIN) as their activities could contribute to enhancing fisheries resources and the environment (i.e., through the PCD monitoring water quality, the RID removing knotweeds, and the CORIN promoting protected areas).

The WAI on fishers' perceptions of the DOF was high (Table 4). This might have been because the DOF often released fry into these sites. Also,

Table 2 Fisheries problems

Problem	Downstream		Midstream		Upstream		Total	
	N	%	N	%	N	%	N	%
Deteriorating water quality	34	22.4	39	25.7	42	27.6	115	75.7
Fish decline and fish deaths	25	16.4	29	19.1	30	19.7	84	55.3
Knotweeds	34	22.4	54	35.5	34	22.4	122	80.3
Illegal methods	1	0.7	1	0.7	7	4.6	9	5.9
Dam operation	3	2.0	2	1.3	5	3.3	10	6.6
Total	41	27.0	57	37.5	54	35.5	152	100.0

Table 3 Weighted average index of perception of resource conditions

Condition	Downstream		Midstream		Upstream		F-test	Total	
	WAI	PL	WAI	PL	WAI	PL		WAI	PL
Aquatic environment	-0.41	B	0.06	G	0.26	G	0.00	0.01	G
Freshwater aquatic animals	-0.24	B	0.08	G	0.21	G	0.04	0.04	G

WAI = Weighted average index, PL = Perception level, VG = Very good, G = Good, NB = Not good or bad, B = Bad, VB = Very bad

fishers' perceptions of communities or fisher groups were high. This might have been because fisher groups serve as negotiators with government agencies, other stakeholders, and fish middlemen, and are also involved in fisheries management. Also, regarding the fishers' perception of other stakeholders (Table 5), the interviewees responded positively to all other stakeholders, except for farmers, who the fishers considered used chemicals in agriculture which sometimes were washed into the river, causing fish deaths. The respondents at the downstream site had a negative perception of the RID because when RID officials had opened the gates unannounced, the strong water current had damaged their fishing gear, and in particular their gill nets.

Table 4 Weighted average index of fishers' appreciation of fisheries management agencies

Organization	Downstream		Midstream		Upstream		F-test	Total	
	WAI	AL	WAI	AL	WAI	AL		WAI	AL
1. DOF	1.54	AS	1.81	AS	1.84	AS	0.01	1.75	AS
2. PCD	0.59	A	0.65	A	0.54	A	0.78	0.60	A
3. RID	0.22	A	0.10	A	0.46	A	0.40	0.25	A
4. CORIN	0.22	A	0.22	A	0.05	A	0.45	0.13	A
5. NGOs	0.00	ND	-0.02	D	-0.04	D	0.62	-0.02	D
6. TAOs	1.02	AS	0.92	A	1.12	AS	0.49	1.02	AS
7. Community and fisher group	1.07	AS	0.86	A	1.28	AS	0.05	1.06	AS

DOF = Department of Fisheries, TAOs = Tambon administrative organizations, PCD = Pollution Control Department, RID = Royal Irrigation Department, CORIN = Coastal Resource Institute, NGOs = Non-Government organizations; WAI = Weighted average index, AL = Assessment level, AS = Strongly agree, A = Agree, ND = Neither agree nor disagree, D = Disagree, DS = Strongly disagree

Table 5 Weighted average index of respondents' perception of other stakeholders

Stakeholder/issue	Downstream		Midstream		Upstream		F-test	Total	
	WAI	AL	WAI	AL	WAI	AL		WAI	AL
1. Farmers/chemicals, water usage	-0.66	D	-1.32	DS	-0.60	D	0.00	-0.89	D
2. Fish traders/price	0.66	A	0.57	A	0.47	A	0.58	0.56	A
3. Consumers/price	0.98	A	0.83	A	0.82	A	0.64	0.86	A
4. RID/gate operation	-0.29	D	0.21	A	0.54	A	0.05	0.20	A
5. CORIN/license, protected areas	0.20	A	0.10	A	0.05	A	0.65	0.11	A
6. PCD/water monitoring	0.49	A	0.76	A	0.58	A	0.31	0.63	A
7. DOF/restocking	1.90	AS	1.83	AS	1.81	AS	0.43	1.84	AS

RID = Royal Irrigation Department, CORIN = Coastal Resource Institute, PCD = Pollution Control Department, DOF = Department of Fisheries; WAI = Weighted average index, AL = Assessment level, AS = Strongly agree, A = Agree, ND = Neither agree nor disagree, D = Disagree, DS = Strongly disagree

The Fisheries Act B.E. 2490 (1947) included fishing bans in protected areas, closed seasons, and areas for spawning, periods of closed seasons for spawning, restrictions on fishing gear and methods, and increased penalties to maintain the sustainability of fishing in the area. License fees did not increase. Respondents were not willing to pay the license fees because they had suffered losses in their fishing income and because most of the fish they caught were for home consumption. Furthermore, the WAI shows that the respondents' perceptions of fishing bans in protected areas at the downstream site were lower than midstream and upstream (Table 6). This could have been because the main income source of most respondents midstream and upstream was fishing. Fishing bans in the protected area negatively affected their catch and income.

The investigation of the fishers' perception of the outcomes of fisheries management found that their expectations were high (Table 7). The fishers stated that restocking, having protected areas, and participatory or cooperative management involving government and the local people should result in increased fish catches and fisher numbers, and sustainable development, finally leading to improvements in fishers' livelihoods. Moreover, fishers expect cooperative action among government agencies and local groups, especially between the DOF and local groups (TAOs or community or fishers groups). Consequently, the local fishers and other stakeholders should be involved in fisheries management, sharing ideas equally in management at all levels such as planning and decision making. They preferred setting up the dam's operation jointly and/or being informed of its operation times. This would be very helpful to them in terms of choosing fishing times and gear during the periods when the gates were opened.

Fishers' suggestions for future fisheries management

The fishers suggested that fisheries management should be undertaken with strong cooperation between the government and local stakeholders working as partners, especially the DOF and fisher groups. Restocking fish species, fishing rule enforcement, patrolling protected areas, environmental monitoring, aquaculture promotion, and encouraging involvement should be vigorously continued by fisheries management agencies in cooperation with local fishers. The respondents expected some activities and measures in the future

Table 6 Weighted average index of perception of fisheries management regulations

Measure	Downstream		Midstream		Upstream		F-test	Total	
	WAI	AL	WAI	AL	WAI	AL		WAI	AL
1. Ban on fishing in protected areas	1.07	AS	1.76	AS	1.79	AS	0.00	1.60	AS
2. Ban on fishing during spawning season	0.78	A	0.70	A	0.82	A	0.85	0.76	A
3. Temporary ban during spawning season	0.63	A	0.59	A	0.74	A	0.81	0.65	A
4. Gear and fishing method restrictions (mesh size, electricity, explosives etc.)	1.95	AS	1.95	AS	2.00	AS	0.25	1.97	AS
5. Legal penalty provisions	0.93	A	0.70	A	0.91	A	0.37	0.83	A
6. Fishing license fees	-0.07	D	-0.06	D	0.04	A	0.89	-0.03	D

WAI = Weighted average index, AL = Assessment level, AS = Strongly agree, A = Agree, ND = Neither agree nor disagree, D = Disagree, DS = Strongly disagree

Table 7 Weighted average index of fishers' appreciation of fisheries management efficacy issues in this area

Issue of fisheries management	Downstream		Upstream		Midstream		F-test	Total	
	WAI	AL	WAI	AL	WAI	AL		WAI	AL
1. Fishing in this area helps improve your life	1.76	AS	1.73	AS	1.93	AS	0.06	1.81	AS
2. Total quantity of fish catch in this area is increasing	1.90	AS	1.89	AS	1.84	AS	0.65	1.88	AS
3. Species quantity of fish catch in this area is increasing	1.88	AS	1.86	AS	1.81	AS	0.65	1.84	AS
4. Number of fishers is increasing	1.27	AS	1.11	AS	1.05	AS	0.61	1.13	AS
5. Fisheries in this area is sustainable	1.85	AS	1.84	AS	1.67	AS	0.09	1.78	AS
6. Fisheries in this area should be restored	1.85	AS	1.90	AS	1.81	AS	0.44	1.86	AS
7. Requirement of fish catch increases every year	1.90	AS	1.95	AS	1.86	AS	0.35	1.91	AS
8. Fisheries management should be cooperative between local people and government agencies	0.61	A	1.17	AS	0.65	A	0.04	0.84	A
9. Get more benefit by applying co-management for fisheries	1.51	AS	1.62	AS	1.68	AS	0.46	1.61	AS
10. Protected areas are beneficial for fisheries resource sustainability	1.12	AS	1.48	AS	1.74	AS	0.00	1.48	AS

WAI = Weighted average index, AL = Assessment level, AS = Strongly agree, A = Agree, ND = Neither agree nor disagree, D = Disagree, DS = Strongly disagree

such as no fishing during the spawning season or within spawning grounds, and controls over discharging fuel and wastes (Table 8). However, the respondents disagreed with some future measures (i.e. controlling the quantity of fish catches, number of fishers, and time for fishing) and would not participate or cooperate in their implementation. They thought that these measures would affect their fish catches and income. In addition, the WAI of respondents' opinions on those measures differed between study sites. The WAI at the downstream site was higher than at the other sites. This might have been because most respondents at that site depend on fishing. They were apprehensive that those proposed measures would affect their livelihood (Table 9).

Finally, for improved fisheries management, a strong participatory program among official organizations and major local stakeholder groups should be designed to ensure that fisheries resources maintenance is harmonized with sustainable use, with low or no impact on the environment. Developing strong collaboration among the various stakeholders in the area is the best alternative policy for the future successful and sustainable fisheries management (Pomeroy, 1995; Doma & Yakupitiyage, 2011). Thus, successful inland fisheries management should promote capacity building in knowledge and awareness of the sustainable use of the resources among all social groups, establishing efficient participatory actions for fisheries and environmental activities.

Table 8 Weighted average index of fishers' opinions on potential activities to maintain aquatic resources in the future

Activity	Downstream		Midstream		Upstream		F-test	Total	
	WAI	AL	WAI	AL	WAI	AL		WAI	AL
1. Fishing only for catch of right size	1.00	H	0.96	H	0.95	H	0.30	0.97	H
2. No fishing in protected areas	0.78	H	0.79	H	0.82	H	0.88	0.80	H
3. No fishing in spawning season	0.66	H	0.51	H	0.54	H	0.22	0.56	H
4. No use of illegal fishing gears	0.95	H	0.85	H	0.88	H	0.21	0.89	H
5. No fishing of aquatic animals during spawning time	0.70	H	0.51	H	0.54	H	0.08	0.57	H
6. Releasing fish fry to the river	1.00	H	0.96	H	0.96	H	0.22	0.97	H
7. No discharge of fuel or litter	0.61	H	0.51	H	0.50	L	0.47	0.53	H
8. Helping government staff take care of fisheries resources	0.78	H	0.71	H	0.75	H	0.57	0.74	H

WAI = Weighted average index, AL = Assessment level, H = High, L = Low, N = No

Table 9 Weighted average index of fishers' opinions on future fisheries management measures

Future fisheries management measure	Downstream		Midstream		Upstream		F-test	Total	
	WAI	AL	WAI	AL	WAI	AL		WAI	AL
1. Setting appropriate fishing gear	0.63	A	0.84	A	0.81	A	0.22	0.78	A
2. Setting appropriate amount of fishing gear	0.51	A	0.83	A	0.75	A	0.06	0.72	A
3. Controlling number of fishers	-0.59	D	-0.03	D	-0.07	D	0.00	-0.19	D
4. Controlling fish catches	-0.71	D	-0.22	D	-0.14	D	0.00	-0.32	D
5. Setting allowed time for fishing	-0.46	D	-0.22	D	0.04	D	0.02	-0.19	D
6.Setting aquaculture areas	0.68	A	0.92	A	0.65	A	0.01	0.76	A
7. Providing aquatic animal species for aquaculture	0.73	A	0.89	A	0.63	A	0.02	0.76	A
8. Supporting villagers in fisheries management participation (Co-management)	0.83	A	0.79	A	0.91	A	0.19	0.84	A
9. Establishing more protected areas	0.83	A	0.86	A	0.86	A	0.90	0.85	A

WAI = Weighted average index, AL = Assessment level, A = Agree, N = Not decidedl, D = Disagree

CONCLUSION AND RECOMMENDATIONS

Based on the findings, the following activities in the area are recommended to achieve the sustainable use of the fisheries resources in terms of ecological integrity, social equity, and management efficiency.

Management program on fisheries resources

According to fisheries resources degradation, fishers' perceptions and attitudes on fisheries resources and environment should be regularly assessed to provide useful data to be used in decision-making in fisheries resources management. Such information can help fisheries managers better understand the current conditions of the fisheries resources, the aquatic environment, and fishers. The managers can provide effective activities and guidelines in the management systems. Loading of chemical fertilizers and pesticides from farming areas is one of the major causes of fish deaths in the study area. Controlling and minimizing the usage of these materials should be encouraged and organic fertilizers and pesticides should be promoted. People's awareness of the environment should be increased through information campaigns. Also, regular monitoring of water quality should be carried out in the interests of good public health. The responsible agencies for this activity should be the DOF, the PCD, the Department of Agricultural Extension (DOAE), and communities or fisher groups and farmers. Moreover, restocking programs of aquatic animals or fishes (both commercially important and rare species) should be continuously conducted in order to increase fish production and diversity, and the fishing income of fishers. The species introduced in the area should be based on fishers' request and suitable to the aquatic environmental conditions, such as giant freshwater prawn and Nile tilapia. This practice should be undertaken by the DOF and fisher group or the TAOs.

Enhancement programs on the socio-economics of fishers

Due to the fish catch decline and the subsequent low fishing income, aquaculture in ponds and cages should be promoted to provide a good source of income for fishers, to alleviate the poverty of fishers, and to decrease the pressure on natural resources in the area. Some examples of species which should be cultured are giant freshwater prawn, tilapia, and climbing perch. In addition, other income sources such as handicrafts and alternative fish processing that can add value to their products should be promoted in order to increase fishers' income. Responsible agencies for such activities should be the DOF, the Community Development Department (CDD), and the fishers themselves.

Institution establishment

An institution of cooperation among users (such as fishers' groups and communities) and government organizations (such as the DOF and the RID), should be established. Also, the participation of local people/fishers/stakeholders and local authorities should come with the empowerment to contribute to the process of planning and decision-making in natural resources management. The institution can build interrelationships with various sectors of the resource usages and can better implement the existing policies.

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