

Reviewing human security through fishing livelihoods and brackish environmental hazards in Songkhla Lake, Thailand

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Abstract

This paper integrates three dimensions on people livelihoods and human security and brackish environmental hazards. It seeks for identifying the vulnerability of brackish environmental hazards in a context of livelihood dimension. The perspective places high emphasis on illustrating the adaptation to brackish environmental hazards in fishing communities, in order to address human security at the community level.

Based on that, a detail case study was conducted in Songkhla Lake which is brackish and the largest lake in Thailand. The findings explain that environmental hazards have been increasingly undermining fishing activities and as a result threatening human security. The degradation poses a challenge to the fishing communities and leads to various livelihood adaptation patterns according to the geographical difference and anthropogenic pressures. These identifications will be helpful in throwing some light on innovative factors of resilient community development toward sustainability.

1. Introduction

A concept of human security arose from various emerging threats beyond traditional security. One of the major threats, environmental degradation combined with globalisation tends to pose severe

insecurity situation in many parts of the world (Khagram et al. 2003; Mathews 1986; Matsushita 2007; Ogata and Sen 2003; Paris 2001). Water scarcity, for instance, may not cause conflict but still endanger insecurity plaguing human lives, food production and livelihood opportunities (Khagram et al. 2003). Million people in Indonesia, Central America and sub-Saharan Africa have been forced to leave their homes in part because of insufficient food resulting from the loss of tree cover, the disappearance of soil, and other environmental deterioration (Mathews 1986). It is important to note that even during the civil war, environmental changes made a million refugees from Ethiopia, Uganda and Chad immigrate to Sudan (ibid). As the world is becoming increasingly integrated, a great deal of human security is likely to be more influenced by environmental changes.

Environmental degradation impacts people livelihoods especially in areas which are more dependent on natural environment and resources. The impacts are expanding faster and being visible from local, national and international levels. These kinds of phenomena seen in a diverse and broad way have serious effects on human security across generations and time (Ogata and Sen 2003). Especially, coastal brackish areas are considered to be vulnerable to different types of environmental hazards. These are situated at both extremity of river basins and sea marine, where are dynamic and complex environmental characters: these are transitional ecosystems between land and sea and between fresh and marine water. The unique brackish ecotone endows with a highly productive natural resources and a valuable biodiversity, enabling a large number of peoples to make a living for survival. On the other hand, these brackish areas are one of the most vulnerable environmental places due to sea-level rise, increased level of inundation and storm flooding, seawater intrusion, coastal erosion and water pollution from the upstream. In response to the climate variability, these zones are subject to various influences from not only the coastal and brackish environment but also the adjacent marine and terrestrial areas including the water basin areas. Communities in these areas are needed to build their resilience to cope with the exposures in collaboration with relevant stakeholders. Such environmental problems require regional or “ecosystem-wide” solutions, rather than policies based at the national level (Homer-Dixon 1994).

Based on the above discussions, this paper aims to offer deep insights into the linkage between people livelihoods and human security and brackish environmental hazards. The research seeks for identifying and solving the vulnerability of brackish environmental hazards in a context of livelihood dimension. Firstly, this paper describes a profile of field study area (Songkhla lake, Thailand) and explains about research methodology. Secondly, it reviews the historical trend of environmental changes with due consideration of fishery resources in the lake. Thirdly, we analyse the livelihood perspective in fishing communities of Songkhla lake and identify vulnerability to environmental changes at the community level. The findings can provide adequate information to understand fishery livelihood security to address the adaptation to brackish environmental hazards in Songkhla lake.

2. Profile of Field Study Area and Methodology

Songkhla lake is the largest lake in Thailand, and is situated between 7°08' and 7°50' North latitude and 100°07' and 100°37' East longitudes (Figure 1) **[INSERT FIGURE 1 HERE]**. The lake covers an area of approximately 1,042 km² which is consisted of four interconnected lake eco-system (Ratanacai and Sutiwipakorn 2005); Thale Noi (approximately 27 km²), Thale Luang (approximately 473 km²), Thale Sap (approximately 360 km²) and Thale Sap Songkhla (approximately 182 km²). The water environment in Songkhla lake is a unique assemblage of marine, brackish and fresh water ecosystem with estuarine characteristics. Thale Noi, which is the farthest inland-enclosed lake, is a freshwater ecosystem. On the other hand, Thale Sap Songkhla, which is connected to the Gulf of Thailand, is transitional ecosystem between fresh and marine water.

The average depth in the lake is approximately two meters (Sompongchaiyakul and Sirinawin 2005) but varies from place to place on the basis of geographical characters and anthropogenic pressures. In some areas, the water is becoming around ten centimeter shallower every year

(Fezzardi 2001) due to sedimentation. Nue and Chanachai (2002) pointed out that the issue of water shallowness caused a large number of fish died especially in Thale Noi. In addition to the water depth, salinity in the lake plays a vital role on biological species distribution (Tookwinas and Sirimontaporn 1988). The extent of salinity level affects fish species distribution in the ecosystem so that fishing activities must adjust to the change.

Under the circumstances, there are reported to be around 160 fishing villages. In 1997, the total number of fishing population is approximately 36,200 accounting for around 12.6 per cent of the total population in Songkhla lake while of household is approximately 7,100 (PCRMBST and FFST 1998). Major portions of fishing population are Buddhists and Muslims. Integration of practical knowledge and experience with their faiths and beliefs had brought into harmonized fishery resource management (Corporate Communications Department 1998). Songkhla lake, however, has been experiencing severe environmental hazards combined with anthropogenic pressures as Section 3 illustrates.

Based on the above, field work was carried out in Songkhla lake during May in 2007, January, February, July, September and October in 2008. The research used both qualitative and quantitative data including structural questionnaires, participatory rural appraisal (PRA), key informants interviews and secondary data. The primary data from structural questionnaires were collected from more than 10 per cent households in each fishing villages on the basis of four interconnected lake ecosystem, bringing the total to 98 household samples. The questionnaires were aimed to assess pressing constraints and positive strengths of sustainable fishery livelihoods in Songkhla lake while to understand the difference of fishery livelihoods and adaptive capacity to brackish environmental hazards related to the variant lake ecosystem and anthropogenic pressures in each fishing village. Further, village history profile and seasonality maps were applied as a PRA exercise for understanding the community context of environmental adaptation in Songkhla lake. Moreover, semi-structured interviews with key informants (government officers, village leaders, NGOs, researchers, etc.) were conducted to validate and compliment the information.

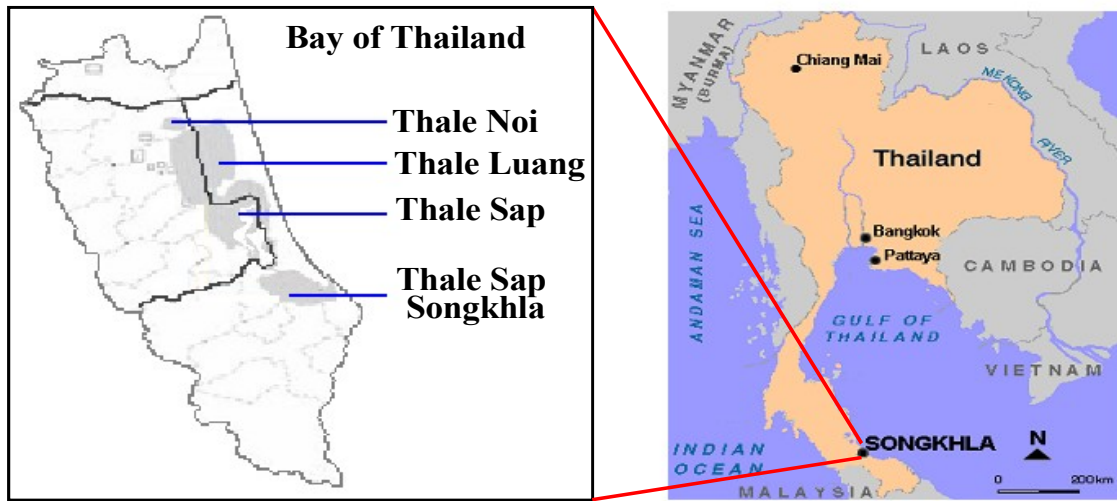


Figure 1 Map of Songkhla Lake (Thailand)

3. Environmental Changes in Songkhla Lake

Indeed, a rich ecosystem in Songkhla lake has endowed a highly productive fishery resources. A marine consultant argued that the lake was considered to be a body of water where shrimps were the most abundant (Corporate Communications Department 1998). Such substantial environment in the lake enables a large number of fishers and local persons who are engaged in allied fishery business activities to support their livelihoods. As the years passed, however, the entire area of Songkhla lake has been undergoing various types of tremendous changes in availability of fishery resources.

A first major environmental change occurred in 1956 because of construction of sluice gates at Pak Ra Wa which is located on the northern part of Thale Luang (Fezzari 2001). Royal Irrigation Department constructed and closed the gates to prevent salt-water intrusion from the sea for farming purposes. The closure, however, hindered the exchange of water between sea and lake, resulting in the lower salinity level especially in Thale Noi that affects many living creatures for survival. In response to this, many fishers have continuously protested against the implementation and made a strong demand that Pak Ra Wa be opened and maintain the status in quo ante. Despite of this, what

is worse, there has been another emerging environmental threat; the governments have strived to initiate dam constructions in Songkhla lake for farming and industrial purposes since 1971. A series of dam construction projects were suspended through strong opposition of various stakeholders including fishers, consultants and NGOs, but the debates have been constantly discussed yet. These hydrological changes as consequences of water barrier are expected to impact on the water environment in the lake to a great extent.

In addition to the above, a second major environmental change has occurred especially since 1980s. Land use change along globalisation has been practised in Songkhla lake basin; many paddy fields in the fringe of the lake was converted for shrimp farms since around 1987 (Ratanacai and Sutiwipakorn 2005), causing severe damages to the lake ecosystem. Likewise, deforestation and illegal logging have been prevailed even in reserved forests. The felling areas tend to be legally or illegally converted for rubber and oil palm plantations as shown in Table 1 **[INSERT TABLE 1 HERE]**. Such monoculture practice combined with extending commercialisation provokes flooding of major streams and induces soil erosion from the upstream into the lake. Related to this, annual floods, irrespective of variant fishing sample communities, were regarded as risky (37,5 per cent) or most risky (33.3 per cent). These land use changes made Songkhla lake more vulnerable to brackish environmental hazards by way of climate variability and sedimentation with water shallowness. Furthermore, it needs to address that modernized industrialization and rapid population growth poses tremendous threats on the water quality, which affect adverse impacts on aquatic animals in the lake. Indeed, around 81.6 per cent respondents regarded their surrounding water quality as bad one.

Under the circumstances, fishing communities also faced with another issue of destructive and illegal fisheries (ex. push nets fisheries, electrification, fish poisoning). Introduction of new fishing gears enables fishers to achieve more catches. Some of them, however, tend to negatively impact the natural recruitment of aquatic animals unless due considerations are taken. Particularly, push nets fisheries, which were legally prohibited in 1972 but still practiced in some areas, are

considered responsible for the most critical damages in the lake. It is apparent that push net fisheries are different from other fishing methods in terms of their catch per unit effort (CPUE) as shown in Table 2 [INSERT TABLE 2 HERE]. Such destructive fishing methods make fish stocks decreased and destroy fish traps in the area of Thale Sap and Thale Sap Songkhla.

As a result of these anthropogenic pressures, a decline of fishery resources has widely been prevailed. Two major and systematic studies on fish catches in Songkhla lake reported a 22 per cent reduction in quantity between 1984-86 (12,290 tons/year) and 1994-95 (9,634 tons/year) (Ratanachai et al. 2005). Although the total catches of fishery resources increased in Thale Sap Songkhla¹, these marked a decline in other areas especially in Thale Noi. Those negative impacts triggered fishers' households and related people to feel them urgent necessity to adapt to these environmental hazards in an appropriate manner.

Table 1 Land use change in Songkhla lake basin between 1993 and 2002

Land Use Category	Area [Unit: Rai] (%)		Change (%)
	1993	2002	
Residential area	120,224 (2.26)	139,837 (2.63)	16.3
Agricultural land	2,982,508 (56.17)	3,537,827 (66.63)	18.6
Paddy rice field	1,412,916 (26.61)	1,126,211 (21.26)	-20.3
Abandoned rice field	-	83,340 (1.57)	-
Rubber plantation	1,428,753 (26.91)	2,125,775 (40.04)	48.8
Mixed orchard, oil palm, etc.	120,373 (2.27)	161,273 (3.04)	34.0
Shrimp farm	20,466 (0.39)	31,341 (0.59)	53.1
Forest land	974,376 (18.35)	727,426 (13.70)	-25.3
Water body	-	668,668 (12.59)	-
Natural	-	661,848 (12.47)	-
Man-made	-	6,820 (0.13)	-
Others	-	245,485 (4.63)	-
Total	**5,309,356 (100)		

Source: revised from Ratachanai and Sutiwipakorn (2005)

Table 2 CPUE of Fishing Gears in Songkhla Lake in 1994-95

Fishing Gear	Catch Per Unit Effort (CPUE – Kg/Hour)			Average CPU (Kg/Hour)
	Thale Sap Songkhla	Thale Luang	Thale Noi	

¹ The increase of fish stocks might be related to improvement of fishing equipments and more equipment per head.

Sitting Cage	0.02 – 0.80	0.02 – 0.50	-	0.34
Gill Net	0.20 – 1.30	0.12 – 0.25	0.15 – 0.32	0.39
Horizontal Fish Traps	0.10 – 0.25	-	-	0.18
Set Bag	2.50 – 15.00	1.50 – 10.00	-	8.25
Push Net	8.00 – 45.50	-	-	26.75

Source: revised from Fezzardi (2001)

4. Livelihood Analysis in Fishing Communities of Songkhla Lake

This section aims to assess the condition of fishery livelihoods in Songkhla lake through the case study (Section 4.1) and link it with environmental change in community context (Section 4.2).

4.1 Livelihood Condition of Fishing Communities

The basic information on sample fishing communities in Songkhla lake are shown in Table 3 [INSERT TABLE 3 HERE]. The case study reveals that the livelihoods of fishing communities largely depend on the fisheries from Songkhla lake (62.9 per cent on average). The fishers normally go fishing in each area of interconnected lake ecosystem that is mostly below two meters deep (83.3 per cent). Most of them use small-scale outboard engine (94.4 per cent) with various fishing gears. Utilization of gill nets and horizontal fish traps are common features in all sample fishing communities. On the other hand, the fishers in each area use different types of fishing gears and methods. For instance, sitting cage fisheries are more concentrated in Thale Sap Songkhla than in other areas. Some fishers in Thale Sap Songkhla, which is brackish lake environment, engage in shrimp culture while nobody in the area use cast nets for fishing. Next to gill nets, however, utilization of cast nets is the second majorest fishing gears in Thale Sap and Thale Luang. Likewise, it found that utilization rate of gill nets (100 per cent) and horizontal fish traps (45 per cent) are highest in Thale Noi. As Ratanachai et al. (2005) argued, these variant characteristics of fishing methods are largely attributed to conditions of fishery resources in each part of interconnected lake.

Related to their occupational characters, the range of their annual household incomes in sample

fishing communities is 50,001 to 100,000 Thailand Baht (TBH), followed by 25,001 to 50,000 TBH, 100,001 to 200,000 TBH, etc. The income is not sufficient to cover their living expenses given that the range of their monthly household expenditure is largely concentrated on 5,001 to 10,000 TBH, followed by 2,501 to 5,000 TBH, etc. The expenditure for food was regarded as the highest priority while housing, electric products, clothes and savings were identified as lowest ones.

Table 3 Information on Sample Fishing Communities in Songkhla Lake

Area	Sample Communities	Household Numbers	Sampling Numbers	Family Numbers	Occupation	
					Primary	Secondary
Thale Noi	TN Village	188	21	3.38	Fisheries	Mat Making
Thale Luang	KK Village	145	15	4.06	Fisheries	Agriculture
Thale Sap	CF Village	186	21	4.04	Fisheries	Rubber Plantation
Thale Sap Songkhla	TS Village	387	41	4.24	Fisheries	Merchants
Total		906	98	3.99		

4.2 Adaptive Response to Environmental Changes in Songkhla Lake

On account of variant conditions of fishery resources in each part of interconnected lake, the case study reveals that their livelihood strategies against environmental changes in Songkhla lake spatially differ. The strategies can be compiled into two components: economic diversification and movement of fishery co-management regime in Songkhla lake.

4.2.1 Economic diversification

Tracing back to the historical sketch in Songkhla lake, the local in fishing communities have been exposed to rapid environmental deterioration. As the Section 3 illustrated earlier, hydrological changes and land use development combined with extending commercialisation affected to a great extent the lake ecosystem by way of water pollution, salinity reduction, water shallowness, etc.

These factors change the whole situation of fish ecology and might reduce the fish stocks drastically. On account of this, many fishers except in Thale Sap Songkhla tend to supplement their household income with a side job or change their jobs from fishing to alternative occupations. Around one third of working peoples in fishing communities (33.4 per cent) has secondary job especially in Thale Sap (70.0 per cent), as opposed to the results in Thale Sap Songkhla (16.8 per cent) owing to abundant conditions of fishery resources. The local in Thale Sap has engaged in multiple occupations in the base of fisheries and rubber plantation due to less availability of fishery resources. Likewise, 35.3 per cent fishers in Thale Luang engage in another job of agriculture or animal husbandry as well as fisheries. Aside from diversifying income sources, most of wives in Thale Noi (71.4 per cent) worked as mat making to maintain their livelihoods. Some of them also engage in the fisheries with their husbands, which is applicable to all sample fishing communities.

Moreover, coping strategies for economic diversification can be found in receiving multiple sources of financial loan. Around 75.5 per cent households borrowed money from various sources (approximately 1.4 lenders) at an average of 45,644 TBH. The main purpose of indebtedness (83.7 per cent) was linked to costs for purchasing or repairing fishing gears. Interestingly, the difference between Thale Sap Songkhla and other interconnected lakes can be shown in the way of how to obtain the loan sources. In the former, their loans were mainly provided from specific persons; relatives (22.6 per cent) and fish merchants (19.4 per cent). In the latter, these were obtained from organized groups, rather specific persons; village revolving fund (41.1 per cent), government banks (28.8 per cent), private banks (16.4 per cent). Particularly, establishment of village revolving fund plays a great role on having flexible and easy access to financial loan in rural areas at lower interest rate. Elaborations were made on obtaining immediate money for adjusting to any contingency such as health care and natural disasters, enabling the local to mitigate the impacts of environmental changes in Songkhla lake.

4.2.2 Movement of fishery co-management regime in Songkhla lake

Economic diversification is a key option of livelihood adaptation in fishing communities of Songkhla lake. As well, fishery resource management is more or less the core point to be addressed. The resource is the principal form of livelihood for survival and affects lives in various ways. In an effort to maintain (and preferably improve) fishery resources in Songkhla lake, there is an increasing trend of fishery co-management regime in the base of fishers.

Facing dangers of being losing fishery resources, people organizations have been established with an aim to protesting operations of push net fisheries in Thale Sap Songkhla in 1983 and stopping destructive and illegal fisheries for natural restoration of Thale Noi in 1989, respectively. However, the availability of fishery resources had been still remained or gotten worse in some parts of the lake as practice of destructive and illegal fisheries, water shallowness and water pollution in the lake became obvious. Many fishers came to recognize a necessity of lake conservation and empowerment of small-scale fishers against commercial fishers.

Consequently, the fishery co-management regime was formally established by the initiatives of village leaders, fishers and NGOs in 1993 called “the Federation of Fisherfolk in Songkhla Lake (FFSL)”. The federation is consisting of five people organizations which cover the entire area of Songkhla lake. Their principal goals are to influence the government policy and implement conservation projects with an emphasis on community rights and participation (Nue and Chanachai 2002). The federation enables fishers to create common arena for information exchange to raise environmental awareness toward wise use of fishery resources. The arena also provides them for discussions to understand their underlying problems of Songkhla lake fisheries and integrate such information into policy planning with appropriate advocacy. For lake conservation, the federation encourage each associated village to set up conservation zones while to establish village revolving funds for flexible adaptation to environmental changes in Songkhla lake. In 2008, the conservation zones amount to 34 numbers which cover more than 20,854.25 rai out of the lake. In order to augment the number of fish stocks, elaborations are made on releasing juvenile aquatic animals in

these zones with a help from government agencies, researchers and NGOs. Related to this, Department of Fisheries (DOF) in combination with National Institute of Coastal Aquaculture (NICA) have launched a project of “sea farming” since 2004, which aims to promote sound fishery management system with due responsibility between the communities and the state; the fishing communities require formulating their own rules for management of conservation zones including patrolling and punishment while DOF is in charge of empowering their capacity, releasing juvenile aquatic animals in their sea farming and conducting environmental assessment in collaboration with NICA.

5. Conclusions

Putting it all together, this paper sought to address human security in a context of livelihood dimension by identifying the vulnerability of brackish environmental hazards in the case study of Songkhla lake. Brackish lake is one of the most vulnerable water environments so that external impacts including climate variability and the surrounding areas are extremely subject to the lake ecosystem. On account of this character, the fishing communities in Songkhla lake required adjusting to strong restriction of nature’s force. Hydrological changes and land use development affected to a great extent the lake ecosystem by way of water pollution, salinity reduction, water shallowness, etc. Exposure to these negative factors combined with anthropogenic pressures eroded soundness of fish ecology and subsequent fishery livelihoods. The decline of fishery resources endangers human insecurity plaguing their lives, livelihood opportunities and dignity.

Under the circumstances, the fishing communities in Songkhla lake applied their livelihood strategies to adapt to brackish environmental hazards (Figure 2)**[INSERT FIGURE 2 HERE]**. The strategies are mainly based on economic diversification and fishery co-management in the base of fishers. In order to cover the decrease of fish landing amounts, many fishers except in Thale Sap Songkhla took actions for obtaining multiple income sources or changing to alternative occupations. Further, elaborations were made on receiving multiple sources of financial loan especially from

organized groups. These enable fishers' family to flexibly mitigate the impacts of brackish environmental hazards.

Apart from economic diversification, collective actions toward fishery co-management among the fishers and between the fishers and the state can be observed in Songkhla lake. These stakeholders came to share the significance of fishery co-management with due responsibility and empowerment among them, resulting from the confluence of environmental threats that is excessively linked to human activities in Songkhla lake basin. The movement of fishery co-management has been accelerating, in order to mobilize collaborative relationship among the stakeholders toward sustainable lake fisheries. Those efforts are considered effective adaptation in fishing communities in collaboration with relevant stakeholders.

In this regard, however, attention also should be taken into account watershed conservation at the larger level which this paper did not include in the analysis. In response to extending demands and over-consumption of water resources in Songkhla lake basin, a Songkhla lake basin committee was established to act as coordination of sustainable development in Songkhla lake basin among the stakeholders including different government agencies, researchers and people sectors. However, the management and administration mechanisms of the committee have been structurally flawed, led to inefficiency in tackling the watershed management (Ratachanai et al. 2005). The perspective of watershed management is imperative for understanding fishery livelihood security to address their adaptation to brackish environmental hazards in Songkhla lake. Therefore, further research is called for analysing the process of watershed management and conservation in Songkhla lake basin and identifying pressing constraints and positive strengths toward integrated Songkhla watershed management.

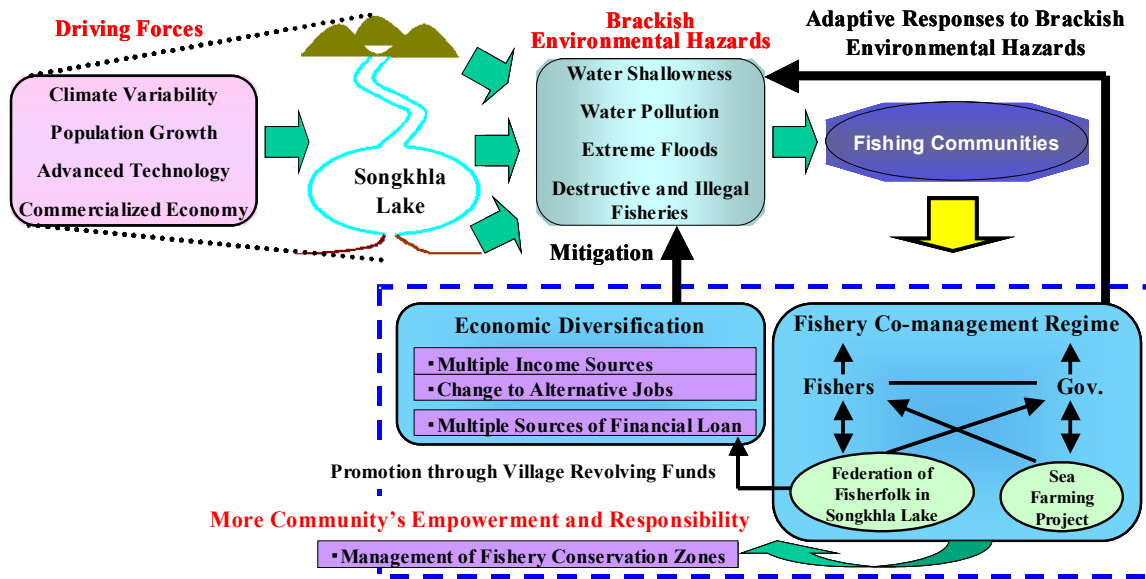


Figure 2 Livelihood Strategies to Adapt to Brackish Environmental Hazards in Songkhla Lake

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