Responses of Fishers to a 25-year Seasonal Closed Measure on the Andaman Coast of Thailand

Sampan Panjarat & Nathan Bennett

A report of Project IMPAACT and the Marine Protected Areas Research Group

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This publication should be cited as:

Panjarat, S. & Bennett, N. (2012). Responses of Fishers to a 25-year Seasonal Closed Measure on the Andaman Coast of Thailand. Report prepared for Project IMPAACT and the Marine Protected Areas Research Group, University of Victoria. 21 pages.

Design and layout: Nathan Bennett, Cover Photo: Nathan Bennett,

Executive Summary

To address fisheries declines and protect stocks, a Seasonal Closed Measure (SCM) was established in Phang-Nga and Krabi Bays in 1985 and later amended in 2007. Although the SCM has been in place for more than 25 years, its overall effectiveness has been questioned. Generally, fisheries policy decisions in Thailand are made in a top-down fashion by centralized government agencies. The knowledge and opinions of fishers are not taken into account in the creation of policies or the design of management measures. This practice persists despite the fact that attitudes and perceptions of fishers can indicate whether a regulatory instrument is appropriate within a particular social context and can assist with the effective implementation of the measure over the short and longer term.

To address this gap, this report presents the results of a study that examined knowledge, attitudes, and perceptions of fishers on the SCM. The study examined levels of knowledge, perceptions of impact, satisfaction, behaviors, and opinions regarding the SCM. An individual questionnaire survey of 100 fishers was undertaken during October-November 2010 in Phang-Nga, Phuket, Krabi and Trang Provinces, Thailand.

The important findings of the study include the following: 1) most fishers had low knowledge on the SCM because of ineffective knowledge mobilization; 2) fishers lacked participation in most management activities because of inappropriate mechanisms for participation; 3) some fishers disagreed with the time and area of the restriction, and some of them opposed the SCM, a few fishers continued to ignore the SCM regulations, 4) fishers were dissatisfied with the performance of patrols and the enforcement of the measure, 5) fishers distrusted patrol officers and did not report violators, 6) fishers distrusted fishers from outside their communities and doubted that they would comply with the SCM, and 7) most fishers were satisfied with the SCM (74%) - however, they felt that it still requires improvement.

The following recommendations are made in response to the research findings: 1) the enhancement of the standard knowledge transfer mechanisms especially through social networks and improved participation and involvement, 2) the enhancement of participation requires creation of appropriate and timely processes that incorporate awareness of the social characteristics and the nature of fisheries occupations and the holding of meetings and discussions at the local level preferably via pre-established networks or associations, 3) the re-assessment of various aspects of the SCM including the time and areas of restriction and the exempted fishing gears; the assessment method should integrate the scientific knowledge base and traditional knowledge of fishers and provide for local involvement in order to build trust and commitment, 4) the examination of the capacity and performance of patrol officers in order to ensure effective and equitable enforcement of regulations; further, the building of trust with fishers will enhance information sharing between fishers and patrols, save costs for patrolling, and resolve conflicts. 5) The establishment of appropriate mechanisms to slowdown the race-to-fish that currently occurs after closed season is also recommended. 6) Finally, the provision of capacity building and conservation knowledge, establishment of strict no-take-zones, and creation of incentives for stewardship are also recommended to sustain the SCM and marine resources in Ao Phang-Nga and on the Andaman Sea Coast of Thailand over the long term.

Marine Protected Areas Research Group

The Marine Protected Areas Research Group focuses on all aspects of the establishment and management of marine protected areas within the context of integrated coastal management. We believe that interaction amongst committed individuals from different backgrounds and perspectives provides an enriched environment for advancing knowledge regarding MPAs. The group undertakes research on all aspects of MPAs, ranging from institutional assessments and social surveys through to basic bio-geographical studies on marine and coastal ecosystems. Active research programs have been or are currently underway in Canada and throughout much of the developing world including Southeast Asia, Africa, and Latin America. For more information on the Marine Protected Areas Research Group, please visit http://mparg.geog.uvic.ca/.

Project IMPAACT

The Andaman Bioregion of Thailand is one of the most abundant and diverse marine ecosystems in the world and is home to 18 marine protected areas. The region is a centre of tropical marine biodiversity, but the reefs and other key ecosystems are deteriorating due to a wide range of pressures. This year (2010) witnessed the most severe coral reef bleaching ever and climate change will have an increasing impact on marine ecosystems in the future. At the same time there are many communities that are dependent upon marine and coastal resources for their livelihoods. These dependencies range from traditional and commercial fishing activities through to more recent dependence on coastal tourism. These activities will also see significant changes as coastal ecosystems change. The goal of Project IMPAACT is to provide further understanding of likely climate-change induced changes in coastal ecosystems and communities and suggest interventions that can increase the resilience of ecosystem conservation and the adaptive capacity of livelihood dependent communities in the future. The IMPAACT acronym stands for Improving Marine Protected Areas on the Andaman Coast of Thailand. IMPAACT is a project of the Marine Protected Areas Research Group at the University of Victoria, Canada. For more information about Project IMPAACT or this publication please visit http://projectimpaact.asia or contact:

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Acknowledgements

The research that lead to this report was completed as part of a master's degree at the Asian Institute of Technology under the supervision of Dr Shivakoti, Dr Cochard, and Dr Ebbers. The work was supported financially by Ministry of Agriculture and Cooperatives. Project IMPAACT is a project of the Marine Protected Areas Research Group at the University of Victoria. International and Thai partners of Project IMPAACT include the Bay of Bengal Large Marine Ecosystem Project, the Department of Fisheries, Phuket Marine Biological Centre, the Department of Marine and Coastal Resources, the Department of National Parks, Wildlife and Plant Conservation, Centre for Biodiversity in Peninsular Thailand at the Prince of Songkla University, and the Department of Conservation in the Faculty of Forestry at Kasetsart University.

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1 Introduction

A Seasonal Closed Measure (SCM) in the Andaman Sea Coast of Thailand (ASCT) was first established in 1985. It was created to protect stocks of the Indo-Pacific Mackerel, which are very important for food security, economic value, and fisheries livelihoods. This fish species plays an important role in terms of protein supply for households, and at the same time, it is an integral part of Thailand's food culture. However, the ongoing exploitation of undersized fish was a threat of the species. As a result, it was selected as the flagship species to be conserved during the spawning and nursing season in Phang-Nga Bay. Initially, in 1985, an annual closed period was created from 15 April to 15 June and restricted areas were established. Later on, in 2007, the SCM was amended in order to protect other commercial pelagic fishes. The area of restriction was expanded from 2 provinces to 4 provinces including Phang-Nga, Phuket, Krabi and Trang and the closed period was extended from only two months (15th April-15th June) to three months (1st April-30th June) (Figure 1). The primary goal of the SCM is the prohibition of trawlers and fishing activities employing gillnet carrying mesh size less than 4.7 cm.

The enforcement of the SCM directly relates fishers in the area. Although the SCM has been established for more than 25 years, the assessment of its effectiveness has emphasized ecological outcomes– whether it has resulted in the increasing/decreasing of fishery resources - rather than the social aspect of resource users despite the fact that they are the key to the functioning of the SCM in the long run. Doubts have been expressed regarding the attitudes and perceptions of fishers towards the SCM and whether they understand or support the measure. Thus, this research aimed to evaluate the effectiveness of the SCM through the exploring the attitudes and perceptions of fishers towards the SCM. In this report, the results derived from interviewing and surveying fishers are analyzed and explained. In addition, the report provides lessons learned from the case and make recommendations for the more effective implementation of the SCM as a tool for marine and fisheries conservation.

Figure 1 - The SCM on the Andaman Coast of Thailand and the research sites

2 Methodology

Data for this study was collected through initial reconnaissance interviews and subsequently through face-to-face surveys. Prior to running the survey, an initial pre-test was conducted. The questionnaire was then improved to respond to the real conditions in the study areas and to improve the validity and reliability of questionnaires to an acceptable level (Cronbach's α 0.6-0.8). The main questionnaire survey was conducted during October-November 2010 with 100 fishers in 10 villages surrounding Ao Phang-Nga and the SCM in Krabi, Trang, Phang-Nga, and Phuket provinces (**Figure 1**).

3 Results

The following section will present the results of the surveys. The focus will be on1) the characteristics of fishers and fisheries in the Andaman Sea Coast of Thailand and the study sites, 2) the level of knowledge of fishers about the Seasonal Closed Measure (SCM) and sources of information, 3) the level of participation of fishers in the SCM establishment and management processes, and 4) the attitudes and perceptions of fishers on the SCM.

3.1 Fisheries characteristics in the area

Fishers in the 4 Provinces affected by the SCM can be characterized by fisheries assets such as amount of fishing gears possessed, sizes of fishing boat, areas of fishing, etc. However, fishers can be mainly distinguished by whether they participate in small-scale fisheries or large-scale fisheries.

Large-scale fishers owned large-scale single gears, which are associated with the use of a larger size of boat (>14 m). Gears utilized by large-scale fishers included trawlers, purse seiners, day-anchovy purse seiners or anchovy light-luring purse seiners. There were more varieties of large-scale gears in Phang-Nga Bay than in Krabi Bay where only purse seiners were found. Large-scale fisheries required a large crew for labor – up to 40 individuals. Fishing masters are usually boat owners. However, they can also be wage earners. Laborers received both salaries and commission, which they were paid periodically– for example, once per moon cycle, once per three months, or once per six months depending on the type or types of fishing gear. Most of the fishing laborers in the Phang-Nga Bay were Burmese while all fishing laborers in the Krabi Bay were Thai. For the day-anchovy purse seiners, they were found only on Koh Yao Yai Island of the Phang-Nga Bay. The characteristics of this fishery are different from other large-scale fisheries. Even though this kind of fishery is defined as large-scale and it requires 10-12 crews or more, most crews were local people and they commonly were relatives or neighbors of boat owners or investors. The profit obtained is shared among them under previously agreed conditions. The detail of profit sharing was not provided. Under these circumstances, these fishers refused to be classified as commercial fishers and declared that they were subsistence fishers. Large-scale fishers spend nearly all their time fishing and work the entire year. As a result, their income is 100% derived from fisheries. However, since fisheries occupations have no security; a few of them invested in parallel businesses such as house renting or agriculture. All of the large-scale fishing gears, except day-anchovy purse seine, was prohibited to operate within the restricted area during the enforcement period of SCM. Fishers had to find fishing grounds that were further afield. As a consequence, more fuel was consumed. Ultimately, a few fishers, who owned purse seiners in Krabi Province, temporarily stopped their fishing activity during the closed season and worked in alternative occupations.

In contrast, the small-scale fishers operated small-scale fishing gears with smaller boats (<14m) and required less crew (2-3 persons). These crews are normally family members or neighbors. Fishers in Krabi Bay operated a wider variety of small-scale gears than fishers in Phang-Nga Bay. Types of gears were up to 5 types per fisher in order to catch different target species in different periods of the year. From 63 small-scale fishers, the total number of gears possessed was 106 units. Fishing grounds were often located closer to shore and fishers often did not spend the whole day fishing, depending on the types of gears. Fishers had daily income because catch was landed and sold every day. Some fishers worked in parallel occupations such as in the agricultural sector, either as investors or wage earners. Small-scale fishers of Koh Kiam Village in Krabi Bay of Trang Province have also been allowed by local administration to utilize natural Nypa palm by a quota system. Thus, these fishers periodically received income from Nypa palm harvest.

However, both large-scale and small-scale fishers stated that fishing occupations were both risky and hard work. Thus, they often attempt to support their children to complete the highest educational level possible so that their children will not have to work in this hard and insecure occupation in the future. The average size of fishers household was 4.7±1.7 members. The maximum number of family member was up to 18 in Ban Koh Yao where extended families were commonly found living together.

3.2 Knowledge of fishers about the SCM and sources of information

3.2.1 Levels of knowledge about the SCM

"Knowledge of fishers about the SCM and understanding of SCM regulations were low"

Overall, approximately half of fishers at first stated that they were aware of the existence of the SCM and/or knew about the amendment. However, when tested on knowledge-related questions - including time and area of restriction, prohibited gears, exempted gears, and sanctions- fishers realized that they had misunderstandings and/or lacked knowledge on the important elements of the SCM (Table 1).

For the test on knowledge on the area of restriction, the mean score was 40%. Large-scale fishers could usually identify the areas of restriction correctly both by recalling the latitudes and longitudes which were recorded in Global Positioning System (GPS) of boats and by observing the surrounding islands on the testing map. Some of them clarified that it was not necessary to remember the area because they were usually made aware of the area of restriction by warning system setting in the onboard GPS. Nevertheless, day-anchovy purse seine fishers in Phang-Nga Bay have less knowledge of the area of the SCM because they perceived that the gear was exempt for the SCM restriction. Similarly, most small-scale fishers could not identify the area of restriction or even list the Provinces under the SCM competently. They openly admitted that they did not pay much attention to the area since they have freedom to fish in it. Moreover, many fishers in Trang Province stated that they had known about the SCM for a long time, but they did not receive the information that the area of restriction had been extended to Trang Province. Accordingly, they still perceived that the SCM related to only fishers in Phang-Nga and Krabi Bays.

For the test on knowledge on the time of restriction, the mean score was 35%. Many fishers still perceived that the closed period was for2 months instead of the present 3 months. Although they could approximately state the timeframe of the closed period, they could not identify the precise start and end dates. As previously mentioned, small-scale fishers in Krabi Bay, especially in Trang Province,

sincerely stated that they had no idea either the length of closed or the started and ended dates because they did not aware that it covered the area of Trang Province as well.

The mean score of the test of prohibited fishing gear was only 25%. Large-scale fishers could identify whether their gears were prohibited to operate in the restricted area during the SCM enforcement or whether the gears were exempt. Even though small-scale fishers could easily cite commonly prohibited gears which were large scale such as trawlers and purse seiners, few fishers were aware that gill nets carrying mesh size less than 4.7 cm are prohibited and that it is the major element of the measure. Moreover, some fishers included other kinds of illegal fishing gears such as push nets or beach seines. It was surprising that when this question was asked, small-scale fishers in Trang Province were seriously concerned that their gears would be prohibited though they only possessed the gears that were allowable during the closed period. Unlike fishers in Phang-Nga Bay, fishers in Krabi Bay could not cite the exempted gear list of the SCM because there were no exempted gears in their area.

The SCM policy document states that sanctions for violation of rules can include a 5,000-10,000 baht fine and/or not more than 1 year of imprisonment will be applied to the violators and that prohibited gears will be confiscated. Most fishers could not identify the punishment associated with violating the SCM. As a result, the overall tested mean score was very low (16%). A few fishers could state by their previous experiences or rumors that violators will be fined and that fishing gears will be destroyed.

Table 1 - Levels of fishers' knowledge on the SCM

Knowledge of the following aspects of the SCM	% answering correctly		
	Phang-Nga Bay(n=49)	Krabi Bay (n=51)	All fishers
A. Aware of the SCM	52	46	49
B. Area of restriction	36	44	40
C. Time of restriction	44	27	35
D. Prohibited gears	33	18	25
E. Exempted gears	29[a]	07[b]	18
F. Sanctions	20	12	16

[A]Scale of response: 0=wrong answer 1=right answer; the different superscripts in row between fishers from Phang-Nga Bay and Krabi Bay denote tested scores that are statistically different at 95% of confidence interval of Chi-square test.

3.2.2 Information sources

"Fishers of the both bays cited multiple sources of information while government officers, neighbors, and printed media played the most important roles in the distribution of information"

Fishers cited multiple sources of information about the SCM. Overall, government officers played an important role in information distribution followed by neighbors, printed media, and community leaders. Considering level of information obtained by participants in each Bay, relatives/neighbors, government officers, and community leaders were the first three major sources of information of fishers in the Phang-Nga Bay while the major information sources in the Krabi Bay were government officers, printed media and relatives/neighbors (Table 2). Fishers also received information in several informal ways including rumors. There were no differences between the levels of information obtained from each source with the exception that fishers in Krabi Bay received information from relatives/neighbors less than fishers in the Phang-Nga Bay. It is noteworthy that some fishers in Krabi Bay felt that conflicts among fishers in their village affected relationships and led to lack of communication or miscommunication about the SCM. Overall, it was clearly seen that the level of distribution of information was rather low and that the relevant agencies played a less significant role. For example, fishing ports and fisheries associations had made less of a contribution in distributing

information. From the results, it appears that Non-Governmental Organizations (NGOs) played almost no role in distributing information about the SCM.

Table 2 - Number of fishers using different information sources in Phang-Nga & Krabi Bays

Information sources	Numbers of fishers using different information sources		
	Phang-Nga Bay (n=49)	Krabi Bay (n=51)	All fishers
radio	4	1	5
television	8	4	12
printed media	9	16	25
neighbors/relatives	19	10	29
government officers	16	17	33
community leaders	14	8	22
NGO	1	0	1
fishing ports	1	2	3
fisheries association	4	8	12

[A]Note: some fishers cited multiple answers and therefore columns do not add up to the total number of fishers.

3.3 Fishers' participation in the SCM

"Most fishers did not participate in the processes of SCM establishment, or actively monitor for illegal fishing, or get involved in SCM related activities"

Most fishers noted that there was a lack of participation in the process of the SCM development, establishment, monitoring of illegal fishing activities, and limited involvement in other SCM related activities, such as releasing fish seedling or the SCM campaign. Some fishers in Trang Province indicated that they did not know about the establishment of the SCM until it had entered into force, or, for some fishers, until this research survey took place. Many participants noted that during the process of SCM establishment the official meetings were usually held far away from communities in the office of DOF located in Phuket province. In addition, the uncertain timetable of fisheries occupations made it difficult for them to participate in the official meetings. As shown in Table 3, fishers in Krabi Bay had no significant involvement in the process of SCM establishment, unlike fishers in the Phang-Nga Bay. However, most fishers from both bays accepted that they shared the benefits of the SCM in the form of protection of the resource or increasing levels of the resource for them to fish.

Table 3 - Level of participation of fishers in each participatory activity of the SCM

Categories of participation	Fisher group mean score[A]		
	Phang-Nga Bay (n=49)	Krabi Bay (n=51)	All fishers
A. Process of establishment	0.04[a]	-0.43[b]	-0.20
B. Monitoring illegal fishing	0.12[a]	-0.20[b]	-0.20
C. Involving the SCM stewardship activities	-0.02	-0.51	-0.27
D. Sharing benefit from the SCM	0.41	0.35	0.38

[A]Scale of responses: 1=yes; 0= neutral & not sure; -1=no; the different superscripts in row between fishers from Phang-Nga Bay and Krabi Bay denote responses that are statistically different at 95% of confidence interval of Chi-square test.

3.4 Fishers' attitudes and perceptions

3.4.1 Levels of agreement with the SCM

"Fishers in Phang-Nga Bay agreed with all aspects of the SCM with the exception of the performance of patrolling while fishers in Krabi Bay neither disagreed with the performance of patrolling nor the time of the restriction. There was differences of opinion about the withdrawal of the day-anchovy purse seiners from the exempted gear list"

Overall, most fishers agreed that the SCM is an appropriate instrument to conserve fisheries resources (Table 4). For example, some fishers stated that it was a good concept to have a "fishing holiday" in order to renew fisheries resources. Most fishers have realized there is a reduction in fisheries resources, as their catch has declined significantly over time. Many fishers felt it was not an overly extreme regulation to conserve resources. Some fishers added that this instrument automatically raised awareness among fishers and the public concerning the reduction of fisheries resources.

Fishers agreed on the appropriateness of the area of restriction with the mean score of 36. Fishers in the Phang-Nga Bay agreed with the time of restriction with the mean score of 47. In contrast, fishers in Krabi Bay disagree with the time of restriction with the mean score of 20. Fishers in Krabi Bay who owned prohibited gears stated that three months of closure was too long. They preferred the former SCM that had only two months of closed season. Additionally, they did not agree with the time of fish spawning. They argued that the spawning time of fish in the Phang-Nga Bay and in Krabi Bay and the area along the coast of Trang Province are different. However, there was no common understanding on the spawning period for Krabi Bay: opinions differed widely between fishers - e.g., October to November, January, and March to April.

In general, fishers agreed with the lists of prohibited fishing gears and levels of agreement did not differ significantly between fishers from both bays. It was not unexpected that the small-scale fishers would agree on the prohibition of large-scale gears, especially trawls and purse seines. However, most trawler fishers in Phang-Nga Bay also stated that prohibited or allowable gears were not important for them. Indeed, the area under the SCM is already a "no trawlers" zone under existing legislation. Therefore, trawlers are permanently unable operate in the area.

During the field survey for this study, there was an issue related to the exempt fishing gears. There are three kinds of exempt gears in the SCM policy: day-anchovy purse seines, night-beam trawls, and set net. As mentioned earlier, at present, only day-anchovy purse seines are operated within the area; the night-beam trawls were restricted by the "no trawler" zone, which includes the SCM area, and the fish fences are few in number. Some fishers proposed to withdraw the day-anchovy purse seine from the exempt gear list of the SCM. However, the day-anchovy purse seine fishers disagree and have asked the DOF for a hearing regarding the issue. In recognition of this issue, this survey specifically focused on the opinions of fishers on the exemption of the day-anchovy purse seine. The results showed that the level of agreement of fishers in Phang-Nga Bay (47%) significantly differed from the agreement of fishers in Krabi Bay (0%) on whether the purse seines should remain exempt. In Phang-Nga Bay, where the day-anchovy purse seines exist, there were two groups of respondents. On the one hand, the majority of fishers, including 16 day-anchovy purse seine fishers, agreed with the exemption of the day-anchovy purse seine gear because, they commented, this kind of gear was a selective gear that catches only anchovy with no harm to other marine species. Moreover, they felt that day-anchovy purse seine fishers should not be prohibited during the SCM. The day-anchovy purse seine fishers claimed that the terminating of fishing for three months of one day-anchovy purse seiners would consequently impact a

number of local households in the community because labour crews were their relatives or neighbours. On the other hand, a minority group was in disagreement regarding the purse seine exemption, commenting that the SCM had to be equitable treatment and it should not be compromised for some large-scale fishers. Overall, many fishers in Krabi Bay responded neutrally regarding the exemption because they did not know the characteristic of the day-anchovy purse seiners which operated only in the Phang-Nga Bay or understand whether it was a destructive gear or not. Furthermore, fishers in Krabi Bay did not want to state that the SCM had to equitably treat all large-scale fishers because, they clarified, if the day-anchovy purse seine was not a destructive gear but had to be terminated, this was unfair to those fishers who owned the gears.

Significantly, fishers from both bays perceived that performance of patrol officers was poor. Fishers did not trust patrol officers. They felt that patrol officers did not treat fishers in a fair and evenhanded manner. They believed that corruption existed. They felt that, as a result, fishers with high capital could break the SCM without punishment. They supported their beliefs with anecdotes concerning the corruption. Another reason that fishers disagreed on the performance of the officers is that the patrol officers do not monitor and observe, when the fishers report violations. They noticed that patrol officers have never come to sanction violators, even when they receive reports. The fishers do not trust the patrol officers to provide information to fishers on illegal fishing in the SCM area.

Table 4 - Fishers' levels of agreement with different aspects of the SCM

Aspects of the SCM	Fisher group mean score[A]		
	Phang-Nga Bay	Krabi Bay	All fishers
A. Appropriateness of the instrument	0.71	0.82	0.77
B. Area of restriction	0.41	0.31	0.36
C. Time of restriction	0.47[a]	-0.20[b]	0.13
D. Prohibited gears	0.59	0.75	0.67
E. Exempted gears	0.47[a]	0.00[b]	0.23
F. Performance of patrol officers	-0.31	-0.29	-0.30

[A]Scale of responses: 1=agree; 0=neutral; -1=disagree; the different superscripts in row between fishers from Phang-Nga and Krabi Bays denote responses that are statistically different at 95% of confidence interval of Chi-square test.

3.4.2 Fishers' perceptions on the impact of the SCM

"Fishers in the Phang-Nga Bay perceived that the SCM has increased levels of conflict and does not help to increase the size of fish while fishers in the Krabi Bay perceived the opposite."

More than half of the fishers in Phang-Nga Bay stated that the SCM negatively impacted levels of conflict— both conflict among fishers and conflict between fishers and government officers. The SCM unintentionally increased levels of tension between fishers who possessed allowable gears to fish and fishers who possessed prohibited gears to fish. In particular, night-beam trawl fishers felt that it was always unfair for them despite the fact that this gear was exempted in the SCM as it was permanently restricted by the "no trawler" zone. Large-scale fishers noted the difficulties of fishing in farther fishing grounds and as they had to confront monsoons during closed period. Large-scale fishers noted that small-scale fishers were allowed to fish everywhere including in the areas outside traditional inshore waters and in areas where large-scale fishers normally fish. As a result, the level of conflict increases when the small-scale fishing

gears are destroyed. Both groups of fishers felt that officers treated them unfairly. On the contrary, fishers in Krabi Bay stated that the SCM had positive impact on levels of conflict in their area. The distribution of fishers or restriction of fishing gear in the bay reduces levels of conflict among fishers who fish in the Bay. It should be noted, however, that there are no trawlers in Krabi Province that are impacted by the "no trawler" zone in Krabi Bay. The zone excludes only trawl fishers from other Province. Fishers in the both of bays stated that sizes of fish were the same size with or without the existence of the SCM. However, generally, participants felt that the amount of fish had visibly increased as a result of the SCM (Table 5).

Table 5 - Fishers perceptions on the impacts of the SCM

Categories of impact	Fisher group mean score[A]		
	Phang-Nga Bay	Krabi Bay	All fishers
A. Impact on conflicts	-0.51[a]	0.16[b]	-0.17
B. Impact on fishers	0.08	0.76	0.43
C. Increasing sizes of fish	-0.10	0.10	0.00
D. Increasing amount of fish	0.43	0.22	0.32

[A]Scale of responses: 1=positive, agree; 0=neutral; -1=negative, disagree; the different superscripts in row between fishers from Phang-Nga Bay and Krabi Bay denote responses that are statistically different at 95% of confidence interval of Chi-square test.

3.4.3 Fishers' satisfaction on the SCM

"Most fishers were satisfied the SCM while 26% of fishers were dissatisfied"

Although the majority of fishers in the both bays were satisfied with the existing SCM, some fishers were strongly dissatisfied or dissatisfied with the SCM (Table 6). Fishers' explanations regarding their dissatisfaction was not regarding the appropriateness of the SCM but due to the ineffectiveness of the instrument as a result of poor patrolling practices and/or lack of strict and equitable enforcement of the rules.

Table 6 - Fishers' levels of satisfaction with the SCM

Level of satisfaction[A]	Percentages of fishers		
	Phang-Nga Bay (%)	Krabi Bay (%)	All fishers (%)
1. strongly dissatisfied	4	4	4
2. dissatisfied	24	20	22
3. fair	0	0	0
4. satisfied	33	39	36
5. strongly satisfied	39	37	38

[A]Likert's scale (1-5)

3.4.4 Behaviors of fishers in relation to the SCM

"Fishers from the both bays neither trusted the compliance of outside fishers nor called patrol officers when they noticed violators. Moreover, some fishers opposed extending the timeframe and expanding the area of restriction. Few fishers fished illegally during the SCM"

Table 7 shows that most fishers agreed with the time and areas of restrictions and employed only the allowable gears during the SCM. However, a few fishers elaborated on their experiences of protesting before the enforcement of the SCM to express their disagreement with the prohibition of gill nets with mesh size less than 4.7 cm. They felt that they were simply small-scale fishers who utilized gill nets with small long-tail boats and that their nets would always shrink after soaking into the sea. They also claimed that other kinds of illegal fishing gear - e.g. set-bag nets - were utilized in the area without punishment. They had negative impressions of the SCM as they were not successful in their protests. Fishers who used exempt day-anchovy purse seine stated that they will oppose the SCM or withdraw their support if they are not allowed to use their gears in the SCM in the future

Table 7 - Behavioral attributes of fishers in the SCM

Categories of behaviour	Fisher group mean score[A]		
	Phang-Nga Bay	Krabi Bay	All fishers
A. Opposed extending the time of restriction	0.16	0.27	0.22
B. Opposed expanding the area of restriction	0.16	0.27	0.22
C. Used only allowable gears during the SCM	0.92	0.73	0.82
D. Trusted in compliance of fishers in the same communities	0.14	0.06	0.10
E. Trusted in compliance of fishers from outside community	-0.47	-0.41	-0.44
F. Called patrol when noticed violators	-0.61[a]	-0.22[b]	-0.41

[A]Scale of responses: 1=yes; -1=no; the different superscripts in row between fishers from Phang-Nga Bay and Krabi Bay denote responses that are statistically different at 95% of confidence interval of t- test.

3.4.5 Fishers' opinions on the improvement of the SCM

"Fishers agreed on the existence of the SCM. However, they felt that it still needed improvement."

Table 8 shows the opinions of fishers on the improvement of SCM. Thirty seven of fishers felt that the present SCM regulations were better than those associated with the former SCM because they perceived that the larger area and longer time period is likely to provide better conservation outcomes. However, the majority of participants agreed that the SCM still needed improvement including the time and the area of restriction and, most importantly, the enforcement of regulations. The majority of fishers in both bays also disagreed with the idea of withdrawing the SCM. Although it was not the perfect instrument, they argued, it was still required to reduce exploitation rates and to help in increasing fisheries resources. The other area of agreement relating to the withdrawal of the SCM is that if was ineffective, it does not matter whether it did or did not exist.

Table 8 - Opinions of fishers on the SCM

Categories of opinion	Fisher Group mean score[A]		
	Phang-Nga Bay	Krabi Bay	All fishers
A. Agree on the existing of the SCM	0.35	0.41	0.38
B. The SCM requires withdrawal	-0.88[a]	-0.55[b]	-0.71
C. The SCM requires improvement	0.37	0.59	0.48

[A]Scale of responses: 1= agree; 0= neutral ; -1=disagree; the different superscripts in row between fishers from Phang-Nga and Krabi Bays denote responses that are statistically different at 95% of confidence interval of the Chi-square test.

4 Discussion and Recommendations

4.1 Fisheries information in management policies

Fishers in Phang-Nga and Krabi Bays are similar in that they are from mixed livelihood communities that are still united and shaped by the fishery. However, on an individual basis, fishers are different in many aspects whether social or economic - e.g. age, religion, domicile, number of fishing gears possessed, level of capital, degree of dependency on fisheries, and so on. The combination of these demographic variables shapes fishers' attitudes and perceptions and influences their behavior in fisheries (Richardson et al., 2005). So, fishers responded differently to the SCM. For instance, large-scale fishers who stopped fishing during the SCM or moved to fish in farther fishing grounds likely desired a shorter period of closure. Although small-scale fishers can alternate between prohibited and allowable gear, some fishers persisted to use prohibited gears. In addition, the success of the SCM may be simply judged by fishers' level of experience. For example, younger fishers perceived that fish sizes are larger because of the existence of SCM; however, it did not fulfill the expectation of older fishers who had seen the larger fish of the past. Greater understanding of these fisheries characteristics and communities will facilitate the creation of improved fisheries management policies and criteria for establishment.

Although fishers are accustomed to the risk and uncertainty of fisheries, they also would like to have alternative choices to sustain their living and for the next generation. Fishers do not want their children to be fishers. Fishing is a difficult lifestyle, an uncertain and debt-driven occupation, and costs and financial remuneration are easily influenced by markets. Thus, fishers are sensitive to the changing of rules and regulations. For instance, fishers in Trang Province worried about the expansion of the SCM within their province. One fisher expressed sympathy towards another fisher who was caught doing illegal fishing with the simple reason that they are from the same fishing community. The feeling of being part of the same disadvantaged group may be inherent in fishers' norm, morals, or in their religion. For example, Muslim fishers have more trust towards outside fishers' compliance, and they refused to call patrol officers even when they noticed violators, as they look at them as people from the same community. Fishing communities both in Phang-Nga and Krabi Bays have been shaped by fisheries and at the same time the combination of their demographic variables influenced or shaped their attitudes and perceptions on the fisheries regulation. As a result, a thorough understanding of fishers and fishing communities are required for policy makers to create fisheries management and conservation policies in these areas. In addition, fishers' realities should be recognized directly through on-the-ground research instead of relying on the assumptions about their realities made by outsiders (Hagmann et al., 2002). For example, the results of this study should be integrated into the next technical effectiveness assessment of the SCM. This type of analysis was not included in the official report of the previous SCM assessment (DOF, 2007).

The single SCM may not be the single best nor the only suitable tool for fisheries management in these areas where the core values - e.g. uses of coastal and fisheries resources and harvesting by small-scale versus large scale fisheries or local versus outside fishers - are still being debated. In this case, a single regulation deals with fishing communities that are complex, diverse, and where all dynamics might be difficult to contend with (Jentoft and Chuenpagdee, 2009). A suite of instruments and strategies - e.g. parallel job extension and social security system - should be practiced in order to achieve the desired conservation outcomes. Moreover, the proposed instrument should be structured to fit the unique social, economic, and biological elements of communities in Phang-Nga and Krabi Bays.

4.2 Knowledge and understanding of fishers on the SCM

Although the SCM has been in existence for more than 25 years, the results of this study indicated that knowledge and understanding of fishers on this existing regulatory framework was rather low. Without this sort of systematic study, the issue would continue to be invisible to the government or policy-makers as even fishers did not realize that they did not know the main goals and rules of the SCM. This study shows what fishers knew about the SCM and/or its amendment. However, they do not have thorough knowledge on the key principles of the existing rule including time and area of restriction, prohibited gears, exempt gear, and sanctions. Lack of knowledge may lead to ineffectiveness and unsuccessful results from fisheries management interventions, such as the SCM. For example, small-scale fishers in Trang Province were seriously worried when initially informed that the SCM had been extended to their Province as they misunderstood that all kinds of fishing gears would be prohibited. Some fishers thought that day-anchovy purse seine fishers are violators in the SCM enforcement area as they did not know that the day-anchovy purse seine is an exempt gear. Many participants thought that enforcement within the SCM is weak and inequitable and/or that the performance of patrol officers is poor and that this will possibly lead to further conflict. Interestingly, fishers with less knowledge on the SCM appeared to have less trust in the levels of compliance of outside fishers.

How can a 25-year old SCM be effective without the thorough knowledge and understanding of fishers who are the key resource users and either rule followers or rule breakers? Perhaps there were already rules being used and the changing of such rules from the top down did not directly reach fishers and/or reached them in inappropriate ways. This study shows the actual levels of knowledge of fishers and how they perceive the regulation. Knowledge and perceptions are the key ways to assess the effectiveness of management instruments (Cinti et al., 2010). Understanding of knowledge and perceptions of local fishers can assist policy-makers to improve the performance of strategies to transfer of information and consequently lead to improved performance of fisheries management.

Although fishers cited several main sources of information, the level of access to information was rather low and the quality of some sources was unclear. For example, fishers mainly received SCM information from their neighbors or relatives in informal ways including through rumors. Although government officers are the qualified source for information, it can be seen that they were unable to equally and successfully reach all fishers. The transfer of information requires more effective communication between government agencies, local institutions, and fishers. However, only focusing on the one-way flow of information is not expected to be very effective. To provide fishers full access to information and to ensure a complete understanding on the SCM, it should be through a participatory approach that allows fishers to be involved in the process of making regulations related to the establishment and the enforcement of the SCM. During the participatory process, the related key stakeholders - including the head of fishing communities, fishing port owners, and fisheries associations - should be motivated to play more central roles in the transfer of important information.

The research finding indicated that fishers in Krabi Bay received less information from their neighbors due to a conflict within the community. This shows that government agencies should consider the differences between communities when implementing policies and mobilizing information. Appropriate solutions should incorporate biophysical and social characteristics of intended communities.

4.3 Participation of fishers in the SCM

The results indicate that there was little or no participation of fishers in policy creation during the establishment and enforcement of the SCM. The SCM is thus a form of top-down fisheries management rather than integrating top-down and bottom-up processes. Fishers were not involved in the process of

creating the regulation; rather they were informed of the final decision by policy makers or fisheries regulators. In the end, this information did not reach most fishers. The ineffectiveness of one-way communication did not lead to complete knowledge transfer. One could conclude that the lack of participation lead to the low level of knowledge on the SCM of fishers. Lack of participation may also lead to the exclusion of other forms of social capital and knowledge from fisheries management- e.g. traditional and local knowledge, trust, co-operation, and social networks. Fishers, especially in Krabi Bay, were unable to contribute their knowledge of or ideas about fish movements and spawning seasons. For example, they had no chance to express their opinions that without additional instruments to regulate fisheries resources in the period of time after the closed season, the aim to conserve fish may not be achieved. As a result, fishers may perceive the SCM to be illegitimate and government agencies may have lost the opportunity to gain fishers' trust and belief in the accuracy of the selected spawning period. Without the input of fishers, research was used to determine the best time for restricting harvesting in the bay. The management of fisheries resources without contribution of social capital and local knowledge may result in more mistakes, less flexibility to change, increased management costs, and poor compliance with fishing rules (Grafton, 2000). Without participation, fishers have less incentive to collaborate or commit their time to improve fishery outcomes (Grafton, 2005). The participation of fishers to the SCM should be promoted as a priority of fisheries management in the Phang-Nga and Krabi Bays. Effective participation will result in better understanding of fishers about the SCM and will lead to improved effectiveness of the SCM.

Fishery is an occupation with a different time schedule. The forms of participation also have to be deliberately considered. Meetings held by government agencies during regular office hours is not appropriate and the location of the meeting should be close to the fishers' place of residence. If location and timing are not appropriate, this will unintentionally exclude fishers from involvement. For instance, fishers in Trang Province had no chance to participate in the meeting on the SCM that was held in Phuket Province and as a result they were not informed about the SCM. Furthermore, network building and institutional building activities within communities can facilitate the participation of fishers in fisheries management. For example, integrating meetings with pre-existing committee meetings can be an alternative. In addition, there should be continuous communication among stakeholders rather than only one meeting. With more appropriate and effective means for engaging fishers, the problems of lack of knowledge of fishers on the SCM, lack of trust of fisheries officers and patrols, and conflict could be decreased or eliminated.

4.4 Management implications of attitudes and perceptions of fishers

Fishers agreed that the SCM was an appropriate instrument to conserve fisheries resources, and at the same time it was not an extreme or overly difficult instrument for them. Apart from raising awareness among fishers, an educational campaign during the yearly SCM enforcement should have been arranged because it would have helped transfer information to the broader public and increased public awareness. Public support for the SCM is important so that it can become a flagship of fisheries management on the Andaman coast.

This study showed that the lowest level of agreement of fishers on the SCM was related to the performance of patrol officers. Fishers agreed that patrols were performing poorly in terms of their behaviour and their lack of capacity to enforce the SCM. Fishers did not trust to call patrol officers even when they noticed violations. Fishers suspected that patrol officers are corrupt and/or not able to handle violators. Nor did fishers want the responsibilities or difficulties associated with being a witness. These are important underlying causes of the ineffectiveness of the SCM. In addition, budgets and thus the capacity of patrols to monitor the vast area of restriction are limited. Thus without the support of fishers in stewardship and management activities, SCM measures are unlikely to achieve the sustainability of resources in the area.

Indeed, trust will encourage knowledge and information sharing about fisheries resources between fishers and management agencies (Pomeroy and Berkes, 1997).If fishers trust patrol officers, this will encourage legal compliance and, consequently, it can reduce the regulatory costs and ameliorate management outcomes (Grafton, 2005). Without trust, the outcome may be the poor and/or ineffective implementation of fisheries management instruments. Management agencies should examine the root of this problem in order to find an appropriate resolution. Facilitating effective communication between fishers and agencies responsible for enforcement and patrol officers may build trust and enhance compliance. However, fishers' lack of trust towards patrol officers in both bays may have a long history and some time will be required to resolve this issue.

The study findings also showed that fishers in Krabi Bay disagreed with the time of the restriction. Several different views emerged on this issue. For large-scale fishers in Krabi Province, it was not surprising that there was a preference for two months of closed season rather than three months. On the other hand, small-scale fishers in Trang Province did not believe that April to June is the right spawning time for fish in the bay. They argued, based on their experience, that fish in Krabi Bay and Trang Province were not the same stocks as fish in Phang-Nga Bay. Scientific research was used by the government agencies to determine the appropriate time to create the closure and fishers were excluded from the process of the SCM establishment including setting up of time restrictions. This example shows how the SCM was established without adequate sharing of information and knowledge between government agencies and fishers.

Although government agencies may have higher capacity to carry out standard scientific research, fishers are the key resource users who hold traditional and local knowledge. If fisheries management instruments such as the SCM integrate local fishers' knowledge and participation, this is more likely to lead to the sustainable use of local stock (Grafton, 2005). In contrast, the SCM may not be effective over time if there is less support from fishers at the outset.

The study also revealed the NIMBY (Not-In-My-Back-Yard) (Livezey, 1980) phenomenon related to the management of fisheries resources. For example, the day-anchovy purse seine fishers in Krabi Bay stated that they would remove their support for the SCM or even oppose the SCM if their gear is no longer exempt. However, most fishers, including fishers owning day-anchovy purse seines, in Phang-Nga Bay agreed with the exclusion of this gear. Yet fishers in Krabi Bay clearly expressed their lack of understanding on this issue. Perhaps this phenomenon could be addressed through public hearings, focus groups, and/or workshops in order to explore the advantages and disadvantages of continuing with the use of this gear in the area – for example, through exploring socio-economic impacts on fishers, and scientific information and traditional knowledge on the issue. Ideally, the consultative decision-making process should incorporate both fishers and regulators (Grafton, 2005) in order to create desirable outcomes and increase commitment.

The study showed the perceptions of fishers on the impact of the SCM. First, it was hoped that the SCM would decrease conflict in Phang-Nga Bay but the opposite occurred. However, the wide variety of large-scale fishers gears within the limited area of the bay may be one among many causes for ongoing conflict among fishers and between fishers and government officers. The overlapping fishing area of large-scale fishers and small-scale fishers may also be another reason for the conflict. Nonetheless, a deeper understanding of "why" and "how" the conflict is happening and of conflict management strategies are required in this area to effectively address the conflict. Secondly, although fishers felt that there the SCM had increased the amount of fish, they were unsure whether there had been an increase in the size of the fish. However, according to official scientific reports, the trends of catch and catch per unit of effort (CPUE) of pelagic fish dramatically decreased from 18,790 tons and 30,077 kg/day in 1998 to 8,896 tons and 1,994 kg/day in 2002 (Boonsuk et al., 2003). Additionally, the CPUEs of large-scale fisher using lights and purse seines during the closed and opened period in 2009 and 2010 fluctuated between

880-4,424 kg/day and 563-8,872 kg/day. This result does not clearly indicate a change in the amount of fish. These results are similar to vessels using Indo-pacific mackerel gill nets which showed fluctuations of CPUE (AFDEC, 2010). It is important that stakeholders perceive that there has been a positive change as a result of the existence of the SCM. If fishers do not perceive any change as a result of regulatory or management policies, at some point their behavior will return to the previous or traditional pattern which will continue the trend away from fisheries sustainability over the long-run (Pretty, 2003). The problems of the reduction of marine resources in the Bays are not only due to illegal fishing during the SCM. The overexploitation has likely taken place for many years because of the excessive number of fishers and overcapacity within fisheries (FAO, 2005). As a result, the effectiveness of the SCM is limited in its ability to achieve the sustainability of marine resources in the area. A more comprehensive and integrated management strategy is required. For example, many boats are anchored along the border of restricted areas at the end of the SCM and wait to fish until after midnight of June 30th resulting in a "race to fish" (Grafton, 2005). As a result, there is a short increase in the amount of fish caught suddenly after the closed season while the share per boat may be less. This demonstrates how the potential positive outcomes of the SCM are immediately reduced after the time of restriction, if there are no other complementary measures (Cochrane, 2002). Decreasing of fishing numbers and capacity in order to reduce the overfishing of the area is also urgently needed.

Although the majority of fishers were satisfied with the SCM, there were some fishers who disagreed with the SCM. They insisted on fishing during the SCM as long as the government agencies did not strictly enforce the regulations on other acts of illegal fishing– for example, using stow nets. In addition, some fishers argued that they did not fish the smaller fish if they used nets with large mesh sizes. They also felt that patrol officers did not have the will nor the capacity to enforce against illegal fishing during the SCM. This shows that effective fisheries management requires fair, consistent, and ongoing enforcement – which in turn requires skilled enforcement officers and adequate capacity and infrastructure.

5 Conclusion

Although the SCM has been established for more than 25 years, fishers still lack knowledge and understanding on the SCM because information has not directly reached them and/or has reached them in inappropriate ways. The standard knowledge about the SCM - especially the major elements of time and area of restrictions, the list of prohibited, allowable and exempted gear, and the statement of sanctions - should be properly communicated to reach fishers. The knowledge should be transferred via social networks, representatives of communities or the relevant organizations that are close to fishers - e.g. fishing port managers and fishing associations. However, in particular villages where conflict and mis-communication have taken place, the direct knowledge transfer by government officers may be more appropriate. Fishers lacked participation in most management activities of the SCM. Increased levels of participation of fishers is recommended as it will allow fishers and fisheries regulators to effectively assess and improve the SCM to fit both fisheries resources and resource users.

Overall, most fishers were satisfied with the SCM; however, they still felt that it required improvement. The other important findings regarding attitudes and fishers to the SCM include: disagreement with time and area of restriction; some opposition to the SCM; some defiance of SCM regulations, skepticism regarding the performance of patrols and enforcement of measures; distrust of patrollers and lack of reporting; distrust of fishers from other communities. Therefore, a re-assessment of various aspects of the SCM, including areas of restriction and exempted fishing gear, is recommended to respond to these findings. The assessment should integrate scientific knowledge with traditional knowledge of fishers and create a process for local involvement in order to build trust and commitment. In addition, a review of the capacity and performance of patrol officers is required to ensure effective and equitable enforcement of regulations. Increased trust would enhance

information sharing between fishers and officers, potentially saving costs and resolving conflicts. The establishment of appropriate measures is also required to slow down the race-to-fish that is taking place immediately after closed season. Increasing conservation knowledge (e.g., ecological and fisheries impacts of the SCM), no-take-zones within the area, and incentives for stewardship are also needed to sustain the SCM and marine resources in Ao Phang-Nga Bay and regionally on the Andaman Sea Coast of Thailand.

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