THE ASSESSMENT OF CHAO-SUMRAN BEACH QUALITY, PETCHBURI PROVINCE

การประเมินคุณภาพสิ่งแวดล้อมหาดเจ้าสำราญ จังหวัดเพชรบุรี

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The principal aim of this study was to assess Chao-Sumran Beach quality, Petchburi province, carried out in summer, rainy and winter season. The beach surveyed base on 50 specific indicators covering 4 environmental aspects. Aspects of social was measured in term of questionnaires and administered through tourist's satisfaction (*n=400).* Aspect of physical, pollution and biological were measured by visual observation technique and laboratory instrument. The resulted data were marked and totaled according to the Simple Weighting Score Equation of Morgan (1999) then classified beach quality into 4 Classes, A, B, C and D. As a result, Chao-Sumran Beach was classified in Class B, very good environmental beach quality, in every season. Only social factor was the serious problems because tourism facilities available remain poorly. While biological, pollution and physical achieved high score, respectively. This result was considered useful for the local government and concerned organizations managing, using and implementing actions in order to protect environmental problems and develop tourism facilities.

Keywords : assessment / environmental quality / Chao-Sumran Beach / Petchburi province

การวิจัยในครั้งนี้มีวัตถุประสงค์เพื่อประเมินคุณภาพสิ่งแวดล้อมหาดเจ้าสำราญ จังหวัดเพชรบุรี โดยดำเนินการสำรวจในฤดูร้อน ฤดูฝนและฤดูหนาว ครอบคลุมปัจจัยสิ่งแวดล้อม 4 ด้าน ได้แก่ สิ่งแวดล้อมทางสังคมเก็บข้อมูลโดยใช้แบบสอบถามนักท่องเที่ยว จำนวน 400 ชุด ส่วนคุณภาพสิ่งแวดล้อมทางกายภาพ มลพิษและชีวภาพ เก็บข้อมูลโดยวิธีการสังเกตและการวิเคราะห์ทางห้องปฏิบัติการ รวมทั้งสิ้น 50 ตัวชี้วัด และใช้สมการถ่วงน้ำหนัก อย่างง่ายของ Morgan, 1999 ในการคำนวณและแบ่งระดับชั้นคุณภาพชายหาด ผลการศึกษาพบว่าคุณภาพสิ่งแวดล้อมของชายหาดเจ้าสำราญโดยรวมอยู่ในเกณฑ์ดีมาก (กลุ่ม B) สภาพชายหาดโดยทั่วไปสงบร่มรื่นด้วยต้นสนตลอดแนวชายหาด ไม่มีกลิ่นและเสียงดังรบกวนจากยานพาหนะและกลุ่มคนโดยรอบ คุณภาพสิ่งแวดล้อมไม่เป็นปัญหา ยกเว้นบริการการท่องเที่ยวไม่ว่าจะเป็นที่พัก ร้านอาหาร กิจกรรมนันทนาการ เช่น เรือกล้วย ห่วงยาง จักรยานเช่า ฯลฯ มีให้บริการน้อยมาก ข้อมูลที่ได้จากการประเมินจักเป็นประโยชน์ให้แก่องค์กรและหน่วยงานที่เกี่ยวข้องในการกำหนดนโยบายวางแผนพัฒนาปรับปรุงโครงสร้างพื้นฐานด้านการบริการนักท่องเที่ยวควบคู่กับการจัดการคุณภาพสิ่งแวดล้อมเพื่อส่งเสริมการท่องเที่ยวชายหาดต่อไป

คำสำคัญ : การประเมิน / คุณภาพสิ่งแวดล้อม / หาดเจ้าสำราญ / จังหวัดเพชรบุรี

1. INTRODUCTION

Beach tourism is one of the Thailand's highest income industries. It has generated approximately $ 10 billion dollars (US) in income (Tourism Authority of Thailand, 2003). Several beaches were widely interested and well known by both domestic and foreign tourists as Pattaya, Phuket, Koh-Samui, etc. Chao-Sumran Beach is the top three popular beaches in Petchburi province, located on the West coast within the Gulf of Thailand. It is just 180 kilometers from Bangkok with only 3 hours drive and good accessibility. It surrounded by wonderful nature and freshness air. These perfect for visiting. However, the development and expansion of tourism industry and human activities that take place on beach can be harmful impacts on beach such as litter items, wastewater discharged, noise pollution, etc. Therefore, it was necessary for assessing the beach quality. As a result, can be classified and grouped several beaches quality in Thailand. Furthermore both the local government and concerned organizations would virtually set up the most suitable policy for the successful development and promotion of beach tourism.

2. METHODOLOGY

2.1 Site Description

Chao-Sumran Beach, chosen for this study, is one of the top three popular beaches in Petchburi province. It located in the West coast within The Gulf of Thailand (Fig.1), just 180 kilometers from Bangkok with 3 hours drive. It is located about 20 kilometers northern of Cha-am Beach and about 8 kilometers northern of Phok-Tian Beach. Not many tourists on beach both on workdays and weekends which different from near beach as Cha-am Beach and Phok-Tian Beach.

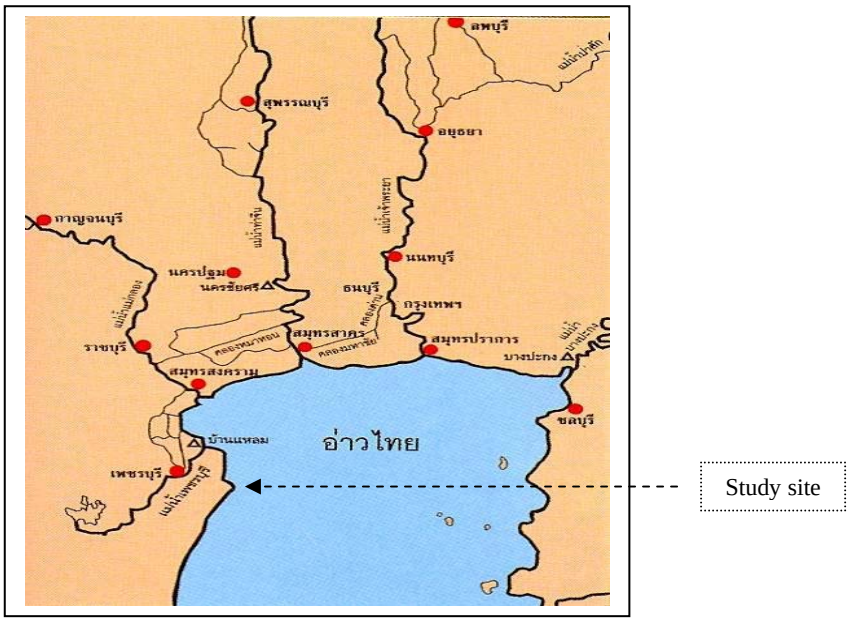

Fig.1. Study site

2.2 The beach survey

The beach survey based on aspect of "physical" (9 indicators), "social" (22 indicators), "pollution" (13 indicators) and "biological" (6 indicators) (Table 1) and carried out 3 times a year, summer, rainy and winter season.

Table 1 Environmental indicators and beach scores

No.	Indicators	Weighting score: W	Rating score: R		beach score(WR)	
			maximum	minimum	maximum	minimum
	Physical					
1.	Beach length	4	5	1	20	4
2.	Beach width	4	6	1	24	4
3.	Sand size	4	5	1	20	4
4.	Sand color	4	5	1	20	4
5.	Predominant beach material	4	6	1	24	4
6.	Beach slope	4	3	1	12	4
7.	Submerged obstacles	4	4	1	16	4
8.	Sand softness on the beach	4	5	1	20	4
9.	Sand bed characteristics	4	5	1	20	4
	*Total beach score				176	36
	Social					
1.	Life-guards	3	5	1	15	3
2.	First aid posts	3	5	1	15	3
3.	Safety equipment	3	5	1	15	3
4.	Emergency telephone services	3	5	1	15	3
5.	Hospital	3	5	1	15	3
6.	Warning alarm system	3	5	1	15	3
7.	Criminal	3	5	1	15	3
8.	Natural disaster	3	5	1	15	3
9.	Disease	3	5	1	15	3
10.	Traffic accident	3	5	1	15	3
11.	Water accident	3	5	1	15	3
12.	Accommodation	3	5	1	15	3
13.	Restaurants	3	5	1	15	3
14.	Souvenirs shop	3	5	1	15	3
15.	Recreational activities services	3	5	1	15	3
16.	Shower & toilets	3	5	1	15	3
17.	Telephone services	3	5	1	15	3
18.	Shop	3	5	1	15	3
19.	Information sign	3	5	1	15	3
20.	Information center	3	5	1	15	3
21.	Beach accessibility	3	5	1	15	3
22.	Car parking and traffic	3	5	1	15	3
	*Total beach score				330	66
	Environmental pollution					
1.	Floatable solid/litters	2	4	1	8	2
2.	Floatable oil & grease	2	3	1	6	2
3.	Water color	2	4	1	8	2
4.	Water odor	2	3	1	6	2
5.	Water clarity	2	5	1	10	2
6.	TCB	2	2	1	4	2
7.	Litter on beach	2	5	1	10	2
8.	Noise from motor vehicle	2	3	1	6	2

Table 1 (Cont.)

No.	Indicators	Weighting score: W	Rating score: R		beach score(WR)	
			maximum	minimum	maximum	minimum
9.	Noise from industry/ funfair	2	3	1	6	2
10.	Noise from water sport e.g. banana-boat, jet skiing. etc.	2	3	1	6	2
11.	Odors from engines, boat exhausts of cars, other road vehicles	2	3	1	6	2
12.	Animal permitted on beach	2	2	1	4	2
13.	Vehicles permitted on beach	2	2	1	4	2
	*Total beach score				84	26
	Biological					
1.	Beach forest /tree cover within 100 m	1	5	1	5	1
2.	Harmful animals (jelly fish, weeverfish)	1	3	1	3	1
3.	Endanger species area	1	2	1	2	1
4.	Breeding area of animal	1	2	1	2	1
5.	Flies (on beach)	1	4	1	4	1
6.	Cockroaches (at accommodation)	1	4	1	4	1
	*Total beach score				20	6

*Total beach score were calculated by Simple Weighting Score Equation follow by Morgan (1999)

Aspects of social measured in term of questionnaires administered through tourist's satisfaction toward tourism facilities, safety and accessibility (*n=400).* Aspect of physical, pollution and biological were measured by visual observation technique and laboratory instrument. In term of the weighting score(W), all factors were weighted according to the priorities which the highest priority was given to physical, social, pollution and biological was lower, mark was 4, 3, 2 and 1, respectively. The scoring system of 50 indicators (rating score system) was shown on table 2-5.

2.3 Beach quality assessment

All indicators were marked according to rating score system (Table 2-5), totaled and assessed beach quality followed by Morgan (1999) and classified beach quality into 4 Class, A, B, C and D according to level score. Data coming from assessment can be useful for setting up the long-term planning, improving and managing environmental beach quality.

3. RESULTS AND DISCUSSION

3.1 Physical aspect

The physical beach survey was conducted at Chao-Sumran Beach which focused on scenery/landscape and beach characteristics such as beach length, beach width, sand size, etc. (Table 2). The mentioned indicators were observed and analyzed according to Elmanama et al. (2005) and Morgan (1999). The result, Chao-Sumran Beach is the Mainland beach, approximately 500-1000 m long, a very narrow beach approximately 80 -100 m wide which more decreases in rainy and winter

season. Shoreline was covered with the protected rocks that resulted from shoreline erosion. It was the light tan sand beach affect from the river sediment which outflow from the closet major river, the Tha - Chin River, which was located about 2 km northern. Predominant beach material was sand its size about 0.25 - 0.50 mm mixed with a little shell and coral litter, moderate sand softness (sand sample was collected with a 3 inch diameter corer, to a depth of 15 cm (Lasta et al., 2006) for sand size analysis). Absence of harmful submerged rocks and other obstacles, slight beach slopes (Transit and stadia rod Method of Lacey et al., 1988) varying from 0.62° to 0.85° and safe for swimming.

3.2 Social aspect

Social aspect described about tourist's satisfaction (a five-point Likert scale) toward safety, accessibility and tourism facilities availability in term of 22 indicators (Table 3). These were collected by questionnaires administered through personal opinion (*n=400).* The result, almost of tourists were fair pleasant on safety and accessibility indicator. Tourism facilities service achieved poor score, especially accommodation, restaurant, souvenir shop and recreational activities service as jet skiing, banana boat, car for rent etc. Not many tourists both on workday and weekend.

3.3 Pollution aspect

This aspect was used for assessing the aesthetic beach quality (Table 4). Beach survey was the most widely used method for estimated the amount of residue litter on beach in a specified area (Somverville et al., 2006), in this study within 100 m^2 (Pollution Control Department, 2003). The result, some present 2.5 kg per 100 m^2. Because of the action plan of local government and concerned organizations were poorly. Water samples were collected while the sampler stood in water at chest level (about 1.3 m) approximately 20-30 cm. below the surface (Elmanama et al., 2005) and analyzed on the sampling site directly following APHA, AWWA and AWPCF (1995) except TCB, water sample were placed on ice inside a cooling box and delivered to the laboratory for analysis within 24 hr (Shibata et al., 2006). The result, water transparency about 0.55-1.5 m, absence of floatable litters and grease on surface. Water color and odor is normal. Total Coliform Bacteria was 2 MPN/100 ml in summer and increased to 80 and 400 MPN/100 ml in winter and rainy season, respectively. Traffic fumes and odors was absent, but was detectable when many tourists visited same as noise from vehicle.

3.4 Biological aspect

This aspect included positive indicator which effect on tourist's attractiveness and negative indicator which effect on tourist's health (Table 5). These indicators were assessed by the checklist and visual observation technique. The results showed that Chao-Sumran is the shady beach, many tree along the beach, animal species were poor, only a few species and general species such as crab, shell, bird, etc. Some present of harmful animal as jelly fish, in rainy season. Absence of animal breeding area and

rare species because of almost area was disturbed from tourist activities and local community. Flies can found only at the bin and absence of cockroaches at accommodation.

3.5 Chao - Sumran Beach's scores

The result data from analyze and survey on field were marked according to rating score system for physical, social, pollution and biological factors were 32, 57, 33 and 18 marks, respectively in summer. And 32, 59, 31 and 16 mark in rainy season and in winter season was 32, 59, 32 and 17 mark. (Table 2- Table 5)

Table 2 Rating score system and beach scores of physical aspect

No.	Indicator	Rating score system (R)	Mark	Mark		
				summer	rainy	winter
1.	Beach length (m)	10,000	5			
		5,000 – 10,000	4			
		1,000 – 5,000	3	3	3	3
		500 – 1,000	2			
		<500	1			
2.	Beach width (m)	>800	6			
		400 – 800	5			
		200 – 400	4			
		50 – 200	3	3	3	3
		20 – 50	2			
		< 20	1			
3.	Sand size (mm)	0.0625-0.125	5			
		0.125-0.25	4			
		0.25-0.5	3	3	3	3
		0.5-1.0	2			
		1.0-2.0	1			
4.	Sand color	White/whitish	5			
		Light tan	4	4	4	4
		Brown	3			
		Gray	2			
		Black	1			
5.	Predominant beach material	Cobbles/rock (> 50 mm)	6			
		Gravel (1.0 – 50.0 mm)	5			
		Sand (0.1 – 1.0 mm)	4	4	4	4
		Mud	3			
		Flat rock	2			
		Sea wall/ jagged rock	1			
6.	Beach slope	< 5°	3	3	3	3
		5-20°	2			
		Very steep > 20°	1			
7.	Submerged obstacles	Absent	4	4	4	4
		occasion found	3			
		Some present	2			
		Many present and big size	1			

Table 2 (Cont.)

No.	Indicator	Rating score system (R)	Mark	Mark		
				summer	rainy	winter
8.	Sand softness on the beach	high softness	5			
		moderate softness / a little of shell and coral litter	4			
		slightly hard / a little of shell and coral litter	3	3	3	3
		moderate hard / moderate of shell and coral litter	2			
		high hard / many shell and coral litter	1			
9.	Sand bed characteristics	fine sand/soft sand bed	5	5	5	5
		coarse sand/hard sand bed	4			
		mud mixed with sand	3			
		very coarse sand	2			
		submerged shingle or rocky	1			
		Total mark	9 – 44	32	32	32
		WR	36 – 176	128	128	128

Table 3 Rating score system and beach scores of social aspect

No.	Indicator	Rating score system (R)	Mark	Mark		
				summer	rainy	winter
1.	Life-guards	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1	1	1	1
2.	First aid posts	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1	1	1	1
3.	Safety equipment	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1	1	1	1
4.	Emergency telephone services	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1	1	1	1
5.	Hospital	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2	2	2	2
		Completely dissatisfied	1			

Table 3 (cont.)

No.	Indicator	Rating score system (R)	Mark	Mark		
				summer	rainy	winter
6.	Warning alarm system	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1	1	1	1
7.	Criminal	Completely satisfied	5			
		Somewhat satisfied	4		4	4
		Neither satisfied nor dissatisfied	3	3		
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
8.	Natural Disaster	Completely satisfied	5			
		Somewhat satisfied	4	4	4	4
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
9.	Disease	Completely satisfied	5	5	5	5
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
10.	Traffic accident	Completely satisfied	5			
		Somewhat satisfied	4		4	4
		Neither satisfied nor dissatisfied	3	3		
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
11.	Water accident	Completely satisfied	5		5	5
		Somewhat satisfied	4	4		
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
12.	Hotel, Accommodation	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2	2	2	2
		Completely dissatisfied	1			
13.	Restaurants	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2	2	2	2
		Completely dissatisfied	1			
14.	Souvenirs shop	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3	3	3	3
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			

Table 3 (cont.)

No.	Indicator	Rating score system (R)	Mark	Mark		
				summer	rainy	winter
15.	Recreational activities service	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2	2	2	2
		Completely dissatisfied	1			
16.	Shower & Toilets facilities	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3	3	3	3
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
17.	Telephone services	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3	3	3	3
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
18.	Shop	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3	3	3	3
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
19.	Information Signs	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3	3		
		Somewhat dissatisfied	2		2	2
		Completely dissatisfied	1			
20.	Information centre	Completely satisfied	5			
		Somewhat satisfied	4			
		Neither satisfied nor dissatisfied	3	3		
		Somewhat dissatisfied	2		2	2
		Completely dissatisfied	1			
21.	Beach accessibility	Completely satisfied	5			
		Somewhat satisfied	4	4	4	4
		Neither satisfied nor dissatisfied	3			
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
22.	Car parking & Traffic	Completely satisfied	5			
		Somewhat satisfied	4		4	4
		Neither satisfied nor dissatisfied	3	3		
		Somewhat dissatisfied	2			
		Completely dissatisfied	1			
		Total mark	22 – 110	57	59	59
		WR	66 – 330	171	177	177

Table 4 Rating score system and beach scores of pollution aspect

No.	Indicator	Rating score system (R)	Mark	Mark		
				summer	rainy	winter
1.	Floatable Solids/ litters	Absent	4	4		
		Some present, natural litter	3		3	3
		Some present, non-degradable	2			
		Many present	1			
2.	Floatable Oil & Grease	Absent	3	3	3	3
		Present	2			
		Many present	1			
3.	Water Color	Blue	4			
		Green	3	3		
		Orange/Red	2		2	2
		Black	1			
4.	Water Odor	Absent	3	3	3	3
		Present	2			
		strong	1			
5.	Water clarity (m): can see bottom at maximum depth	> 4.0	5			
		3.0 – 4.0	4			
		2.0 -3.0	3			
		1.0 – 2.0	2	2		2
		< 1.0	1		1	
6.	TCB (MPN/100ml.)	≤ 1,000	2	2	2	2
		> 1,000	1			
7.	Litter on beach (kg/100 m^2)	Less than 1.0	5			
		Present 1.0 – 2.0	4			
		Present 2.0-3.0	3	3	3	3
		Present 3.0 – 4.0	2			
		Abundant > 4.0	1			
8.	Noise from motor vehicle	None	3		3	3
		Detectable	2	2		
		High level	1			
9.	Noise from industry/funfair	None	3	3	3	3
		Detectable	2			
		High level	1			
10.	Noise from water sports e.g. banana boat, jet skiing	None	3	3	3	3
		Detectable	2			
		High level	1			
11.	Odors from engines, boat exhausts of cars, other road vehicles	Absent	3	3	3	3
		Present	2			
		Present, strong	1			
12.	Animal permitted on beach	Banned from beach	2			
		Allowed on beach	1	1	1	1
13.	Vehicles permitted on beach	Banned from beach	2			
		Allowed on beach	1	1	1	1
		Total mark	13 - 42	33	31	32
		WR	26 - 84	66	62	64

Table 5 Rating score system and beach scores of biological aspect

No.	Indicator	Rating score system (R)	Mark	Mark		
				summer	rainy	winter
1.	Beach forest /tree cover within 100 m	Tree along the beach, shady	5	5	5	5
		Tree along the beach, in far	4			
		Partly tree of beach	3			
		Some, area was adapted	2			
		Absent	1			
2.	Harmful animals (jelly fish, weeverfish)	Absent	3	3		
		Some present	2		2	2
		Present, many	1			
3.	Endanger species area	Present	2			
		Absent	1	1	1	1

Table 5 cont.

No.	Indicator	Rating score system (R)	Mark	Mark		
				summer	rainy	winter
4.	Breeding area of animal	Present	2			
		Absent	1	1	1	1
5.	Flies(on beach)	Absent	4	4		4
		4-5 flies move and fly	3		3	
		Some present , on floor < 5	2			
		Many present on floor > 6	1			
6.	Cockroaches (at accommodation)	Absent at night	4	4	4	4
		Present run on floor 2-3 in the dark	3			
		Present run and fly 4-5 in the dark	2			
		Present creep on floor, fly at night when switch off	1			
		Total mark	6 - 20	18	16	17
		WR	6 - 20	18	16	17

Results marked were calculated by Simple Weighting Score Equation follow by Morgan (1999) as follow equation (1).

$$BQ = W_p\Sigma R_{i-n} + W_s\Sigma R_{i-n} + W_{pol}\Sigma R_{i-n} + W_b\Sigma R_{i-n} \ldots\ldots\ldots\ldots (1)$$

BQ: Beach Quality

W_p, W_s, W_{pol}, W_b : weighting score of physical, social, pollution and biological factor (4, 3, 2 and 1 respectively)

R_{i-n}: Rating scale of indicator 1, 2,3, …, n

So, beach score in summer, rainy and winter season was 383, 383 and 386 marks, respectively were shown on Table 6.

Table 6 Chao - Sumran Beach's scores

Season	Score (WR)				Total score
	physical	social	pollution	biological	
Summer	128 (32×4)	171 (57×3)	66 (33×2)	18 (18×1)	383
Rainy	128 (32×4)	177 (59×3)	62 (31×2)	16 (16×1)	383
Winter	128 (32×4)	177 (59×3)	64 (32×2)	17 (17×1)	386
Total. Max. score	176 (44×4)	330 (110×3)	84 (42×2)	20 (20×1)	610

3.6 Classification of beach quality

Environmental beach quality was calculated according to Simple Weighting Score Equation follow by Morgan (1999) on equation (1), the beach score was 610 maximum and 134 minimum. (Table 1) These score represent the environmental beach quality, were classified into 4 Class, A, B, C and D ((maximum - minimum) / 4) are following on Table 7

Table 7 Classification of beach quality

Class	Score	Beach quality standard
A	491.0 – 610.0	excellent environmental beach quality
B	372.0 – 490.9	very good environmental beach quality
C	253.0 – 371.9	fair environmental beach quality
D	134.0 – 252.9	poor environmental beach quality

3.7 The assessment of Chao-Sumran Beach quality

Chao-Sumran Beach's score in summer, rainy and winter season were 383, 383 and 386 marks, respectively. This score was compared with the classification of beach quality on Table 7. As a result, it was classified in Class B (very good environmental beach quality) in every season. Especially, biological factor, on average achieved the highest score 17 marks (about 85%) from the beach survey found many trees along the beach and safe from harmful animal as jelly fish and weeverfish. But the abundance species was poor, can found only a few and general species such as ghost crab, ocypode macrocera, etc. and hard to found unique species. Because of almost beach area was disturbed from tourist activities and local community. Pollution factor achieved 66 marks (about 78.6%) in summer. Because of both on workday and weekend day not many tourists visited here, amount of residue litter on beach, water quality, noise and odor from motor vehicle wasn't the serious problem. Physical factor achieved 128 marks (about 72%), the serious problem was coastal erosion same as other beaches which located in the West coast within the Gulf of Thailand. Only social factor was the serious problems, on average 175 marks only (about 53.03%). Because of the availability of tourism facilities service as accommodation, restaurants, souvenir shop, etc. and recreational activities services as banana-boat, jet-skiing, car for rent, etc. remain poorly. However all factors were necessary still abatement strategies and local environmental action plans, monitoring program for a period of 6 months continuously.

4. CONCLUSION

It can be concluded that Chao-Sumran Beach remained in Class B; very good environmental beach quality. Especially biological indicator achieved the highest score. However in this criterion, species diversity weren't considered whereby biological beach score was high in spite of species diversity was poorly. Pollution indicator such as water, noise and air quality achieved high quality same as physical factor, except coastal erosion which was the major problem of the West coast of the Gulf of Thailand. Tourism facilitates services as accommodation, restaurant, souvenir shop etc. and recreational activities services such as jet skiing, banana boat, car for rent etc. remains poorly. This result was useful for concern organization such as Pollution Control Department and Tourism Authority of Thailand for classifying Chao-Sumran beach quality. Because of it didn't record data and classify beach quality. Further more**,** result data was useful for both the local government and concerned

organizations would virtually set up the development policy and environmental management action plan for promoting beach tourism.

5. REFERENCES

American Public Health Association, American Water Works Association and Water Pollution Control Federation (APHA, AWWA and AWPCF). (1995). **Standard Methods for the Examination of Water and Wastewater.** APHA, Inc., New York.

Burak, S., E. Dogan and C. Gazioglu. (2006). **Impact of urbanization and tourism on coastal environment**. J. Oceocaman. 47: 515-527.

Elmanama, A. A., M.I. Fahd, S. Afifi, S. Abdallah and S. Bahr. (2005). **Microbiological beach sand quality in Gaza Strip in comparison to seawater quality**. J. Envres. 99: 1-10.

Lacey, E.M. and J.A. Peck. (1988). **Long-Term beach profile variations along the south shore of Rhode Island.** J. Coastal research. 14: 1255-1264.

Lasta, M., R. de La Huz, A.G. Sanchez-Mata, I.F. Rodil, K. Aerts, S.Beloso and J. Lopez. (2006). **Ecology exposed sandy beaches in northern Spain: Environmental factors controlling macrofauna communities**. J. Seares. 55: 128-140.

Morgan, R. (1999). **A novel, user-based rating system for tourist beaches**. J. Tourman. 20: 393-410.

Micallef, A and A.T. Williams. (2004).**Application of a novel approach to beach classification in the Maltese Islands**. J. Oceocaman. 47: 225 - 242.

Nelson, C., R. Morgan, A.T. Williams and J. Wood. (2000). **Beach Awards and management**. J. Oceocaman. 43: 87-98.

Pollution Control Department, Ministry of Natural Resource and Environment. (2003).**Environmental beach Index**. Ministry of Natural Resource and Environment.

Shibata, T., H.M. Solo-Gabriele, L.E. Fleming and S. Elmir. (2006). **Monitoring marine recreation water quality using multiple microbial indicators in an urban tropical environment**. J. Watres. 38: 3119-3131.

Somerville, S.E., K.L. Miller and J.M. Mair. (2006). **Assessment of aesthetic quality of a selection of beaches on the Firth of Forth, Scotland.** J. Marpolbul. 46: 1184-1190.

Tourism Authority of Thailand. (2003). **International Tourist Arrival, 2003 (I).**

Tourism Authority of Thailand. (2004). **International Tourist Arrival, 2004 (I).**

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