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ความสัมพันธ์ระหว่างดัชนีคุณภาพน้ำ (WQI) กับการมีส่วนร่วมของชุมชนในการจัดการแหล่งน้ำดิบ บริเวณแม่น้ำพุมดวง จ.สุราษฎร์ธานี ประเทศไทย

Relationships between Water Quality Index (WQI) and Community Participation in Water Resource Conservation in Phum Duang River, Surat Thani Province, Thailand

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บทคัดย่อ

วัตถุประสงค์และที่มา : แม่น้ำพุมดวงเป็นแม่น้ำสายสำคัญของคนในพื้นที่หลายๆอำเภอในจังหวัดสุราษฎร์ธานี ที่ใช้น้ำในการอุปโภคบริโภคโดยเฉพาะใช้ในการผลิตน้ำประปาหมู่บ้านในหลายตำบลของอำเภอคีรีรัฐนิคม ซึ่งแม่น้ำพุมดวงไหลผ่านนอกจากนี้ในบริเวณอำเภอพุนพิน จังหวัดสุราษฎร์ธานี มีการใช้น้ำดิบจากแม่น้ำพุมดวงเพื่อผลิตน้ำประปาของการประปาส่วนภูมิภาค และจากผลการศึกษาคุณภาพน้ำในแม่น้ำพุมดวงโดยสำนักงานสิ่งแวดล้อมภาค 14 พบว่าคุณภาพน้ำแม่น้ำพุมดวงอยู่ในเกณฑ์มาตรฐานแหล่งน้ำผิวดิน แต่อาจพบกลุ่มโคลิฟอร์มแบคทีเรียในบริเวณพื้นที่ชุมชนหนาแน่น ในช่วงฤดูฝนมีตะกอนเพิ่มมากขึ้น แม่น้ำตื้นเขิน นอกจากนั้นยังพบว่าบริเวณริมแม่น้ำพุมดวงในหลายตำบลมีการกัดเซาะชายฝั่งอย่างเห็นได้ชัด ส่งผลให้ชุมชนได้รับผลกระทบทั้งการนำน้ำดิบมาผลิตน้ำประปา และใช้ประโยชน์ทั่วไป เพื่อให้ชุมชนได้มีส่วนร่วมในการดูแลคุณภาพน้ำและสามารถนำน้ำมาใช้ประโยชน์ได้ดียิ่งขึ้น ดังนั้นงานวิจัยนี้จึงมีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างดัชนีคุณภาพน้ำกับการมีส่วนร่วมของชุมชนในการจัดการแหล่งน้ำ และคุณภาพน้ำบริเวณแม่น้ำพุมดวง จังหวัดสุราษฎร์ธานี

วิธีดำเนินการวิจัย : ทำการคำนวณดัชนีคุณภาพน้ำโดยโดยใช้ข้อมูลคุณภาพน้ำจากสำนักงานสิ่งแวดล้อมภาค 14 ปี พ.ศ. 2564 และศึกษากลุ่มตัวอย่างชุมชนบริเวณริมแม่น้ำพุมดวง จำนวน 400 ครัวเรือน เครื่องมือในการวิจัย คือแบบสอบถาม และสถิติที่ใช้ในการวิเคราะห์ ได้แก่ ค่าเฉลี่ย ความถี่ ร้อยละ ค่าเบี่ยงเบนมาตรฐาน t-test , F-test และสัมประสิทธิ์สหสัมพันธ์ของเพียร์สัน เพื่อหาความสัมพันธ์ระหว่างดัชนีคุณภาพน้ำกับการมีส่วนร่วม

ผลการวิจัย : ผลการศึกษาค่าดัชนีคุณภาพน้ำของแม่น้ำพุมดวงค่าดัชนีคุณน้ำเฉลี่ย (WQI) 76 อยู่ในระดับดี ผลการศึกษาการมีส่วนร่วมของชุมชนต่อการจัดการแหล่งน้ำและคุณภาพน้ำ พบว่าการมีส่วนร่วมของชุมชนต่อการจัดการแหล่งน้ำ ประกอบไปด้วย 4 ด้านดังนี้ 1) การมีส่วนร่วมด้านกายภาพอยู่ในระดับปานกลาง (X-Bar=2.68 S.D.=0.80*)* 2*)* การมีส่วนร่วมด้านความคิดอยู่ในระดับปานกลาง (X-Bar=2.55 S.D.=0.84*)* 3*)* การมีส่วนร่วมด้านอารมณ์ (X-Bar=2.55 S.D.=0.84*)* อยู่ในระดับปานกลาง 4*)* การมีส่วนร่วมด้านความเป็นเจ้าของ (X-Bar=3.04 S.D.=0.74*)* อยู่ในระดับปานกลาง เมื่อนำค่าดัชนีคุณภาพน้ำกับการมีส่วนร่วมของชุมชนมาหาความสัมพันธ์กันโดยใช้สัมประสิทธิ์สหสัมพันธ์ของเพียร์สัน ผลการศึกษาพบว่า 1) การมีส่วนร่วมด้านกายภาพกับดัชนีคุณภาพน้ำ (r=-0.779 sig=0.432) มีความสัมพันธ์ในระดับสูงและเป็นไปในทางตรงกันข้าม 2) การมีส่วนร่วมด้านความคิดกับดัชนีคุณภาพน้ำ (r=-0.933 sig=0.234) มีความสัมพันธ์กันในระดับสูง และเป็นไปในทางตรงกันข้าม 3) การมีส่วนร่วมด้านอารมณ์ (r=-0.482 sig=0.680) มีความสัมพันธ์กันน้อยและเป็นไปในทางตรงกันข้าม 4) การมีส่วนร่วมด้านความเป็นเจ้าของกับดัชนีคุณภาพน้ำ (r=0.931 sig=0.237) มีความสัมพันธ์กันสูงและเป็นไปในทางเดียวกัน

สรุปผลการวิจัย : การศึกษาความสัมพันธ์ระหว่างดัชนีคุณภาพน้ำ (WQI) กับการมีส่วนร่วมของชุมชนในการจัดการแหล่งน้ำดิบบริเวณแม่น้ำพุมดวง จังหวัดสุราษฎร์ธานี ค่าเฉลี่ยคุณภาพน้ำอยู่ในเกณฑ์มาตรฐานแหล่งน้ำผิวดิน ดัชนีคุณภาพน้ำ (WQI) เฉลี่ย 76 คะแนน ความสัมพันธ์ของดัชนีคุณภาพน้ำกับการมีส่วนร่วมโดยเฉลี่ย 5 ด้าน อยู่ในระดับปานกลาง ซึ่งประกอบไปด้วย การมีส่วนร่วมด้านกายภาพ(r=-0.779 sig=0.432) การมีส่วนร่วมด้านความคิด(r=-0.933 sig=0.234) การมีส่วนร่วมด้านอารมณ์(r=-0.482 sig=0.680) การมีส่วนร่วมด้านการเป็นเจ้าของ(r=0.931 sig=0.237) และในการศึกษาพบว่าการมีส่วนร่วมของชุมชนต่อการอนุรักษ์แหล่งน้ำและคุณภาพน้ำมีความสำคัญเป็นอย่างมาก เพราะการจัดกิจกรรมต่างๆ ชุมชนมีส่วนร่วมในการบริหารจัดการ และดำเนินการด้วยคนในชุมชน เพราะฉะนั้นการกระตุ้นจิตสำนึก และให้ชุมชนมีส่วนร่วมในการกำหนดมาตรการต่างๆในการดูแลคุณภาพน้ำในชุมชนเองจึงเป็นปัจจัยสำคัญ

คำสำคัญ : ดัชนีคุณภาพน้ำ ; การมีส่วนร่วมของชุมชน ; การจัดการคุณภาพน้ำ ; แม่น้ำพุมดวง ; จ.สุราษฎร์ธานี

Abstract

Background and Objective : Phum Duang River is an important river for many people in Surat Thani Province. Most communities use water for consumption, especially the production of village tap water in many sub-districts of Khiri Rat Nikhom District. In addition, in Phun Phin District, raw water from the Pum Duang River is used to produce tap water for the Provincial Waterworks Authority. The study conducted by the Environment Office Region 14 on the water quality of the Pum Duang River found that the water quality meets the standards for surface water resources. However, coliform bacteria may be present in densely populated areas. In addition, it was found that the areas along the Pum Duang River in many sub-districts experienced significant coastal erosion. As a result, communities

are affected in their use of raw water for both tap water production and general purposes. So that the community can participate in taking care of water quality and make better use of the water, this research aims to study the relationship between the water quality index and community participation in water resource and water quality management in the Pum Duang River area of Surat Thani Province.

Methodology: The questionnaires and WQI were applied as a tool in this research. The sample groups for questionnaires were representatives from 400 households along Phum Duang river bank. Data were analyzed with descriptive and inferential statistics i.e. frequency, mean, percentage standard deviation, t-test and f-test and Pearson's correlation coefficient in 4 aspects: physical, cognitive, emotional and ownership participations.

Main Results: The results of the study of the water quality index of the Pum Duang River, the average water quality index (WQI) of 76, is at a good level. Descriptive statistic results illustrated: 1) moderate physical, cognitive, and emotional participation with the X-Bar value at 2.68 ± 0.80, 2.55 ± 0.84, and 2.55 ± 0.84 respectively, and 2) moderate ownership participation with X-Bar at 3.04 ± 0.74. Consequently, Pearson's correlation coefficient results illustrated: 1) negative high correlation for physical and cognitive participation with the r value at -0.779 (sig=0.05) and -0.933 (sig=0.01) respectively, 2) negative less correlation for emotional participation with the r value -0.482 (sig=0.680), and 3) positive high correlation for ownership participation with the r value 0.931 (sig=0.01).

Conclusions: The study of the relationship between the Water Quality Index (WQI) and community participation in water resource conservation in the Pum Duang River area of Surat Thani Province found that the average water quality is within the standards for surface water sources. The Water Quality Index (WQI) averaged 76 points. The relationship between the Water Quality Index (WQI) and average community participation in the five areas is at a moderate level. This includes Physical Participation (r=-0.779, sig=0.432), Cognitive Participation (r=-0.933, sig=0.234), Emotional Participation (r=-0.482, sig=0.680), and Ownership Participation (r=0.931, sig=0.237). The study found that community participation in water resource conservation and water quality management is very important. Various activities are managed and operated by people in the community. Therefore, stimulating awareness and involving the community in determining measures to maintain water quality are crucial factors.

Keywords : water quality index ; community participation ; conservation management ; Phum Duang River ; Surat Thani province

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Introduction

Water resources are important for human being. However, increasing or expansion of economic, population, industrial and agricultural activities could cause negative impacts on river health from industrial household wastewater discharge and agrochemical leachate contaminating and deteriorating water quality for consumption purpose (Minakshi & Dulal , 2017). The physical, chemical and biological changes in rivers deteriorated water quality and increased difficulty, cost, and human health risk in producing tap water for consumption (Simge & Aysen , 2015)

The Phum Duang River with 120 km length originated from the Phuket Mountains was an important river for local people in Khiri Rat Nikhom District, Ban Ta Khun District and Phun Phin District, Surat Thani Province. The Ratchaprapha Dam was located upstream to generate electricity and Klong Yan, Klong Saeng and Klong Sok were located downstream of the dam. The population in the Phum Duang River area is 1410 households, population 3695 people. People used the river for consumption, transportation and agriculture (Rattanavijit,2013). In 2022, water use for consumption was less due to the sediment from bank erosion in rainy season and less water from sallow river in dry season. However, water quality complied with the surface water standard with no detection of heavy metals and the total group organochlorine pesticides. Coliform bacteria were found in densely populated areas, but were not exceed the standard. Addition from surface water standard, the Water Quality Index (WQI) calculated from Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Coliform Bacteria (TCB), Fecal Coliform Bacteria (FCB) and Ammonia (NH_3) (Salam *et al.*, 2020) was applied to identify the holistic of water quality. The WQI, 1) at the connection of the Phum Duang River and the Tapi River at Thakham Sub-district, Phun Phin District, 2) at 0 km until the end of the Ratchaprapha Dam, Ban Chiew Lan, Phra Saeng Sub- district, Ban Ta Khun District, and 3) at 121 km were fit in the type 3 water quality, which water could be utilized for agriculture activities and for consumption with general disinfection (Office of Environment and Pollution No. 14, 2021).

The management of water quality necessitates the collection and analysis of extensive water quality datasets, which can pose challenges during their evaluation and synthesis. A range of tools has been developed to evaluate water quality data. The Water Quality Index (WQI) is one such tool. WQI is based on aggregation functions that allow the analysis of large temporally and spatially varying water quality datasets to produce a single value (Md.Galal *et al.,* 2021). For example, the Water Quality Index (WQI) indicates the quality of the waterbody. It is attractive to water management and supply agencies because it is relatively easy to use and converts complex water quality datasets into a single value measure of water quality that is easy to understand

Since the WQI could be used to indicate the water pollution level related to community utilization (Busayamas,2011) and water quality index (WQI) is regarded as one of the most effective way to communicate water quality (Rajankar P.N. *et al.*,2009) then it could promote public participation and conservation (Sri *et al.*, 2019). Then the objective of this research was to study the relationship between the WQI and community participation in water resource management for Phum-Duang River, Surat Thani Province.

Methods

1. Study area

The community participation was studied in Phum Duang River, Surat Thani Province using the water quality data in 2022 from the office of the environment and pollution Control 14 as reference data. Water samples were taken during the dry season in March 2022 and wet season in June-September 2022. Water samples were taken from three locations: 1) Chulachomklao bridge, Phun Phin District, 2) Phum Duang bridge, Phun Phin District and 3) Thamsingkhon temple, Khiri Rat Nikhom District based on the location for tap water production for local people consumption as shown in Figure 1.

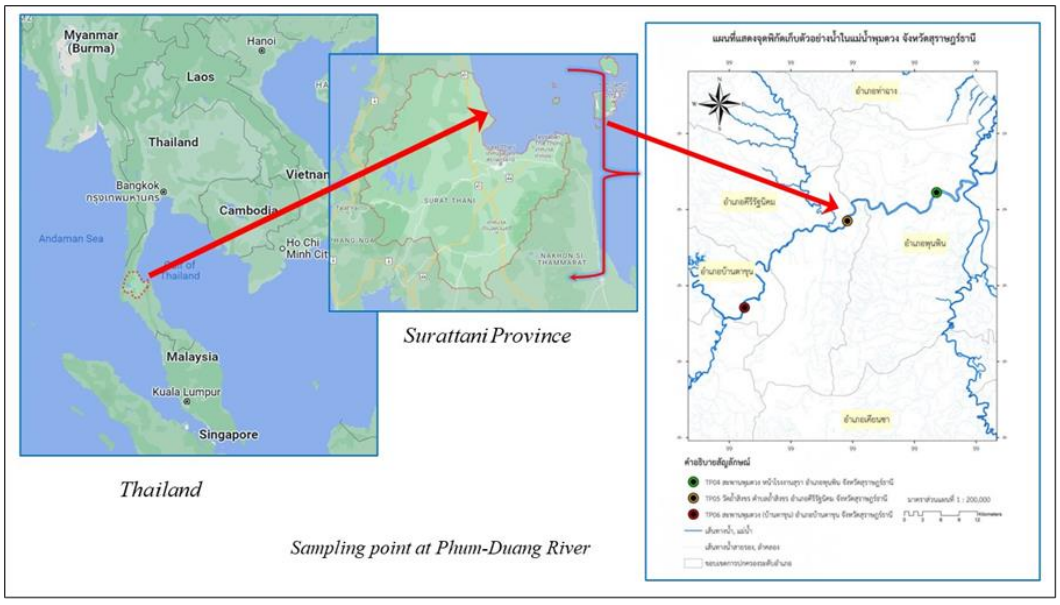

Figure 1 Location map of the study area and sampling site

2. *Study of Community Participation in Water Source Management and Water Quality in Phum Duang River, Surat Thani Province.*

The participation in surface water quality management was analyzed using questionnaires. The questionnaires were collected from 400 people along the Phum Duang River. As shown in Figure 2 Methodology framework

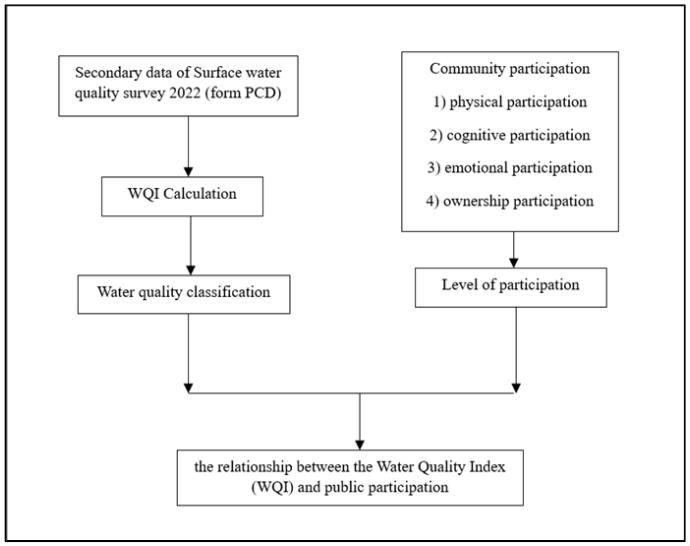

Figure 2 Methodology framework

3. *Population and Sampling*

There were 105,597 people or 20,848 households in Khiri Rat Nikhom District, Phunphin District and along the of the Phum Duang River that used tap water produced by the Phum Duang River. The sample size was calculated by equation 1 with the allowable degree of error equal to 5% and a confidence level of 95% (Taro, 1973).

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

n = sample size

N = total population

e = allowable error (set a degree of error equal to 5% to get a value of 0.05)

$$n = \frac{105,597}{1+105,597(0.05)^2} \quad (2)$$

n = 398.49, n = 399

The calculated sample size was 399 people, therefore the researcher selected 400 people for study. Multi-stage sampling was used, which was random sampling methods composed of 1) simple random sampling, 2) systematic random sampling, 3) stratified random sampling, and 4) random stratification to select the sample group.

Questionnaires in 3 parts was selected for data collection as following:

Part 1: The general status of the respondents with multiple choice answers such as gender, age, occupation, average monthly income and utilization of Phum Duang river were provided.

Part 2: The participation on water management in 4 aspects: 1) Physical participation 2) Cognitive participation 3) Emotional participation and 4) Ownership participation were provided.

Respondents were allowed to choose only one answer. The score was given according to the concept of Likert Scale with 5 levels (5 point rating scale). The scores for participation levels were identified as following:

Table 1 The scores for participation levels

participation level	scores
Always	5
Very often	4
Sometimes	3
Rarely	2
Never	1

Source : Best, 1972

The criterion for analyzing and interpreting the data for each range of average scores was between 1-5 points and the range of average scores was identified (Best, 1972) as following:

Table 2 range of average scores

participation level	scores
Always	4.51-5.00
Very often	3.51-4.50
Sometimes	2.51-3.50
Rarely	1.51-2.50
Never	1.00-1.50

Source : Best, 1972

Part 3: The opinions and suggestions, as free expression

4. *Tool Quality Testing and Human Research Ethics.*

1) *Index of item objective congruence (IOC)*

Steps to evaluate the tools were identified as following: 1) 5 Expert advice and approved on the content, questions, question structure and the language, 2) Specialist reviewed and evaluated the Index of Item-objective congruence (IOC). If the IOC value was more than 0.5, the question was valid. The tool was appropriate and consistent with the objectives (Fouzul *et al*., 2022), which can be calculated from the following equation:

$$IOC = \frac{\Sigma R}{n} \quad (3)$$

IOC = Index of Item-objective congruence

$\sum R$ = sum of specialist opinion scores

n = total specialist

The overall mean was 0.87, indicating that the questionnaire was suitable and consistent with the objectives.

2) *Human Research Ethics*

This research has passed the human research ethics from Suratthani Rajabhat University, certification number SRU-EC2022/124.

5. Data Analytics

The questionnaires were collected and the data were analyzed with a statistical analysis program.

-Personal factor analysis using descriptive statistics such as Frequency and Percentage.

-Mean ($\overline{+}$) and standard deviation (S.D) were used for analyzing the overall level of public participation.

- The hypothesis test with two-tailed t-test was used to analyze differences between opinions. F-test statistical analysis with statistical significance at 0.05 was used to analyz data such as gender, ages. highest level of education, average income per person and occupation.

- Analysis of the relationship between water quality index (WQI) and community participation in water resource management and water quality using Pearson's Correlation Coefficient.

6. Water quality index calculation (WQI)

The calculation of the water quality index showed the holistic water quality. WQI was calculated from 5 parameters using Pollution Control Department's equation (Sarawut *et al,* 2015)

$$WQI = \frac{DO(\frac{mg}{l})+BOD(\frac{mg}{l})+FCB(\frac{mpn}{100ml})+TCB(\frac{mpn}{100ml})+NH_3-N(\frac{mg}{l})}{5} - PS \quad (4)$$

WQI = Water Quality Index

DO = Dissolved Oxygen

BOD = Biochemical Oxygen Demand

FCB = Fecal Coliform Bacteria

TCB = Total Coliform Bacteria

NH_3-N = Ammonia Nitrogen

PS = Different score levels of the water quality with each parameter =0: if levels of water quality each parameter equal ,=10: if levels of water quality each parameter different 1 level ,=15: if levels of water quality each parameter different 2 level, =20: if levels of water quality each parameter different 3 level,

The scores obtained from each parameter were calculated according to the WQI equation to find the total scores to be compared with the water quality index scores by Pollution Control Department as shown in Table 3.

Table 3 Criteria for assessing the quality of water from surface water sources according to the general water quality index.

Surface water quality classification	Score	PCD water quality standard class
Good	71-100	2
Poor	61-70	3
bad	31-60	4
Very bad	<30	5

Source: Pollution Control Department

Results

The results of relationship between water quality index (WQI) and community participation in water source management and water quality were analyzed from secondary data of the average of the water quality index (WQI), and the level of public participation by using Pearson's correlation coefficient.

Community Participation in Water Source Management

The level of people's participation results in water resource management and water quality in the Phum Duang River, Surat Thani Province were consisted of 4 aspects;

1) physical participation at a moderate level ($\overline{X}$=2.68 S.D.=0.80), A study of the level of public participation in water source management and water quality in the Pum Duang River, Surat Thani Province, which consists of four average aspects as follows: Physical participation. This involves the receipt of information about activities related to water resource management in the area. Participating in various activities in the community, involvement in receiving news about water resources, active participation in water user group meetings, and contributing suggestions for various approaches to solving water use problems and making improvements.

2) Cognitive participation, which includes methods for developing water resources, allocation of water sources for maximum benefit, proposing methods for managing water resources, and actively engaging in the recommendation of punishments for offenders. The involvement in the thought process revealed that overall public participation was at a moderate level ($\overline{X}$=2.55 S.D.=0.84).

3) Emotional participation, characterized by a desire to strengthen the community's water resource management, satisfaction with the quality of raw water sources, and the belief that there is sufficient water available for use in all seasons, was found to be at a moderate level ($\overline{X}$=2.55 S.D.=0.84)

4) Participation in ownership was found to be at a moderate level ($\overline{X}$ =3.04 S.D.=0.74), which consisted of community participation in water management. People in the community are satisfied that there is enough water to meet their consumption needs and are actively involved in conserving and maintaining the community's natural water sources. They also express happiness when outsiders join in using the water, and they cooperate in taking care of water pipes laid through their own area. as shown in Table 4.

Table 4 Community Participation

Participation	$\overline{X}$	S.D.	Participation level
1. physical participation	2.68	0.80	moderate
2. cognitive participation	2.55	0.84	moderate
3. emotional participation	2.91	0.66	moderate
4. ownership participation	3.04	0.74	moderate

Water Quality Index

The results of the study on water quality encompassed four parameters: Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Coliform Bacteria (TCB), Fecal Coliform Bacteria (FCB), and Ammonia (NH_4). Secondary data from 2022 obtained from the Environment and Pollution Control Office 14 informed the study conducted across three sites.

Site 1, located at Phum-Duang Bridge in Phun phin District; Site 2, situated at Thamsingkhon Temple in Khiri Rat Nikhom District; and Site 3, positioned at Phum-Duang Bridge in Ban Ta Khun District, were selected for the water quality analysis. This analysis was conducted three times throughout the year, representing the rainy season, dry season, and winter season. The average water quality at all three sampling sites met the standards for surface water sources, as specified by the Pollution Control Department in 2022, and the results are presented in Table 5.

Table 5 Water Quality in Phum-Duang River (2022)

Sampling site	Water Quality Parameter				
	DO (mg/l)	BOD (mg/l)	TCB (MPN/100ml)	FCB (MPN/100)	NH_4 (mg/l)
Site 1: Phum- Duang Bridge, Khiri Rat Nikhom District					
1st sampling 1/2022	5.4	0.9	5,400	170	<0.06
2nd sampling 2/2022	6.7	0.4	4,300	790	<0.06
3rd sampling 3/2022	7.2	1.0	17,000	1,600	<0.06
mean	6.43	0.77	8,900	853	<0.06
Site 2:Thamsingkhon temple, Khiri rat Nikhom District					
1st sampling 1/2022	5.3	0.6	2,100	78	<0.06
2nd sampling 2/2022	5.9	0.3	5,400	1,300	<0.06
3rd sampling 3/2022	7.0	0.6	4,600	400	<0.06
mean	6.06	0.5	4,033	1,778	<0.06
Site 3: Phum-Duang Bridge, Ban Ta Khun District					
1st sampling 1/2022	5.3	0.4	3,300	490	<0.06
2nd sampling 2/2022	6.5	0.6	5,400	2,400	<0.06
3rd sampling 3/2022	7.6	0.6	16,000	350	<0.06
mean	6.32	0.9	7,056	842	<0.06

Source: Environment and Pollution Control Office 14

Water Quality Index (WQI) were calculated. The WQI for site 1 Phum Duang Bridge, Khiri Rat Nikhom Distric, Site 2 Thamsingkhon Temple, Khirirat Nikhom District, and Site 3 Phum-Duang Bridge, Ban Ta Khun District were 74 (good), 78 (good),and 75 (good) consecutively as shown in Table 6.

Table 6 Water Quality Index (WQI) Phum-Duang River, Surat Thani Province in 2022

Sample Site	Water Quality Index (WQI)				
	No. 1	No. 2	No. 3	mean	Quality of Water
Site 1: Phum-Duang Bridge, Khiri Rat Nikhom District.	72	83	68	74	Good
Site 2: Thamsingkhon temple, Khiri rat Nikhom District.	87	70	85	78	Good
Site 3: Phum-Duang Bridge, Ban Ta Khun District.	84	69	72	75	Good
mean	81	74	75		Good

Remark : The water quality criteria were very good (91-100), good (71-90), fair (61-70), deteriorated (31-60) and very deteriorated (0-30).

Source : Environment and Pollution Office 14

Relationship between Water Quality Index (WQI) and people's participation

The relationship between physical participation and water quality index was negatively high (r = -0.779 sig = 0.05). The relationship between cognitive participation and water quality index was negatively high correlation (r = -0.993 sig = 0.01). The relationship between emotional participation and water quality index was negatively (r = -0.482 sig = 0.680). However, the relationship between ownership participation and Water Quality Index was positively high (r = 0.931 sig = 0.01) illustrating that the ownership participation influenced water quality. Details of relationships between participations and WQIs were shown in Table 7.

Since the study of Janon *et al.*,2020, stated that physical participation had influenced on improving water quality, then for this location the physical participation of this study site should be moderately improved. Hathaichanok *et al.*, 2022 and Sarawut *et al.*, 2015 found that community agreement to form a group for water resource conservation would improve water quality, therefore this study site should slightly improve cognitive participation. Moreover, Sivapan *et al.*, 2015 found that emotional participation was important for raising awareness, then the site should slightly improve emotional participation. Ownership participation had high influenced on WQI for this site with positively high correlation but still not showed statistically significant. Therefore, building

participation activities together with more data collection on participation and water quality should be studied further in the future (Pimpunchat ,2011).

Table 7 The relationship between the water quality index and the people's participation in water resource management and water quality at Phum Duang River, Surat Thani Province.

Sample Site	community participation	water quality index	r	P-value
1) Physical participation				
Site 1: Phum-Duang Bridge, Khiri Rat Nikhom District.	2.68	74		
Site 2: Wat Tham Singkhon, Khiri Rat Nikhom District.	2.50	80		
Site 3: Phum-Duang Bridge, Ban Ta Khun District.	2.57	75	-0.779	0.05*
mean	2.57	76.3		
2) Cognitive participation				
Site 1: Phum-Duang Bridge, Khiri Rat Nikhom District.	2.55	74		
Site 2: Wat Tham Singkhon, Khiri Rat Nikhom District.	2.64	80		
Site 3: Phum-Duang Bridge, Ban Ta Khun District.	2.75	75	-0.933	0.01*
mean	2.64	76		
3) Emotional participation				
Site 1: Phum-Duang Bridge, Khiri Rat Nikhom District.	2.91	74		
Site 2: Wat Tham Singkhon, Khiri Rat Nikhom District.	1.89	80		
Site 3: Phum-Duang Bridge, Ban Ta Khun District.	1.65	75	-0.482	0.680
mean	2.14	76		
4) Ownership participation				
Site 1: Phum-Duang Bridge, Khiri Rat Nikhom District.	1.72	74		
Site 2: Wat Tham Singkhon, Khiri Rat Nikhom District.	2.51	80		
Site 3: Phum-Duang Bridge, Ban Ta Khun District.	1.49	75	0.931	0.01*
mean	1.90	76		

*Remarks: *p<0.05*

Discussions

The relationships between community participation (physical participation, cognitive participation, emotional participation and ownership participation) about water resource management and water quality index (WQI) in Phum Duang River, Surat Thani Province were studied by applying Pearson correlation coefficients.

Ownership participation had high influenced on WQI for this site with positively high correlation but still not showed statistically significant. Therefore, building participation activities together with more data collection on participation and capacity building. The community feels ownership of the water source, and when the water quality in the area is affected to the point where the water source cannot be used for consumption, several important actions and considerations come into play (Md. Galal *et al.,* 2023) Especially during the dry season, communities are affected by a decrease in the amount of water in the river (Janon *et al.,* 2020). Additionally, in the rainy season, the water becomes sediment-laden and murky in color, resulting in a reduction in the use of water from natural water sources (Rajankar, *et al.,* 2009).

There are many factors that contribute to good or poor water quality, with community participation being the main factor in preserving water resources (Bhattacharyya ,2015) especially. This is consistent with a study of the water quality and utilization of the Li River in Lamphun Province. Most people in the area seek benefits from the Li River without considering the impact on the water source, resulting in the degradation of the Li River and ultimately preventing people from utilizing it to its fullest potential (Samart *et al.,* 2015). To enable community participation in caring for and conserving water resources within the community (Krishnakumar *et al.*, 2013), it is essential for community leaders, including local leaders, to emphasize the significance of water sources. Organizing various activities aimed at promoting water quality care is a crucial factor in fostering community participation in water quality conservation in the area (Ashok *et al.,* 2011).

Conclusions

The study of the relationship between the Water Quality Index (WQI) and community participation in water resource conservation in the Pum Duang River area of Surat Thani Province found that the average water quality is within the standards for surface water sources. The Water Quality Index (WQI) averaged 76 points. The relationship between the Water Quality Index (WQI) and average community participation in the five areas is at a moderate level. This includes Physical Participation ($r=-0.779$, $sig=0.432$), Cognitive Participation ($r=-0.933$, $sig=0.234$), Emotional Participation ($r=-0.482$, $sig=0.680$), and Ownership Participation ($r=0.931$, $sig=0.237$). The study found that community participation in water resource conservation and water quality management is very important. Various activities are managed and operated by people in the community. Therefore, stimulating awareness and involving the community in determining measures to maintain water quality are crucial factors.

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