Fishermen's Participation in Marine Litter Collection Schemes
in Thailand

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    ขยะทะเลเป็นปัญหาสิ่งแวดล้อมระดับโลกที่เกิดขึ้นในปัจจุบันโดยมีองค์ประกอบส่วนใหญ่คือพลาสติกซึ่งสามารถแตกตัวเป็นไมโครพลาสติกได้ ขยะทะเลนั้นสร้างผลกระทบต่อหลากหลายมิติ ทั้งทางด้านสิ่งแวดล้อม ด้านเศรษฐกิจ และด้านสังคม เช่น การเสียค่ากำจัดขยะทะเลบริเวณชายหาด ผลกระทบต่อธุรกิจการท่องเที่ยว รวมถึงความสวยงามของทรรศนียภาพ รวมถึงการคร่าชีวิตของสัตว์ทะเลและถิ่นที่อยู่อีกด้วย ดังนั้น การจัดการกับปัญหาขยะทะเลจึงเป็นสิ่งสำคัญ โดยมีมาตรการต่างๆ ที่สามารถจัดการกับขยะทะเลได้ ตั้งแต่ต้นทาง เริ่มจากการป้องกันและการลดการเกิดขยะ การป้องกันและลดขยะเข้าสู่ทะเล และขปลายทางคือการเก็บขยะที่เกิดขึ้นแล้วที่อยู่ในทะเล ประเทศไทยได้มีความพยายามในการจัดการกับปัญหาขยะทะเลผ่านปฏิญญากรุงเทพฯ ว่าด้วยการต่อต้านขยะทะเลในภูมิภาคอาเซียนและกรอบการปฏิบัติงานอาเซียนว่าด้วยขยะทะเลในปี 2562 เนื่องจากประเทศไทยถูกจัดอันดับเป็นประเทศอันดับต้นๆ ที่มีการรั่วไหลของขยะพลาสติกสู่ทะเลมากที่สุดในโลก มาตรการหนึ่งที่สอดคล้องกับปฏิญญาดังกล่าว ได้แก่ กิจกรรมขยะคืนฝั่งทะเลสวยด้วยมือเรา ซึ่งกรมประมงได้เริ่มต้นดำเนินการช่วงปลายปี 2562 เพื่อจัดเก็บขยะทะเลโดยมีความร่วมมือจากชาวประมงอาสาที่เข้าร่วมโครงการ อย่างไรก็ตาม หลังจากที่ได้ดำเนินการไประยะหนึ่งพบว่ามีชาวประมงเพียงจำนวนหนึ่งที่เข้าร่วมโครงการ วิทยานิพนธ์ฉบับนี้มีวัตถุประสงค์ที่จะศึกษาปัจจัยที่มีแนวโน้มและเกี่ยวข้องต่อการตัดสินใจเข้าร่วมโครงการเก็บขยะทะเลของชาวประมง โดยอ้างอิงตามทฤษฎีพฤติกรรมตามแผน (Theory of Planned Behaviour) ศึกษา 10 ปัจจัย ได้แก่ ความรู้และความตระหนักรู้ด้านสิ่งแวดล้อม ข้อกังวลส่วนบุคคล แรงกดดันทางสังคม บุคคลรอบข้าง แรงจูงใจ ความพร้อมของสิ่งอำนวยความสะดวกต่อการเก็บขยะทะเล ข้อมูลข่าวสาร เวลาและความสนใจ ขนาดเรือและการปรับปรุงเรือ และประสบการณ์ด้านการเก็บขยะทะเล การเก็บรวบรวมข้อมูลประกอบด้วย การเก็บแบบสอบถามและการสัมภาษณ์เชิงลึกกับชาวประมงกลุ่มตัวอย่าง จำนวน 105 คน จากจังหวัดสมุทรปราการ สมุทรสงคราม และพังงา ผลการศึกษาพบว่า ปัจจัยด้านความพร้อมของสิ่งอำนวยความสะดวกต่อการเก็บขยะทะเล ข้อมูลข่าวสาร และประสบการณ์ด้านการเก็บขยะทะเลมีแนวโน้มที่ส่งผลให้ชาวประมงตัดสินใจเข้าร่วมโครงการเก็บขยะทะเล ผลการศึกษานำไปสู่ข้อเสนอแนะต่อกรมประมงโดยควรเผยแพร่ข้อมูลของโครงการมากขึ้น โดยเฉพาะอย่างยิ่งผ่านสมาคมการประมงและศูนย์ควบคุมการแจ้งเรือเข้าออกที่เข้าถึงเจ้าของเรือประมง นอกจากนี้ ทางโครงการควรเพิ่มจุดรับทิ้งขยะ สำหรับชาวประมงเมื่อนำขยะขึ้นฝั่งและแจ้งจุดที่ทิ้งได้ต่อชาวประมง อย่างไรก็ตาม ภาครัฐควรเพิ่มมาตรการในการลดและจัดการขยะพลาสติกและขยะต่าง ๆ ที่เกิดขึ้นจากกิจกรรมบนบกมากขึ้นซึ่งเป็นสัดส่วนร้อยละ 80 ของขยะทะเลทั้งหมด

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Marine litter is a global environmental problem that poses various threats to the environment, the economy and society. Its impacts, for example, are the cost of beach cleaning, tourism, the beautiful landscape and etc. Marine litter, which later breaks into microplastics, affects marine lives contributing to the loss of economy to the people who depend on them. Several measures are used to tackle marine litter, including prevention and reduction of waste generation, prevention and reduction of litter reaching the marine environment, and marine litter removal. The latter is essential to clean already-at-sea litter or marine debris.

Thailand, among the top countries putting mismanaged plastic waste into the ocean, has committed the effort to tackle the marine litter and initiated the regional effort through the Bangkok Declaration on Combating Marine Debris and the ASEAN Framework of Action in 2019. At the same time, the Thai Department of Fisheries had introduced a voluntary marine litter collection scheme named Trash Back to Shores: Beautiful Seas with Our Hands to engage the fishermen to collect marine litter while they are in their fishing activities. The scheme, however, had not convinced many fishermen to participate. Therefore, this study aimed to investigate potential factors relating to Thai fishermen's participation in the schemes based on the Theory of Planned Behaviour. Ten factors were investigated comprising environmental awareness and knowledge, personal concerns, social pressure, surrounding people, incentive, the readiness of supported practice, information, time and interests, size of vessels and ships adjustment and practice experience.

This study used questionnaire surveys and in-depth interviews to draw insights from 105 fishermen in three provinces, namely Samut Prakarn, Samut Songkhram and Phang Nga. The study found that the readiness of supported practice, information and practice experience potentially influenced their participation. The findings of this study highlight numerous policy recommendations for the improvement of the marine litter collection schemes. The fisheries associations and Port-In Port-Out Control Centers (PIPOs) could increase the dissemination of schemes' information, especially for the owners of vessels. Moreover, storing containers on-board and waste reception facilities are necessary to facilitate the schemes' implementation. More actions should be done to reduce plastic waste and other wastes on land since more than 80 percent of marine debris are generated by land-based activities.

| Field of Study: | Environment, Development and Sustainability | Student's Signature .... |
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CHAPTER I
INTRODUCTION

1.1 Problem Statement

Marine litter is an environmental issue that happened all over the world. It is defined as "any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment" (Jeftic, Sheavly, Adler, & Meith, 2009). Most marine litter is plastics, which can degrade to small particles, micro-plastics, in the marine environment. The plastics are accounted for 50-80 percent of all marine litter found at sea. Others are metals, glass, paper, processed timber, rubber and discarded fabric (Mouat, Lozno, & Bateson, 2010; OSPAR Commission, 2007). The sources of the marine litter are from land-based and sea-based activities accounted for 80 and 20 percent respectively (Jambeck et al., 2015; Mouat et al., 2010; Sherrington, 2016; Surfers Against Sewage, 2014).

Marine litter poses a threat to the economy, such as the cost of beach cleaning, tourism and business around the beaches. Besides, the fisheries and aquaculture which greatly rely on the seas are impacted by the contamination of litter as well (Mouat et al., 2010; Newman, Watkins, Farmer, Brink, & Schweitzer, 2015; Surfers Against Sewage, 2014). The social aspects are also impacted. The risk exposure to human health from litter occurs at beaches and seas such as injuries from metal, glass or shards of plastic on beaches and discarded fishing gears at sea. Moreover, the society also has negative impacts from marine litter such as recreational value, the beauty of the landscape and the people who depend on the coastal and marine biodiversity in their daily life (Mouat et al., 2010; Surfers Against Sewage, 2014; UNEP, 2017). The environmental impacts from marine litter are found and happened to the marine animals and their habitats. They are being threatened with the activities they do not cause. They can mistakenly consume the litter leading to their injuries, suffocating, drowning and deaths as the most

considerable negative consequences. In addition, the loss of the lives of marine creatures such as fish can cause damage to ecosystem functions and services as well as economic loss to the fishermen (Mouat et al., 2010; Surfers Against Sewage, 2014).

As a result of marine pollution caused by marine litter, a hierarchy of marine litter management proposed by Emma Watkins (UNEP, 2017) in Figure 1, adapted from waste management hierarchy, has been proposed classifying instruments dealing with marine litter into three primal steps. It prioritises the prevention of waste generation, which potentially contributes to marine litter. Secondly, the prevention and reduction of waste from reaching the environment. Lastly, the collection of already-at-sea litter is the last resort for dealing with marine litter (UNEP, 2017). The involvement of all stakeholders in the private and public sectors and the people is in need. Fishing industries are one of them, especially in the prevention and collection of marine litter as this study focuses.
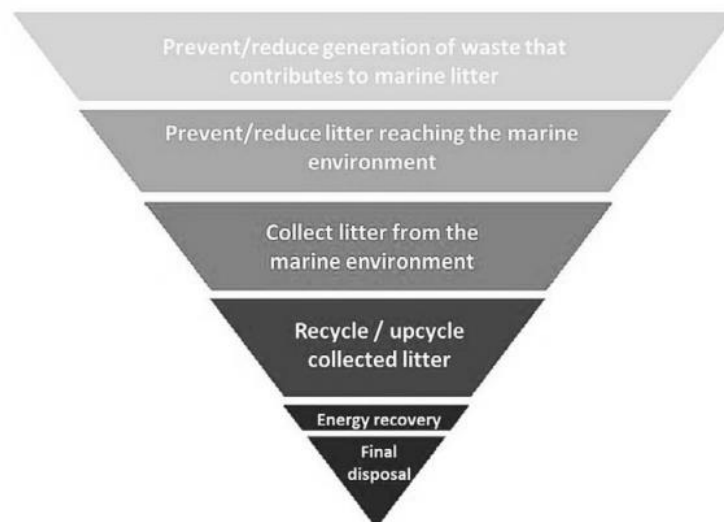
Figure 1 A hierarchy of marine litter management
Source: UNEP (2017)

In this regard, many governments, private companies and groups of people are enacting a measure collecting floating marine litter by fishers who are close to the

marine environment. The marine litter collection schemes by fishermen, both active and passive, are implemented in many places of the world. The examples are including Fishing For Litter as a voluntary scheme implementing in many European countries, Buy Back Programme implementing in South Korea using incentive function.

Thailand is one of the countries initiating marine litter collection schemes to restore the polluted ocean. Many schemes have been established and implemented for collecting marine debris by fishermen. Catch the Trash, one of the marine litter collection schemes, was established in 2018 (Auonauon, 2019; Department of Fisheries, 2018). However, the project discontinues by the appearance of the new marine litter collection scheme, Trash Back to Shores: Beautiful Seas with Our Hands. The Department of Fisheries initiates the programme in October 2019 and operating since November 2019. The programme covers all 23 sea-connected provinces with the cooperation amongst the fishermen associations, ports, and Fisheries Port In-Port Out Control Centers indicated by W. Rattanachu (personal communication, May 14, 2020). Besides, a stand-alone project, Catching the Trash with Care, is implementing in Samut Songkhram by the Samut Songkhram Fishermen Association since December 2019 (National News Bureau of Thailand, 2019; Samutsongkhram Provincial Cooperative Auditing Office, 2019).

However, the schemes of marine litter collection have not convinced a high number of fishermen to participate. Besides, a risk of practices' abandonment by the fishermen could occur, which potentially makes the schemes discontinued. Therefore, the study of "Fishermen's Participation in Marine Litter Collection Schemes in Thailand" is a necessity to consider the needs and motivations' drivers of fishermen to participate in the schemes as well as hindering factors of non-participating to be an information for increasing the number of participants. Furthermore, the already participating fishermen's motivations are needed to be studied to indicate their demands for further optimization of the marine litter collection schemes. Thus, the study will

mainly focus on the "Trash Back to Shores: Beautiful Seas with Our Hands" to make a contribution of potential influencing factors of participation which could be beneficial for a sustainable practice at last.

1.2 Objectives

1. To review and synthesise the current marine litter collection practices implementing worldwide
2. To investigate the overall practices and performances of marine litter collection schemes in Thailand and potential factors relating to Thai fishermen's participation in the schemes

1.3 Research Questions

1. How have marine litter collection projects been implemented worldwide?
2. What are the practices and performances of marine litter collection schemes in Thailand?
3. What are the potential key factors of Thai fishermen's participation in marine litter collection schemes?

1.4 Scope of the Study

1. The study only includes the marine litter collection schemes in which fishermen are taking parts in litter collection while they are in their normal activities.
2. The targeted fishermen are both participants and non-participants to the marine litter collection schemes.
3. Commercial fishing vessels (more than ten gross tonnes sized) are prioritised in the surveys investigating factors motivating fishermen's participation in marine litter collection schemes.

1.5 Significance of the Study

The findings of the study of "Fishermen's Participation in Marine Litter Collection Schemes in Thailand" would contribute to policy implications as follows

1.5.1 A proposal on the improvement of the scheme to be more sustainable and inclusive which would help reducing marine litter more effectively and hence could help:

  a. Reducing the risks of increasing marine litter from fishermen's litter on board

  b. Reducing the loss to the economy: less beach clean-up cost; fewer impacts on beaches and marine tourism; diminished loss of valuable time and the catch damages

  c. Reducing the occurrence of microplastics and the risk of microplastic contamination in the marine ecosystem and food chain.

1.5.2 Raise awareness among fishermen community and society about the act of fishermen as guardian of the sea

CHAPTER II
LITERATURE REVIEW

This chapter consists of the review of marine litter collection programmes implementing worldwide. The reviewed schemes begin with the widespread Fishing For Litter, followed by incentive and non-incentive marine litter collection schemes as well as the schemes in Thailand. Then, the benefits, comparison and synthesis of reviewed marine litter schemes are shown. The concept of participation and related studies about participation, mostly in the field of marine environment, are reviewed for the conceptual framework of the study.

2.1 Global marine litter collection schemes

Globally, several marine litter collection schemes have been implementing to tackle marine pollution. The fishermen are involved in the schemes as the closest to the marine environment. The last-long and systematic project is Fishing For Litter that is widespread across the European region.

2.1.1 Fishing For Litter

Fishing For Litter is a marine litter collection scheme implementing in the European region. It is a systematic practice with supports from stakeholders and the cooperation of the key players, fishermen. The scheme, currently, takes place in various areas in 11 countries. The FFL-implementing countries are the Netherlands, the United Kingdom, Denmark, Germany, Croatia, Greece, Italy, Montenegro, Slovenia, Ireland and Norway.

1) *The Beginning of the Fishing For Marine Litter*

Fishing For Litter is defined by KIMO (Kommunenes Internasjonale Miljøorganisasjon: local authorities international environmental organization) as an

imaginative yet straightforward initiative that aims to reduce marine litter by involving one of the key stakeholders, the fishing industry (Fishing For Litter UK, 2020c). However, the origination of the Fishing For Litter is not from the KIMO, but it was founded in a single port named Den Helder, Netherlands.

Fishing For Litter (FFL) initiative first began as a pilot project in a Den Helder, a port in the Netherlands in March 2000 operating by the North Sea Directorate of the Dutch Government in cooperation with the Dutch Fisheries Association. The objective of the project was to clean up the North Sea from marine debris by providing bags to fishermen to bring caught-in-nets litter found at sea during normal fishing activities (as a passive practice) back to shore (Fishing For Litter UK, 2020c; OSPAR Commission, 2007).

The operation of the original FFL was run by the North Sea Directorate as aforementioned. Several vessels involved in the period of the trial project were ten. The participating vessels and fishermen received no financial compensation for taking part in the project and for being a cleaner of the sea. Nevertheless, big bags were provided by the North Sea Directorate to the fishermen to collect marine litter while they are fishing. After they brought the collected litter to land, the litter was received by the local port, which being contracted with the authority. Besides, the fishermen did not have to pay for the costs of collected litter disposal. In conclusion, the North Sea Directorate paid all costs for the activities of Fishing For Litter in Den Helder, including the collection and processing of marine litter (OSPAR Commission, 2007).

2) *Save the North Sea's Fishing For Litter pilot project*

Fishing For Litter in Den Helder had been mirrored by a part of the Save the North Sea project (SNS) in the OSPAR region operated by KIMO International (OSPAR Commission, 2007). The initiative was a pilot project starting from 2002- 2004 implementing in harbours in 4 countries including the Netherlands, Denmark, Sweden and the United Kingdom (Fishing For Litter UK, 2020c; OSPAR Commission, 2007;

Save the North Sea, n.d.). The initiative aimed to clear the North Sea of litter, by providing bags to bring ashore litter that was gathered in nets in the fishing activities and disposing of the litter on land (Fishing For Litter UK, 2020c). This project was a voluntary scheme with the participation of fishermen willing to reduce the litter floating in the North Sea. The project of the FFL was coordinated by one of the partners of the SNS project, KIMO international. The scheme was like an expansion of the pilot project of Den Helder because it integrated Den Helder and added other harbours in the Netherlands into the initiative. The target of FFL pilot scheme set 60 vessels would involve with an amount of 1000 tonnes of litter that would be removed.

In the operation of the FFL pilot scheme as part of the Save the North Sea project, KIMO international coordinated with various organisations in the participating countries. The significant organisations were including the fishing industry, harbour authorities, local authorities, and national government in some cases (OSPAR Commission, 2007). The participation of fishermen was based on a voluntary basis. They were contributed with large bags for the collection from the SNS project as it occurred before in the first project of FFL in Den Helder, the Netherlands. In addition, the SNS project provided the fishermen involved in the programmes free of harbour fees as incentives (Save the North Sea, n.d.). After they collected the marine litter, they brought back to shore and gave the litter to the authorities at land to remove and dispose of the collected litter. In this matter, the local authorities of each country paid those costs to be one of the financial supports of the pilot scheme. The local authorities, managed and disposed of litter, depended on the participated country in the FFL of Save the North Sea project. The lists of authorities involving in the FFL process are following (OSPAR Commission, 2007):

In the Netherlands, the project had expanded from Den Helder to other ports in the southern part of the country. It started in December 2002. The authorities responsible for the pilot projects differed, relying on the ports. Relevant harbour authorities,

fishermen's associations and KIMO Netherlands involved in the project (OSPAR Commission, 2007).

In Denmark, the scheme started in October 2003. The involving partners were harbour authorities, Danish Fishermen's association and KIMO Denmark (OSPAR Commission, 2007).

In the United Kingdom, the pilot project was launched only at Scotland in Shetland islands (Lerwick and Scalloway) and Peterhead in June 2003 and April 2004, respectively. The schemes had the participation of the Shetland Fishermen's Association, Lertwick Port Authority, Shetland islands Council, Shetland Amenity Trust for Shetland islands. The Peterhead Port Authority and KIMO UK were involved in the harbour of Peterhead (OSPAR Commission, 2007).

In Sweden, municipality of Sonetäs involved and Two vessels joined in the marine litter collection programme. However, the results showed that no tonnes of litter collected in the port of Smögen (OSPAR Commission, 2007).

The results, however, did not meet the expectation of the target, as mentioned earlier. 54 vessels participating with approximately 400 tonnes of litter removed at the end of the project (OSPAR Commission, 2007). The Table 1 shows the harbours, the number of participating vessels and the amount of marine litter removed by vessels involving in the pilot scheme of SNS.

Table 1 Involved harbours and vessels in the Fishing For Litter pilot projects by country

Country	Harbours	Participating vessels	Amount of Litter removed (tonnages) (2003-2004)
The Netherlands	Vlissingen	5	9.05
	Stellendam	5	49.08

	Breskens	3	12
	Den Helder	10	125.55
Denmark	Hivde Sande	10	170.36
Sweden	Smögen	2	0
United Kingdom (Scotland)	Shetland islands	10	11.8
	Peterhead	9	4.26
Total		54	382.1

Source: data compiled by the Author from OSPAR Commission (2007); Save the North Sea (n.d.)

Even though the project did not meet the target set by the Save the North Sea project, the benefits to this pilot scheme were also estimated as indicated in the reports of OSPAR Commission (2007) and Save the North Sea (n.d.). Explicitly, this helped the environment by the act of litter removal. It also benefited the fishing industry through the decrease of risks of damages to fishing gears and contamination in the catching processes. Furthermore, the economic costs in the form of time-consuming were also a part of the report. It indicated that the action to protect the ocean by removing the litter could decrease the time of fishermen cleaning their nets up to 1-2 hours. The reports implied that fishermen could receive an advantage in the form of opportunity cost by less dealing with marine litter caught in their nets. Therefore, even the apparent consequence of protecting the sea is to the environment, the fishermen using the ocean to receive their own incomes can benefit from the cleaner sea as well.

3) *Current Fishing For Litter schemes*

After the Save the North Sea project was done, Fishing For Litter remains in some countries, especially the Netherlands and the United Kingdom. Moreover, the OSPAR Commission (from OSPAR Convention ratified by Belgium, Denmark,

European Community, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom) has made "Recommendation 2010/19 on the reduction of marine litter through the implementation of Fishing For Litter (FFL) Initiatives" in fishing harbours of its Contracting Parties (OSPAR Commission, 2014b). In 2014, the Commission strengthened the recommendation by the OSPAR Regional Action Plan (action no.53) involving the Netherlands, the United Kingdom, KIMO as leading parties (OSPAR Commission, 2014a). Currently, the implementation of Fishing For Litter conducted in this research can be divided into three categories:

1. Operated by the original initiator, KIMO International through its networks

2. Affiliated projects of Fishing For Litter and operated by independent national authorities

3. Adopted the Fishing For Litter practices from OSPAR Regional Action Plan by national authorities

The following table shows the implementation of the Fishing For Litter by Country.

Table 2 The current Fishing For Litter practices by country

Country	Implemented areas	Initiated year	Number of ports	Number of vessels	Operators	Types of operation
The Netherlands		Since 2001	12	124	KIMO Nederland and België	Run by KIMO network
United Kingdom	Scotland	2003	19	230	KIMO UK	Run by KIMO network
	South West	2009	12	160		Run by KIMO network
Faroe Island, Denmark	Port of Leirvik	2008 – end 2017 – renew	1	4	KIMO Denmark	Run by KIMO network
Germany	Schleswig-Holstein	2011	18	150 fishermen	NABU (Environmental NGO)	Adopted by NABU
	Lower Saxony	2013				
Croatia	Hvar and Tribunj (ports)			20	Institute of Oceanography and Fisheries	Adopted by DeFishGear
Greece	Corfu (port)	2013	15 (pilot)	3	Hellenic Centre for Marine Research	
Italy	Ancona, Cesenatico, Chioggia, Fano, Molfetta (ports)		12 active	54	Italian National Institute for Environmental Protection and Research	
Montenegro	Bar and Herceg Novi (ports)			7	Institute of Marine Biology	

Country	Implemented areas	Initiated year	Number of ports	Number of vessels	Operators	Types of operation
Slovenia	Izola and Koper (ports)			40	Institute for Water of the Republic of Slovenia	
Ireland		2015		244	Seafood Development Agency	Affiliated project run by Department of Agriculture, Food and the Marine
Norway	Tromsø, Ålesund, Egersund, Karmøy, Hvaler, Måløy, Båtsfjord, Austevoll and Stamsund (ports)	2016	9	66	SALT Lofoten AS	Adopted by Norwegian Environmental Agency

Sources: collected by Author from various sources: BIM (2020); Fishing For Litter (2020b); Fishing For Litter UK (2020a, 2020b, 2020c);

KIMO (2017a); KIMO the Nederland En België (2020); NABU (2020); OSPAR Commission (2014a); Ronchi et al.(2019)

4) Fishing For Litter operations

The basis of the Fishing For Litter operations implemented across the European countries has some commons. The operators such as KIMO, BIM, and others provide big bags for involved fishermen. The fishermen voluntarily involve the project doing passive practice-collecting caught in their nets litter and store it in their vessels by not throwing back to the seas where it previously stays. The fishermen also receive no compensation by participating in the schemes or collecting marine litter. Besides, the fundamental of the FFL practice does not include the litter emerged by fishermen while they are out at sea because it is their obligation to bring them back. After bringing the filled bags to shore, harbour staff collect, record and move them to the stocks waiting to send them to disposal treatment (BIM, 2020; European Commission, 2018; Fishing For Litter UK, 2020b, 2020c; KIMO, 2017a, 2017b; KIMO the Nederland En België, 2020; Marlisco, 2020; NABU, 2020; OSPAR Commission, 2014b; Ronchi et al., 2019; SALT, 2017). In some cases, the monitoring process takes place including the Netherlands, the United Kingdom (volunteers), Ireland (to see its pathway), and Germany (with private company analyses the litter) (Fishing For Litter UK, 2020c; KIMO, 2017b; KIMO the Nederland En België, 2020; Marlisco, 2020; OSPAR Commission, 2014b). Then, the recycling process and disposal treatment are carried by contracting parties of each area. The process of Fishing For Litter is shown in Figure 2.
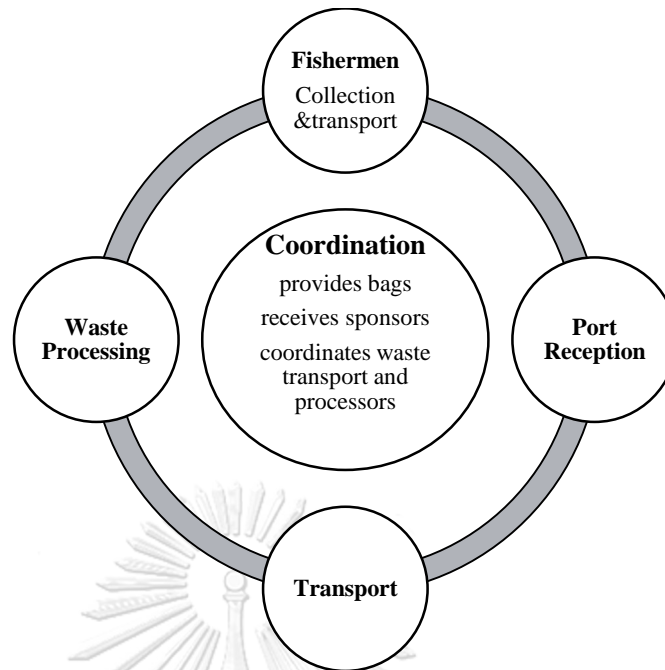
Figure 2 Operations of Fishing For Litter

Source: Adapted from Mannaart (2017)

Figure 3 Provided FFL bags for marine litter collection

Source: Fishing For Litter UK (2020c)

5) *The differences of the Fishing For Litter*

The implementations and the practices of the Fishing For Litter are different. The initiations of the schemes are by KIMO networks, affiliated, and adopted by organisations, as shown in the Table 2. The provided bags are different depending on the operators of the schemes. In some cases, the fishermen are required to separate waste before delivering at ports.

FFL Norway, for instance, requests fishermen to separate the trash into two categories: recyclable fishery waste and other waste (SALT, 2017). Norsk fiskeriretur or Nofir collaborates with the project to manage the recyclable with the transportation of collected waste included. Other wastes are managed by local waste management companies (Norwegian Ministry of Climate and Environment, 2017; SALT, 2017).

Most of the vessels involved in the Fishing For Litter projects are large because they can carry the big bags while at sea. However, FFL Norway has practically solved the issue of small vessel difficulty in carrying large robust bags on board by allowing them to deliver the waste to the reception points as much they can (SALT, 2017). The size of the vessels involved in the scheme ranges from approximately 10 to 75 metres as indicated in the report of SALT (2017).

The financial supports to the FFL schemes are ranging from international funds, national budgets, taxes, companies, landfill taxes. European Union as an international organization provides financial supports through European Fisheries Fund (EFF) and European Maritime and Fisheries Fund (EMFF) to some countries implementing FFL including Scotland, South West, Ireland and Germany. Table 3 shows the supporters and sponsors of FFL projects by country.

Table 3 Supporters and sponsors of Fishing For Litter by country

Country	Operators	Areas	Supporters/Sponsors
The Netherlands	KIMO Nederland and België		National and local governments, waste collectors/treatment facilities

Country	Operators	Areas	Supporters/Sponsors
United Kingdom	KIMO UK	Scotland	Scottish Natural Heritage, the Scottish Government, FLTC, the Crown Estate, Aberdeenshire Council, Ullapool Harbour, Lerwick Port Authority, Scrabster Harbour, Peterhead Port Authority, Sea green Wind Energy, TOTAL E&P, Scottish Fishermen's Trust, Tarbert Harbour, Beatrice Offshore Windfarm, John Lewis and European Union (European Maritime and Fisheries Fund)
		South West, England	Esmée Fairbairn Foundation, the Crown Estate, The Duchy of Cornwall, Cornwall Council, Department for Environment Food and Rural Affairs, Devon County Council, European Union through European Fisheries Fund, Cornwall Fisheries Local Action Group, Environment Agency and Natural England
Faroe Island, Denmark	KIMO Denmark	Port of Leirvik	Pure Voluntary
Germany	NABU (Environmental NGO)	Schleswig-Holstein	The operator, European Union (through European Maritime and Fisheries Fund), federal states, Der Grüne Punkt Deutsch (a private company)
		Lower Saxony	
Croatia	Institute of Oceanography and Fisheries	*Hvar and Tribunj (ports)*	DeFishGear, European Union, local municipalities
Greece	Hellenic Centre for Marine Research	Corfu (port)	
Italy	Italian National Institute for Environmental Protection and Research	Ancona, Cesenatico, Chioggia, Fano, Molfetta (ports)	

Country	Operators	Areas	Supporters/Sponsors
Montenegro	Institute of Marine Biology	Bar and Herceg Novi (ports)	
Slovenia	Institute for Water of the Republic of Slovenia	Izola and Koper (ports)	
Ireland	Seafood Development Agency (BIM)		Port Authorities, the operator, European Union (through EMFF)
Norway	SALT Lofoten AS	Tromsø, Ålesund, Egersund, Karmøy, Hvaler, Måløy, Båtsfjord, Austevoll and Stamsund (ports)	The Norwegian Environmental Agency

Sources: collected by the Author from various sources: BIM (2020); DeFishGear (n.d.); Fishing For Litter UK (2020a, 2020b); KIMO (2017b); Marinenviron (2020); NABU (2020); Ronchi et al. (2019); SALT (2017)

Amongst Fishing For Litter schemes, Faroe Island stands out as an outstanding implemented area because it uses a voluntary basis towards all participating FFL stakeholders– Fishermen, the municipality, waste management company and litter sorting volunteers. This is because of the scale of the project and lack of financial supports (KIMO, 2017a). The municipality, in charge of the waste facilities of the harbour, stores the litter, as an agreement on a voluntary basis, waiting for being categorised and weighed by volunteers. The data collected will be sent to the KIMO coordinator to keep track of the collected marine litter volumes. Then, the inter-municipal waste management company, which is committed to collect the Fishing For Litter waste free of charge, takes care of the disposal process as part of their regular routine (KIMO, 2017a).

Even though the compensation of the participating fishermen is not available, some rewards have been made for the participants. DeFishGear project, which implements in 5 countries, has awarded the involving vessels in the form of flags, stickers, and certificates for being "guardian of the sea" (Ronchi et al., 2019).

6) The outcomes of Fishing For Litter

The reduction of marine litter is the most obvious outcome of the Fishing For Litter programme. The Netherlands, Scotland, South West, Norway and Ireland have removed 2,700, 1,400, 220, 307 and 400 tonnes of marine litter since the start of the project respectively (BIM, 2020; Fishing For Litter, 2020a, 2020b; Fishing For Litter UK, 2020a, 2020b).

Consequently, the collectors are benefited by diminished the loss of valuable time and the catch damages. Local authorities receive fewer costs of beach cleaning as well as the public who enjoy the beach. The advantages, moreover, fall to the aquaculture industry and other industries in coastal areas by less marine litter. Furthermore, the maritime lives are safer from entanglement or being ingested with plastics, as indicated in the report of FFL Scotland (KIMO, 2017b).

2.1.2 Other marine litter collection schemes

Besides the Fishing For Litter, there are other schemes implementing in other regions. The following showed some examples of incentive and non-incentive schemes.

Examples of incentive marine litter collection schemes

1) Buy Back programme, Republic of Korea

In South Korea, Incheon city government had implemented a Buy Back programme since 2003 to economically incentivise fishermen to collect marine litter during the fishing activities and bring them back to the shore (Cho, 2009). The fishermen receive bags from the fisherities cooperative union to collect the litter while at sea.

When they return, they give the bags back to the distributors and receive the payment. The fishermen get 10 USD per 100 litter bag (Watkins et al., 2015). Besides, this Buy Back programme also involves various entities in South Korea, as shown in Table 4 (Northwest Pacific Action Plan, 2008).

Table 4 Participating entities and their roles in South Korean Buy Back Programme

	Roles
MLTM	• Selects the project areas • Allocates the national fund estimate • Makes a project guide • Supervises the project
Local municipals	• Estimates local participation • Supervises the project
The fisheries cooperative union	• Purchases marine litter from fishermen • Requests national funds • Distributes sacks to fishermen
KMPRC & KFPA	• Disposes of marine litter • Makes sacks and distributes them to the fisheries cooperative union • Supplies national funds

Source: Northwest Pacific Action Plan (2008)

After the success of the programme, the South Korean had expanded the programme to 12 major ports in the country. The central government and local governments funded the incentives paying to the fishermen. The rate of compensation provided to fishermen depended on the size of the containers and the debris contained in them. After being implemented for three years, they collected 11,000 tonnes of debris, using USD 9.3 million to purchase those litter (Cho, 2009).

The Buy Back programme was a cost-effective way to remove the marine litter found at sea, both floating and seabed litter. Besides, the income of the fishermen was provided by the public. Lastly, the programme encouraged fishermen to be aware of the

impacts of marine litter which, consequently, contributed to the change of their behaviour saving the ocean (Noh, Kim, Kim, & Han, 2010).

2) 4Ocean, a business model (Active marine litter collection practice)

4Ocean, established on January 7, 2017, is an American ocean business attempting to end the ocean plastic crisis. They use a business model to tackle the marine plastic pollution. 4ocean has removed the trash in 3 operating areas including Bali, Indonesia, Haiti, and Florida, United States. They use the discarded plastic floating in the sea and lying on the coastlines to manufacture their primary merchandise, bracelets, as shown in Figure 4. In order to use plastics to feed their producing process of the product, they collect the plastic at the shorelines and oceans using both human and mechanical machines to do so (4ocean, 2020a). In human labour, they have their teams, volunteers, and fishermen to collect their wanted trash. They employ retired fishermen and workers to be their full-time workers catching plastic pollution and return them with reliable revenues (4ocean, 2020a; Waldron, 2019). The activities of their business, which includes the removal of marine trash, are entirely funded by the purchase of their merchandise by their customers. According to their statistics, they have removed more than 3,000 tonnes of ocean and coastline trash in the three areas where they operate since 2017 (4ocean, 2020b).

Figure 4 An example of 4ocean bracelet

Source: https://4ocean.com/the-4ocean-bracelet/

3) Greece

Enaleia, a social enterprise, introduces an incentive scheme paying to fishermen who collect pulled up in their nets during their ordinary activities in 2018. The ocean clean-up project of the enterprise aims to provide income for the fishermen affected by polluted seas with the reduced fish stocks and to decrease the cause of the problem, marine plastic pollution. Enaleia, therefore, monthly pays 200 Euro for participating fishermen who collect the marine litter (Miner & Karagiorgas, 2019; Ras, 2019). This project has been financed by the AC Laskaridis Charitable Foundation and a recycling group in the Netherlands, which is upcycling plastic waste (Ras, 2019). The recyclable collected marine litter is sent to recycle. Nets and ropes, for instance, are sent overseas to be recycled into socks, bathing suits, etc. Plastics, cans and other waste are sent to Enaleia's certified company to recycle them. The project also changes the behaviour of the participating fishermen who are previously throwing trash away, both theirs and pulled-up, to collect them (Miner & Karagiorgas, 2019).

4) Salvamare Bill, Italian Republic

The Italian government is introducing Salvamare Bill since 2019 to tackle marine litter. It mainly aims to contribute to the marine ecosystem recovery and to recycle accidentally collected debris caught in normal fishing operations (Redazione, 2019; WWF Italy, 2019). Previously, it was illegal for fishermen to carry waste to shores. They were also charged for the disposal costs at ports as waste producers. Consequently, they were seen as marine polluters and marine waste traffickers (Aqua-lit, 2019; Vincenti, 2019). This bill, therefore, legally allows them to bring marine litter back to shores at designated collection points without being charged. They are not subject to the fine and penalty for waste portage any further. The fishermen volunteers, moreover, will receive an environmental certificate showing their commitment to protecting the sea and carrying the sustainable fishing practice. Incentives and rewards are also provided as the bill indicates, but it currently remains unclear (Aqua-lit, 2019;

Redazione, 2019; Vincenti, 2019). However, the costs of managing the collected waste are from regular waste tax (Perisse, 2019).

Before launching the bill, Italian government carried out Fishing For Litter experimental projects–named after the KIMO's Fishing For Litter–in 4 areas in 2018 including Terracina, Puglia, Emilia Romagna and the Tuscan Archipelago with a similar pattern of operation to the original one (Il Faro, 2019; Menorifiuti, 2018). However, the latter added a reward to fishermen who brought back the litter. The reward mechanism came from UNICOOP Firenze, an Italian private company. The supports of UNICOOP came from a part of the sum obtained from its members and customers paying for the fruit and vegetable envelopes (buste in Italian) stamped with MATER-BI (ISPRA, n.d.; Menorifiuti, 2018).

Examples of non-incentive marine litter collection schemes
5) Fisheries for a Sea Without Litter, Portugal

Portugal does not have the Fishing For Litter scheme like some European countries, but the practice of marine litter collection by fishermen is in place to save the sea from the litter since early 2016. The "Fisheries for a Sea Without Litter" is run by the Ministry of Sea, aiming to encourage the fishermen's recognition of the importance of collecting and separating marine litter during the fishing activity. The project provides reception facilities at ports. The initiative aims to improve the management of waste at the level of fishing ports and on the vessels and to raise awareness and stimulate the fishing industry to adopt sound environmental practices that contribute to the reduction of marine litter. The seaport of Peniche is a pilot area. Then, the extension of the project launches to other areas including Ilha da Culatra, Aveiro, Figueira da Foz, Sesimbra, Setúbal, Póvoa de Varzim, Matosinhos, Sagres, Rio Arade, Olhão, Quarteira, Nazaré, Sines and Ericeira–as of November 2019 (Ericeira Mag, 2019; United Nations, 2017). This voluntary commitment has resulted in the involvement of more than 600 vessels and 2,523 fishermen with 449 and 1,023 square metres of packaging and undifferentiated waste, respectively–filled in containers–

collected since the start (Ericeira Mag, 2019). The main partners of the scheme are Portugal Ministry of Sea and Docapesca, SA (state-owned company). The project will expand to all fishing ports in Portugal by December 2030 (United Nations, 2017).

6) Suchitwa Sagaram, Kerala, India

Started by a declaration of Kerala's fisheries Minister in August 2017, Suchitwa Sagaram (Clean Sea) initiative engages fishermen in bringing back plastic waste. The involved fishermen, who have been trained for the initiative, take their part bringing plastic waste floating in the sea back to the shores. The plastic brought back from the sea, is fed into a plastic shredding machine transforming it into materials for road surfacing (UN Environment, 2018). The initiative mostly engages women from fishers' families working at the collection points and shredding units (Sudhish, 2020).

The programme, however, is currently in the crisis. The fishers, who are in the scheme, are having less enthusiastic engagement with the scheme because of a lack of interests by the government. They also receive no supports from the government, such as the rising costs of registration and annual license fees, which apply to all fishermen. These demotivate the sentiment to engage in the project actively. The employed women have delayed payment. In addition, the governmental promise of incentive, which depends on the amount of plastic, is neglected. Lastly, the appropriate collection points and transport are in unfortunate circumstances (Sudhish, 2020).

2.1.3 Marine litter collection schemes in Thailand

In Thailand, marine litter collection schemes are introduced to engage fishermen to combat marine pollution. The schemes are highly depending on the voluntary approach. The schemes that involve fishermen are Catch the Trash, Trash Back to Shores: Beautiful Seas with Our Hands, and Catching the Trash with Care project.

1) **Catch the Trash**

Initiated on the foundation of cooperation amongst public and private sectors, Catch the Trash begins since 2018. The parties of the agreement include the Department of Fisheries, the Department of Marine and Coastal Resources, National Fisheries Association of Thailand, the fishery associations, Thai Fishmeal Producers Association, Thai Feed Mill Association, Charoen Pokphand Foods, Sasin Sustainability & Entrepreneurship Center (SEC), Environmental Justice Foundation (EJF) and SWITCH-Asia SCP Facility (Department of Fisheries, 2018). Currently, more than 7,000 vessels engage in the project (Matichon, 2019).

The fishermen involved in the project received no compensation or reward of participation. Some of them get repaired nets, made by volunteers or fishermen, to fill the caught-up litter (RYT9, 2018). Other used their own bags or tank. Then, they stored the collected litter while at sea and delivered them to ports. The fishermen sorted the litter into two groups: recyclable and non-recyclable. Some of them sold the recyclable waste to scavengers. Some left sorted waste at the reception points. Then, the port authorities managed the collected litter by accounting them for the records, sold the recyclable to scavengers, and contacted the municipalities to dispose of the leftovers and pay for the management cost (P. Saesim, personal communication, September 30, 2019). However, the programme had met an end by the discontinuation and the arrival of the new project called "Trash Back to Shores: Beautiful Seas with Our Hands" in October 2019 (W. Rattanachu, personal communication, May 14, 2020).

2) **Trash Back to Shores: Beautiful Seas with Our Hands**

The Department of Fisheries has initiated "Trash Back to Shores: Beautiful Seas with Our Hands" since October 2019. The aims are to raise awareness among fishermen about waste management, to encourage fishing fleets to collect their on-board litter and bring it back to shore, to promote fishing ports to provide waste reception facilities and to decrease single-use containers while at sea (Department of Fisheries, 2020).

The activity is operating between October 2019 – September 2020 and will continue. By joining the scheme, either an owner or a chief of a vessel is required to register in the first place. The operation is fishermen collecting their on-board litter and marine litter caught-up in their fishing gears. When they return, they are obliged to report the amount of those litter to Fisheries Port In-Port Out Control Centers (PIPOs). Then, the fishing ports manage the waste reception and coordinate waste disposal (Department of Fisheries, 2020).

Currently, the scheme is running in all sea-connected provinces, and 30 PIPOs are responsible for the litter records. Approximately 3,000 of 10,203 Thai commercial vessels have joined the cause (W. Rattanachu, personal communication, May 14, 2020). The amount of litter collected is 34 tonnes as of March 2020. Twenty-seven percent of which are caught-up litter floating in the sea (Department of Fisheries, 2020). Additionally, the operator's cost to the scheme is none because the Department of Fisheries uses voluntary approach as a mean (W. Rattanachu, personal communication, May 14, 2020).

3) Catching the Trash with Care project, Samut Songkhram

The Fishery Association of Samut Songkhram has initiated the Catching the Trash with Care project to dealing marine trash in its area in December 2019. The programme is a duplicated project from Catch the Trash project which has initially implemented in the area. The operation of the project is similar to Catch the Trash. Additionally, a large mackerel-designed container is supported by the private sector to fill the collected marine litter as the fish is a symbol of the province (National News Bureau of Thailand, 2019; Samutsongkhram Provincial Cooperative Auditing Office, 2019).

4) Plans and policies concerning marine litter management in Thailand

In order to combat the marine pollution, Thailand has signed The Bangkok Declaration on Combating Marine Debris along with other ASEAN members to address the marine debris in the region on June 22, 2019. The declaration consists of the ASEAN Framework of Action on Marine Debris. The framework comprises four areas including (1) Policy Support and Planning, Research; (2) Innovation and Capacity Building; (3) Public Awareness, Education and Outreach; and (4) Private Sector Engagement. The actions and suggested activities mostly indicate the management of marine litter. Only a few refers to waste generation prevention and the prevention of land-based and sea-based sources of litter (ASEAN, 2019a, 2019b).

Nationally, the Thai government has implemented several plans and policies concerning waste management. Most of them are concerning solid waste management on land. However, the on-land waste management could result in a better sea environment because 80 percent of marine litter is from land-based sources (Jambeck et al., 2015; Mouat et al., 2010; Sherrington, 2016; Surfers Against Sewage, 2014). The plans and policies are including:

☐ *20-Year Pollution Management Strategy and Pollution Management Plan 2017-2021*

The 20-year Pollution Management Strategy has been established to address the pollution of the country. The Strategy ranges from 2017 – 2036. Under the strategy, the Pollution Management Plan 2017-2021 has been to serve as an immediate plan tackling the pollution. The plan has three strategies: (1) Prevent and Reduce pollution from upstream; (2) Increase the efficiency of waste disposal and pollution control from the originate points; and (3) Develop pollution management system (Pollution Control Department, 2017).

The first strategy has related to marine litter in some areas. The relevant plans are to encourage the eco-design, raise awareness for tourists to sort and avoid throwing environmentally harmful waste to the sea. The second strategy aims to reduce and prevent the litter and pollution explosion to the environment in all industries. The strategy indicates the waste management, which aims to dispose of yesterday's waste properly and systematically run waste management leading by local authorities. Explicitly, the plan indicates the control of litter from sea-based activity such as fishing industry, marine tourism, etc. It also points out the awareness-raising for the reduction of marine litter from the originating points. The third is about the management of waste on land using law enforcement, economic incentives and disposal fees as tools (Pollution Control Department, 2017).

☐ *National Waste Master Plan 2016 – 2021*

The National Solid Waste Master Plan stresses on the management of solid waste and improperly managed solid waste. The plan includes the 3Rs (Reduce, Reuse, Recycle) approach, which aims to reduce waste from its generation. However, the plan does not have the statement of marine litter management (Pollution Control Department, 2016).

☐ *Marine and Coastal Resources Management Master Plan 2017 – 2036*

The Marine and Coastal Resources Management Master Plan 2017 – 2036 aims to (1) conserve and restore marine and coastal resources to be abundant and sustainable; (2) promote the integration and participation of all sectors in the balanced and sustainable management of marine and coastal resources; and (3) create knowledge that responds to the problems of marine and coastal resource management and for thorough dissemination (Department of Marine and Coastal Resources, 2017).

The master plan indicates that marine litter is a threat to the marine environment. The master plan explicitly accepts that the threat is resulting in the death of endangered

marine animals including sea turtles, dugongs, dolphins and whales. It also indicates other impacts from marine litter including the impacts to the ecosystem, the economy, tourism, maritime animals and human health (Department of Marine and Coastal Resources, 2017).

Furthermore, Thai government intends to launch the Roadmap on Plastic Waste Management 2018 -2030 and the Action Plan on Plastic Waste Management 2018 -2022 aiming to reduce and stop the use of 7 types of plastic. The example approaches dealing plastic–which covers the production, consumption and post-consumption processes—are including the substitution by eco-designed and eco-friendly products, 3Rs (Reduce, Reuse, Recycle), the development of the regulations for preventing the littering by marine businesses and tourisms, circular economy (Pollution Control Department, 2018).

2.2 The benefits of marine litter collection practices

The marine litter collection practices generate a wide range of benefits. The reduction of marine litter is an obvious outcome by the abatement of marine debris in the sea and the decrease of parts of 20 percent of sea-based source, which is from fishing vessels, as the Trash Back to Shores: Beautiful Seas with Our Hands of Thailand aims to prioritise (Department of Fisheries, 2020).

The decrease of marine litter makes many advantages to the closest to the sea, the fishermen. It reduces the risks of fishing gears damages and contamination of catch during fishing activities. Besides, fishermen have less time removing litter from their fishing gears (KIMO, 2017b; OSPAR Commission, 2007; Save the North Sea, n.d.).

The activities along the coastlines get benefits from the ease of litter as well. The aquaculture and other industries locating near the shores could deal with less litter.

The costs of beach cleaning, which are mostly the responsibility of municipalities, will be reduced (KIMO, 2017b).

Income generation is an aspect that fishermen receive from some marine litter collection schemes. The provision of litter purchase can be from the public and private as in the cases of Buy Back Programme of South Korea, Italian Salvamare Bill, 4Ocean, and Enaleia in which the latter two cases hire fishermen collecting marine litter. Moreover, some of them use the collected litter for some purposes. 4Ocean use marine plastic as an input to their products while Enaleia uses collected marine litter processing to upcycling and recycling companies (4ocean, 2020a; Miner & Karagiorgas, 2019; Ras, 2019).

Not only fishermen receive economic profitability from the marine litter collection practices, but others can also get it. The project Suchitwa Sagaram of India uses collected marine litter to create jobs for women from fishers' families. Besides, the recycled plastic transforms to road surface which benefits to all (UN Environment, 2018).

The legalisation of marine litter collection is a worthy action for the sake of Italian fishermen. The Salvamare Bill enable fishermen to bring back their collected litter to shore without being charged or fined. This legalised practice, moreover, provides financial and non-financial rewards to fishermen for their action (Aqua-lit, 2019; Vincenti, 2019).

In conclusion, marine litter collection practices have tremendous benefits. The reduction of marine litter is apparent, resulting in significant consequences in many aspects, such as a safer place for marine lives, reduced beach-cleaning costs, etc. The side effects of the practices can go to fishermen and others, depending on the design of policies, programmes, and business models.

2.3 A comparison of marine litter collection schemes

A scale of supports is provided in Figure 5 to show the administration of marine litter collection schemes. The Republic of Italy stands out the strongest point of fishermen collecting marine litter in all cases because the entire country's fishermen are under the Salvamare bill, which is the legislation support. Moreover, they receive the incentive from the governmental supports, in both fiscal terms and non-financial rewards such as an environmental certificate. The fishermen do not have to pay for the disposal cost that they had to pay in the past. The bill, therefore, potentially change the fishermen's behaviour that once throwing litter at sea by the supported law. The South Korean government supports the Buy Back programme and the fishermen receive incentives collecting marine litter in some areas. Portugal project is initiated by the governmental parts cooperating with others. The supports are bags and facilities without rewards. The Suchitwa Sagaram project implementing in India has started by the government, but the current situation makes its position with little supports. Fishing For Litter Ireland and Norway are adopted the practice by governmental part while international organisations and an NGO initiate other FFLs. FFL Faroe Island stands in a position of little supports, which is nearly pure voluntary by the acts of involved stakeholders. The Trash Back to Shores: Beautiful Seas with Our Hands activity of Thailand is in the place where a governmental authority begins the scheme and runs with no supports but records. The only support to the project is KIMO's FFL bags provide to fishermen to store litter while at sea. Fishing For Litter Germany is operated by an NGO, NABU. Then, Greece and 4Ocean are created by private companies providing incentives to fishermen monthly and daily, respectively.
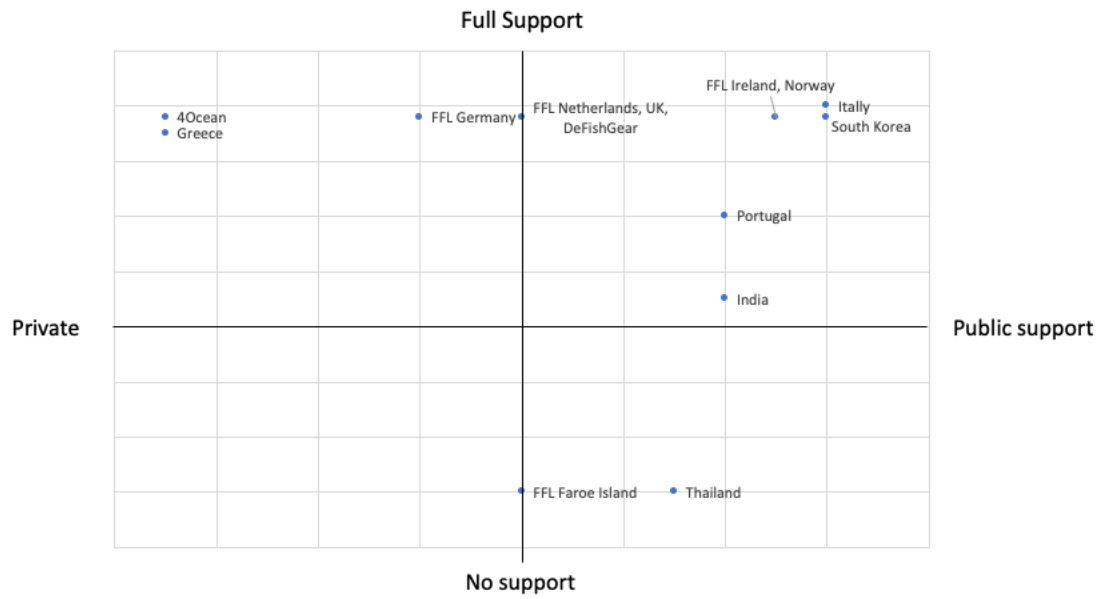
Figure 5 The scale of supports of the marine litter collection schemes

Table 5 Comparison of the marine litter collection schemes

Project	Implementing Country	Established year	Administrators	Involved vessels/ports	Amount of collected debris (tonnes)	Supports	Supporters	Financial rewards availability
Fishing For Litter	Netherlands, UK, Faroe Island (Denmark), Germany, Croatia, Greece, Italy, Montenegro, Slovenia, Ireland, Norway	2000 in Den Helder	Various (Mostly KIMO) *see more in Table 2 the current Fishing For Litter by countries	~1,000 vessels combined	5,027 (as of 2020 – Netherlands, UK, Ireland and Norway)	Large bags, reception facilities, waste disposal	European Union, public and private sectors	No

Project	Implementing Country	Established year	Administrators	Involved vessels/ports	Amount of collected debris (tonnes)	Supports	Supporters	Financial rewards availability
Buy Back Programme	South Korea	2003	South Korean Government	12 ports	11,000 (as of 2009)	Bags, Incentive	MLTM, local municipalities, fisheries cooperative union, KMPRC and KFPA	Yes
Fisheries For a sea without litter	Portugal	2016	Ministry of Sea	600 vessels	1,472 square metres as the size of containers	Reception facilities	Portugal Ministry of Sea and Docapesca, SA (state-owned company)	No
4Ocean	Florida, USA Bali Indonesia Haiti	2017	4Ocean	N/A	3,000 (as of 2020)	Wage	Its consumers	Yes

Project	Implementing Country	Established year	Administrators	Involved vessels/ports	Amount of collected debris (tonnes)	Supports	Supporters	Financial rewards availability
Suchitwa Sagaram	Kerala, India	2017	Government of Kerala	N/A	N/A	Reception facilities	Government of Kerala	No
Ocean clean-ups	Greece	2018	Enaleia	N/A	N/A	Wage	AC Laskaridis Charitable Foundation and a recycling group	Yes
Catch the Trash	Thailand	2018	Mostly by fisheries associations	7,000 vessels	N/A	Repaired nets (sometimes, by fishermen), reception facilities	Mostly fisheries associations	No
Salvamare Bill	Italy	2019	Italian government	N/A	N/A	No more disposal costs, financial	Italian government	Yes plus non-financial rewards

Project	Implementing Country	Established year	Administrators	Involved vessels/ports	Amount of collected debris (tonnes)	Supports	Supporters	Financial rewards availability
						and non-financial rewards		No
Trash Back to Shores: Beautiful Seas with Our Hands	Thailand	2019	Department of Fisheries	3,000 commercial vessels	34 tonnes (as of March 2020)	Litter records, reception facilities	Fishermen association, fishing ports	No
Catching the Trash with Care	Samut Songkhram, Thailand	2019	Mostly by fisheries associations	N/A	N/A	A large mackerel-designed container	Private sector	No

Sources: collected by Author from various sources: 4ocean (2020a); Aqua-lit (2019); BIM (2020); Cho (2009); Ericeira Mag (2019); Fishing For Litter (2020a, 2020b); KIMO (2017a); KIMO the Nederland En België (2020); Mannaart (2017); Marinenviron (2020); Miner and Karagiorgas (2019); NABU (2020); Northwest Pacific Action Plan (2008); OSPAR Commission (2014a); Ras (2019); Redazione (2019); Ronchi et al.(2019); RYT9 (2018); SALT (2017; UN Environment (2018; United Nations (2017); Vincenti (2019); Waldron (2019); National News Bureau of Thailand (2019); (Department of Fisheries, 2020)

2.4 The synthesis of marine litter collection schemes

Ten marine litter collection schemes in Table 5 are synthesised here. It begins with the commons and differences of the schemes. Then, the effectiveness of marine litter collection practices will be synthesised. Moreover, lesson learned is drawn for the improvement of Thai marine litter collection schemes.

2.4.1 The commons

The goals of marine litter collection practices are similar. Most of them aim to remove the marine litter for cleaning up the sea. Some of them aim to change fishermens' behaviour to decrease the use of single-use containers as in the case of Trash Back to Shores: Beautiful Seas with Our Hands (Department of Fisheries, 2020; Wyles, Pahl, Carroll, & Thompson, 2019). Some projects have other related objectives, aiming to merchandise the upcycling products from the collected litter and have indirect benefit from the marine litter in the case of 4ocean and Ocean clean-ups by Enaleia in Greece.

2.4.2 The differences

The differences in marine litter collection practices can lead to differed outcomes of marine litter collection practices. First of all, the areas of implementing marine litter collection schemes are various, as seen in the Table 5. Most of them are in the European region as it is the target area of the Fishing For Litter schemes. The marine litter collection schemes can be divided into two main types: incentive-based scheme and voluntary-based scheme. The former uses the monetary incentives to attract participation, while the latter uses the moral obligation to protect the environment. The programme supports range from no supports, as shown in the case of Faroe Islands which purely voluntary is running the FFL, to fully support, which greatly rely on the incentives as 4Ocean (4ocean, 2020a; KIMO, 2017a). The programmed supporters are

also ranging from international organisations, governmental agencies, the public and private sectors depending on the schemes' design and operation.

2.4.3 The lesson learned from the effective marine litter collection practices

Doubtlessly, all marine litter collection schemes certainly have benefits to the minimisation of impacts from marine litter towards the environment, the economy and the society. Well-designed marine litter collection schemes would make the schemes sustainable in an effective way. **The key operators** of the schemes could secure the sustainability of the programmes. The reviewed schemes have various operators including an international organisation (KIMO) of FFL, government agencies (Thailand, South Korea, India), and private companies (4Ocean, Enaleia). Moreover, the cooperation among operators' port authorities, fishermen's associations and others can be an advantage for the operation of the schemes (Ronchi et al., 2019; Wyles et al., 2019).

Moreover, **the recognition of international institutions** is powerfully advantageous. For instance, Fishing For Litter has been recognised by the OSPAR Commission (Recommendation 2010/19) and the European Union (The Directive on port reception facilities). They encourage member states to adopt the scheme and supporting reception facilities at ports, respectively (OSPAR Commission, 2014b; Ronchi et al., 2019).

The design of a scheme's operation is the first step that should be focused on. The reviewed schemes are voluntary and incentive marine litter schemes. The voluntary schemes, such as FFL and Fisheries For a sea without litter, have no cost paying to fishermen (Fishing For Litter UK, 2020c; NABU, 2020; Ronchi et al., 2019; United Nations, 2017). However, the cost of operations is essentially used for maintaining the continuity of the programmes. On the contrary, the incentive-driven schemes can also bring the same outcomes as voluntary schemes. However, the use of financial incentives

can bring the adverse outcomes because the fishers may throw more litter into the sea if they have extra incomes (Basurko et al., 2015; Wyles et al., 2019). Moreover, the schemes may not last long if incentives discontinue (Wyles et al., 2019).

Financial inputs are essential for the continuation and stabilization of marine litter collection schemes. Almost all reviewed schemes are funded by various sponsors, whether it is incentive-based or voluntary-based schemes. Fishing For Litter is a scheme that runs by the voluntary of fishers, but the cost of operation is covered by the finance of various entities such as the European Union, governments, and private companies (BIM, 2020; DeFishGear, n.d.; Fishing For Litter UK, 2020a, 2020c; KIMO, 2017a; Marinenviron, 2020; NABU, 2020; Ronchi et al., 2019; SALT, 2017). The incentive schemes, of course, have been financed by the consumers or private companies as seen in 4Ocean, Enaleia, and Buy-Back Programme of South Korea (4ocean, 2020a; Miner & Karagiorgas, 2019; Watkins et al., 2015). However, none of the financial inputs exists for Thai marine litter collection schemes which could make the schemes at risk.

After fishers have done their parts, managing **the collected marine litter** is found to be important. Recent studies found that port reception facilities are most desired by fishers to dispose of their waste (Basurko et al., 2015; Brongers, 2017; Ronchi et al., 2019; Wyles et al., 2019). Almost all reviewed schemes have reception facilities for fishers to throw their collected waste. More importantly, the cost of throwing litter at ports must be free of charge, which can avoid the behaviour of throwing litter away at sea. However, landfill taxes still exist in some schemes such as FFL in the UK and pre-Salvamare Bill of Italy (Aqua-lit, 2019; Vincenti, 2019; Wyles et al., 2019).

Recycling and upcycling activities' connection to the post-collection of fishers can benefit the schemes' waste management. The fishers can be paid by the purchase of collected litter which would generate their extra incomes as in the case of 4Ocean and Enaleia (4ocean, 2020a; Ras, 2019). Furthermore, the recycling and upcycling initiatives

can cover the cost of marine litter collection schemes instead of governmental funds which mostly come from taxes (Brodbeck, 2016).

The participation of fishers is foremost among others because they are the key stakeholders of the schemes. It is vital to encourage the new participants continually and to keep the continuation of fishermen's involvement. Without them, a scheme cannot run whether it is an incentive or voluntary scheme (Brongers, 2017; Ronchi et al., 2019; Wyles et al., 2019).

2.4.4 The implication for Thai marine litter collection schemes

Nowadays, Thai marine litter collection schemes use voluntary methods for the practice. **The implementation of some incentive measures** can be useful to attract the fishers to participate in the schemes. In South Korea, Enaleia and 4Ocean schemes, they use financial incentives for the bring-back litter (4ocean, 2020a; Miner & Karagiorgas, 2019; Watkins et al., 2015). However, it should be aware that financial incentives could pose potential risks, as mentioned earlier in the previous part. Thus, non-monetary incentives can be adapted as intervention, which should focus on behavioural change, such as the exchange for commodity, additional fishing days and insurance.

Thai marine litter collection schemes have little **supports** for the operation. Basically, ports reception facilities are required which can facilitate the involvement of fishermen. This could avoid fishermen's burdens to littering away at other sites (Basurko et al., 2015; Brongers, 2017; OSPAR Commission, 2007; Ronchi et al., 2019; Wyles et al., 2019). Other financial supports are also significant to cover the cost of operation. The Fishing For Litter, for example, has various sources of funds, even its design is voluntary. The funds can be used to support the equipments like big bags, cost of coordination and waste management which also facilitate the schemes (BIM, 2020; Fishing For Litter UK, 2020a, 2020c; Ronchi et al., 2019). Therefore, the needs of

sponsors' involvement are a must. They can be international organisations, private companies, or government agencies.

The governments' financial support is good, but **the connection to the recycling and upcycling activities** could make it cost-effective for the schemes to decrease the use of taxes (Brodbeck, 2016). The collected litter could transform into recycling or upcycling products as it has been in the case of 4Ocean, Suchitwa Sagaram, and Enaleia. Therefore, Thai marine litter collection schemes make more stakeholders' involvement efforts to further the schemes' continuation and make collected litter useful.

Education and public campaigns can make Thai marine litter collection schemes effective. It can bring the understanding of marine litter's impacts on the fishermen, which can attract their participation as intrinsic motives (Wyles et al., 2019). Furthermore, the public can see the effectiveness of the ongoing schemes that could potentially bring the supports as a consequence. In some case, they use the power of acknowledged purchasers to fund the operation of marine litter collection schemes (4ocean, 2020a; ISPRA, n.d.; Menorifiuti, 2018).

Lastly, the **stable participation of fishers** is essential. The Thai marine litter collection schemes should focus more on the participation of fishermen. A study of driving factors can help find the intrinsic motives of fishers to join in the programme, which could be advantageous for the scheme's adaptation. However, with all these supports and fishers' participation cannot restore the marine litter issue. The adaptation of daily life, the reduction of plastic consumption and proper waste management should be focused, as Watkins et al. (2015) suggested.

2.5 The concept of participation in environmental management

Participation is a concept that has been long used in various areas. In the development area, the definitions are numerous, but some are widely used. The United Nations Development Programme (1993) defined participation as:

"People are closely involved in the economic, social, cultural and political processes that affect their lives."

While Cohen and Uphoff (1980) indicated that:

"Participation includes people's involvement in the decision-making processes, in implementing programmes, sharing in the benefits of development programmes and their involvement in the efforts to evaluate such programmes."

The concept of participation of Cohen and Uphoff (1980) indicated that people can participate by three types of motives including by force, incentive and their voluntary motivation. They also showed the dimensions of participation which include the decision-making, implementation, benefits and evaluation processes.

de Groot (1992) defined participation as:

"The involvement of target groups in process of collective action"

de Groot (1992) also indicated that the policies can be effective from the means and ends of the participation. It is also inevitable for policies to be effective by the participation of the people. Moreover, the scholar had extended the concept of participation in environmental management defining it as:

"The voluntary (not fully compensated) involvement of target groups in collective action with an environmental objective, be it formulation or implementation, and be it supportive or redirective"

Furthermore, the narrowing concept of participation has gained attention in the form of community participation, especially in environmental management by locals. The terms of community participation in environmental management can be considered in various ways which sometimes overlapped. The community can be defined as a group of people that come together sharing some commons including a share of geography, workplace, social identity, age, gender, issues and shared interests (Duane, 1997; UNEP-IECTC, 2004).

The community participation is a concept that calls for the people to take part in the process of planning, implementing and managing their close environment which involves the people and government in the programmes (UNEP-IECTC, 2004). Community participation helps and affects environmental management projects in various ways.

First and foremost, the quality of life of the people is made at the point of individuals and households. The participation of the community ensures that the environmental issues are tackled and solved at their sources securing the benefits in a long-run. Second, participation is vital to preserving the environment in a decision-making process which a community can discuss their involvement and action to the projects. Third, the involvement and commitment of the community in an environmental management plan can ensure the success of a project. Besides, the involvement has indirect impacts on participants, including the behavioural change and raised awareness. Next, the community participation can draw resources, strategies and local knowledge on specific and complex matters. Lastly, community participation can assure that project monitoring and evaluation can be done and for the community (UNEP-IECTC, 2004).

2.6 Related studies

2.6.1 Studies of motivations of fishermen's participation on marine litter collection schemes

The previous studies on fishermen's participation in Fishing For Litter have been conducted in two specific areas, which are currently active and the strongholds of Fishing For Litter, being implemented for decades ago. These areas are Fishing For Litter in the Netherlands and the United Kingdom.

The study of "The Participation of Dutch Fishermen in waste collection practices at sea" by Brongers (2017) researched the factors that influence the adoption of marine litter collection practices at sea, which included Fishing For Litter as a principal practice, by fishermen. The authors use three categories of factors derived from the adaptation of the factor approach of Parker et al (2009) and three researched-done models of Leeuwis (2004), Meijer et al (2015) and Pannell et al (2006). The theoretical framework of the study can be divided into three categories, including:

1. The perceptions of the natural environment
2. The perceptions of the social environment
3. The beliefs about waste collection practices at sea

The categories used as a theoretical framework of this study were from an approach and models as following:

The factor approach of Parker et al (2009, stated in Brongers, 2017) indicated that external and internal factors act as a driver or barrier to participation. The external factors are regulations, education and financial incentives. The internal factors include knowledge and commitment. However, extra factors were added from research-done models described in the following three paragraphs.

The model of Leeuwis (2004, stated in Brongers, 2017) used in the study has 7 factors which can potentially influence adopters to act. The factors of this model are the perception of own role and responsibility, trust in the social environment, aspirations

in the various lens, experienced social pressure, knowledge, belief in own capacities and risk perceptions. These factors lead to the identity of a person, which consequently determines the action.

The model of Meijier et al (2015, stated in Brongers, 2017) divided the drivers affecting the determination to adopt or not adopt the practices in three categories including characteristics of the individual decision-maker; characteristics of the external environment; and characteristics of the new technology. These are extrinsic variables that are affecting intrinsic variables–knowledge, perceptions and attitudes. The intrinsic factors are interconnected and influence the behaviour of individuals. Besides, individuals can be affected by interventions such as communication, training and extension.
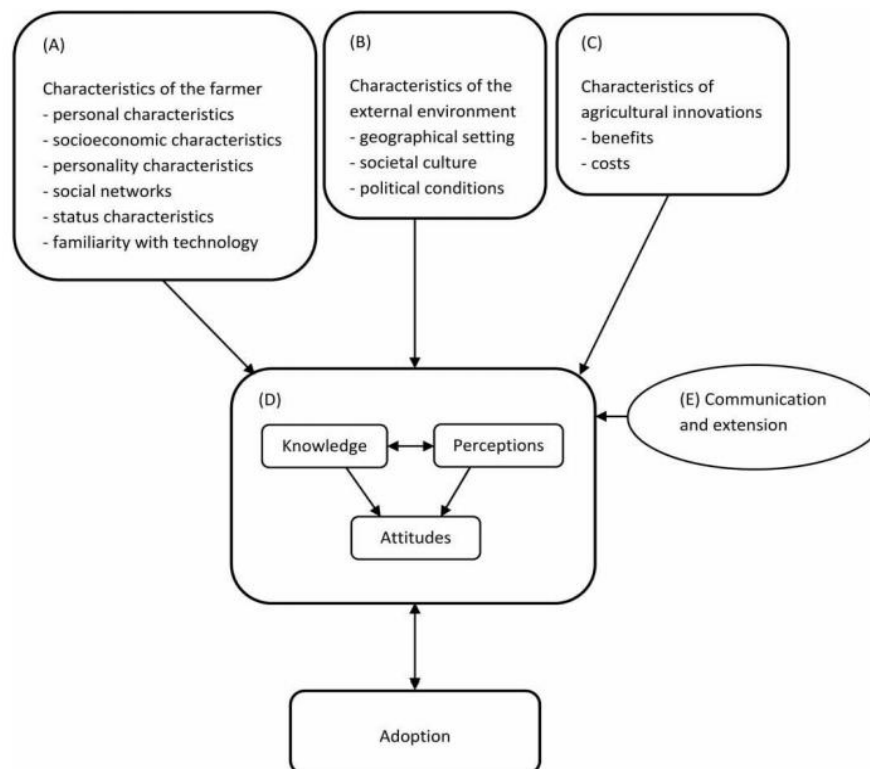
Figure 6 Analytical framework of Meijer et al (2015)

Sources: Brongers (2017)

Lastly, the application of Pannell et al (2006, stated in Brongers, 2017) which studied the adoption of conservation practices by rural landholders was used in Brongers' study. They indicated that the perceptions or expectations of individuals are determined by three sets of issues including the process of learning and gaining experience; the characteristics and circumstances of the social environment (personality, social pressure, circumstances of decision-makers); and the characteristics of the practice (benefits and costs, easiness to adopt practices).

Hence, the nine factors from three categories in Bronger's study from one approach and three previously-researched-done models can be concluded in the diagram as Figure 7:
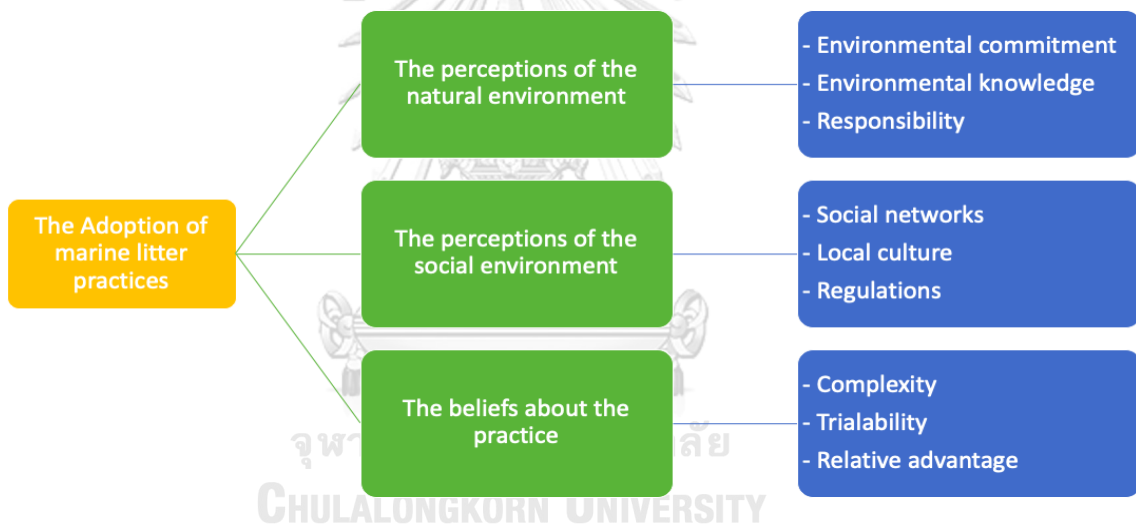
Figure 7 The theoretical framework in the Brongers' study

Source: Brongers (2017)

The method used in this study was qualitative, aiming to investigate the factors influencing fishermen's participation in marine litter collection practices. The author used semi-structured interviews to ask in detail and to get better understandings of fishermen's perceptions. The conducted interviews were from 15 interviewees of 81 intended in which the author making selection from annual report 2010 of FFL by KIMO Nederland & België. The interviewees were from five ports in the Netherlands.

Thirteen of them were marine litter collection practices adopters (eight from FFL; five from non-FFL). The rest were not marine litter collection adopters.

The results of Brongers' study showed that the drivers of fishermen's adoption on marine litter collection practices were from:

Characteristics of individual fishermen

1. Environmental commitment and the level of awareness regarding marine litter
2. Environmental knowledge about marine litter and its consequences

Characteristics of the social environment

The characteristics of the social environment is the most influential group of factors because they directly affect the adoption of the practice. Also, the indirect influence goes to the other characteristics and affect the adoption at last.

3. The influence of family members
4. Direct and indirect influence from fishing associations and port authorities
5. Trust among fishermen and their networks
6. The practical regulations

Characteristics of the practice

7. Sufficient waste facilities and services
8. Concerns of hygiene, efforts and risks associating the collection practices
9. Advantages of the participation such as rewards, environmental effectiveness

However, the representation of this study was at risk because the interviewees might not reflect the whole population of fishermen joining in marine litter collection practices. The first reason was they were from the northern part of the Netherlands, not an entire country. The second was only 15 fishermen of all 280 vessels were involved in the study. These were the reasons that the author indicated in their thesis.

Another study about fishermen's participation in Fishing For Litter scheme was from one of the strongholds of FFL implemented in the world. "An evaluation of the

Fishing For Litter (FFL) scheme in the UK in terms of attitudes, behaviour, barriers and opportunities" by Wyles et al. (2019) surveyed the involvement of UK fishermen joining the FFL scheme. The authors took the research in 2014 to mainly investigate (1) the associations of attitudes and behaviours of fishermen and (2) the opportunities and barriers for the sustainable future of the scheme.

Wyles et al. (2019) used three methods to conduct the research. Desk-based was used to understand the context of FFL. Quantitative as the second method was used in the form of a survey to the fishermen towards marine litter and waste management perceptions. A qualitative method was conducted to acquire the motives of fishermen to join or not in the FFL scheme in the UK in the form of open-ended questions. Besides, the third method was used to conduct in-depth and semi-structured interviews on stakeholders as an assessment of opportunities and barriers to the programme. The interviewees were 97 fishermen from 5 harbours in Scotland and 4 in South West, England. The targeted interviewees must meet more than five metres-vessel criteria set by the researchers. 22 stakeholders were interviewed, which were from FFL staff, sponsors, harbour authorities, fishing associations, NGOs, Government affiliation and waste contractors.

The reasons why fishermen participated in the project of FFL in the UK were categorised into five main motives. First, it was self-determination to reduce the litter at sea by their own needs arguing that it was their responsibility to help promote cleaner sea. The next reason for joining was that they were already in the marine litter collection practice by themselves without the cover of any project before they participated. Thus, participation made them easier and more convenient doing it by the supports of the scheme. The third was a socially accepted practice and social pressure (when everyone does it). The fourth motive argued by the interviewees was that the programme improved the profile and reputation of the fishing industry which generally being seen as one of the causes of marine litter. Lastly, the benefits of marine litter collection

practices were also the reason found in this study. The fishers seemed to have less litter during their normal fishing activities.

On the contrary, the non-participating fishermen did not take part because of the lack of information about the scheme. The FFL was also seen as an impractical practice by non-FFL fishermen. This was because they could not find the litter caught in their nets during their activities. The small-sized vessel was another reason why they saw the FFL difficult for them to apply. The lack of choice was another reason given by fishermen. Some of them did as the skippers or vessels' owners commanded. When those chiefs were not interested in joining the scheme, they could not proceed with the sea-cleaning project by themselves. Lastly, time and interests were also the reasons why they did not join the campaign.

2.6.2 Studies of factors influencing participation in other environmental conservation schemes

As the studies on motivations of fishers' participation in marine litter collection schemes are limited, this study uses other environmental conservation practices to shape the factors for the conceptual framework.

The study of "Factors influencing participation of top-down but voluntary fishery Management-Empirical evidence from Taiwan" by Chen (2010) is a study concerning the fish stock decline in a common pool. The author studied participation in a voluntary suspension of fishing activities introduced by the government to decrease the fishing efforts. To implement the sustainable fishing, there is a need to diminish the days of fishing. In the scheme, the government of Taiwan had offered economic incentives for the reduced fishing days. However, the fishermen's participation in the scheme was not in the great number leading to the study of the author to find the motives and obstructions of the participation.

The study used a survey questionnaire to acquire the influencing factors which were classified into three categories: motive, constraint and attitudes of the fishermen

towards the resource use and management. The population of this study included the owners of ships and fishers who highly engaged in fishing activities. 964 samples were approached to be surveyed. Then, the author analysed the collected surveys by a binary logit regression.

The results of the study showed that the factors influencing the participation of the fishermen in the reduced fishing days as a voluntary scheme of Taiwan included three factors. First, the reward was like a subsidy by the government. This is because of the government of Taiwan cut down the fishery fuel subsidy before the suspension system launched. Then, there were no issues for joining in the scheme. The attitudes of the fishers also affected the intention to participate in the scheme. The environmental knowledge was about the perspectives concerning the roles of the government to take action in the environmental crisis. Besides, the views of fishery resource management were positive to combat the fish stock decline in the common pool.

On the contrary, a factor that hindering the fishermen's participation was that incentive for intentionally joining in the suspension was against fishermen's working ethics. This is because the role of the fishermen in the sea is to fish not to stop working in fishing activities.

In conclusion, the factors that are associating the intention of fishermen's participation in the sustainable fishing industry, in this case, are including the incentives, environmental knowledge and working ethics. The last factor will be excluded in the study because, in the case of marine litter collection scheme, the fishermen can do the practice in parallel with their normal fishing activities.

In another area of environmental management, many scholars have studied the drivers motivating the adoption of Best Management Practices (BMPs) doing in agricultural activities. A review of "Factors Influencing Farmer's Adoption of Best Management Practices: A Review and Synthesis" was gathered by Liu, Bruins, and Heberling (2018). This review focused on factors influencing the adoption of BMPs to

reduce the cause of degradation of water affected by farming activities studies and the conservation practices.

Several drivers were gathered as influences on the adoption of Best Management Practices. The information about the conservation schemes is one of them indicating that the conservation practices need to be educated and well-informed. The financial incentives were also indicated in the gathering data. The authors had shown the positive effects of financial incentives if there was a loan of government subsidies supporting the practices. The adverse effects were lack of cash, the cost of joining and other expenses. Social norms were also driven the adoption of the practices in the case of agricultural conservation. The social norms included the acceptance of society and neighbours and the pressure by other early adopters. Environmental consciousness was also indicated. The environmental awareness of the farmers on environmental issues—such as soil erosion, water quality—led to the adoption of the practices. Moreover, the productivity of crops was one of the concerns that obstructed the adoption. The authors also gathered the location of the farm, characteristics of farms, climate, policy instruments of each case, and demographic factors.

2.7 Conceptual framework of motivations of fishermen's participation on marine litter collection schemes

The results of Brongers（2017）and Wyles et al.（2019）showed the factors influencing fishermen's decision to participate in marine litter collection schemes in the Netherlands and the United Kingdom. Moreover, the resulted factors from (Chen, 2010; Liu et al., 2018) are included for this study. The study of "Fishermen's Participation in Marine Litter Collection Schemes in Thailand" drew their resulted factors as independent variables to investigate their association with fishermen's participation on marine litter collection projects, a dependent variable.

The category of factors is grouped by using the Theory of Planned Behavior (TPB) of Ajzen (1991). The theory explains the behaviour of a person derived from intention. The intention is influenced by three determinants including attitudes, subjective norms and perceived behavioural control.

The attitudes are a consideration of a person to perform the behaviour. If one defines the outcomes of their behaviour as good, they will perform an action. Conversely, if they consider the outcomes of behaviour as negative, the act will not be performed. Subjective Norms are perceived by social pressure to act or not in the circumstances. The influencers to oneself are close to the performer, such as family, friends, colleagues, etc. The last component that can influence one's behaviour is perceived behavioural control. It refers to the perception of the easiness and difficulty of behaviour performing (Ajzen, 1991).

Therefore, this study adapts the Theory of Planned Behavior for grouping the factors derived from previous studies on fishermen's participation in marine litter collection schemes. These factors have a potential determining one's intention which eventually leads to one's action. The concluded factors and conceptual framework of this study are shown in Table 6 and Figure 8, respectively.

Table 6 Factors that will be studied the participation of Thai fishermen on marine litter collection schemes

Category	Factor	Description	Reference
Attitudes	Environmental knowledge and environmental awareness	- The personal knowledge about marine pollution - The knowledge about the benefits of marine litter collection practice - The responsibility to act as guardian of the sea	Brongers (2017); Wyles et al. (2019); Chen (2010); Liu et al. (2018)

Category	Factor	Description	Reference
	Personal concerns	- Hygiene - risks	Brongers (2017); Wyles et al. (2019)
Subjective norms	Social pressure	- From the public and Profile and reputation of fishing industry	Brongers (2017); Wyles et al. (2019); Chen (2010); Liu et al. (2018)
	Surrounding people	- Family - Fishermen - Groups such as Fisheries Associations	Brongers (2017); Wyles et al. (2019); Chen (2010); Liu et al. (2018)
Perceived behavioural control	Incentive	- The financial/non-financial incentives to fishermen	Brongers (2017); Chen (2010); Liu et al. (2018)
	The readiness of supported practice	- Sufficient reception facilities and services - Waste management methods - The supporting regulations of the practice - Waste management regulations	Brongers (2017)
	Information	- The accessibility to the information about the programmes	Wyles et al. (2019); Chen (2010)
	Time and interests	- Extra time - The interests of the owners of vessels	Wyles et al. (2019)

Category	Factor	Description	Reference
	Size of vessels and ships adjustment	- Size of vessels - Ships adjustment	Brongers (2017); Wyles et al. (2019)
Past behaviour	Practice experience	- Already in marine litter collection determined by themselves	Brongers (2017); Wyles et al. (2019)
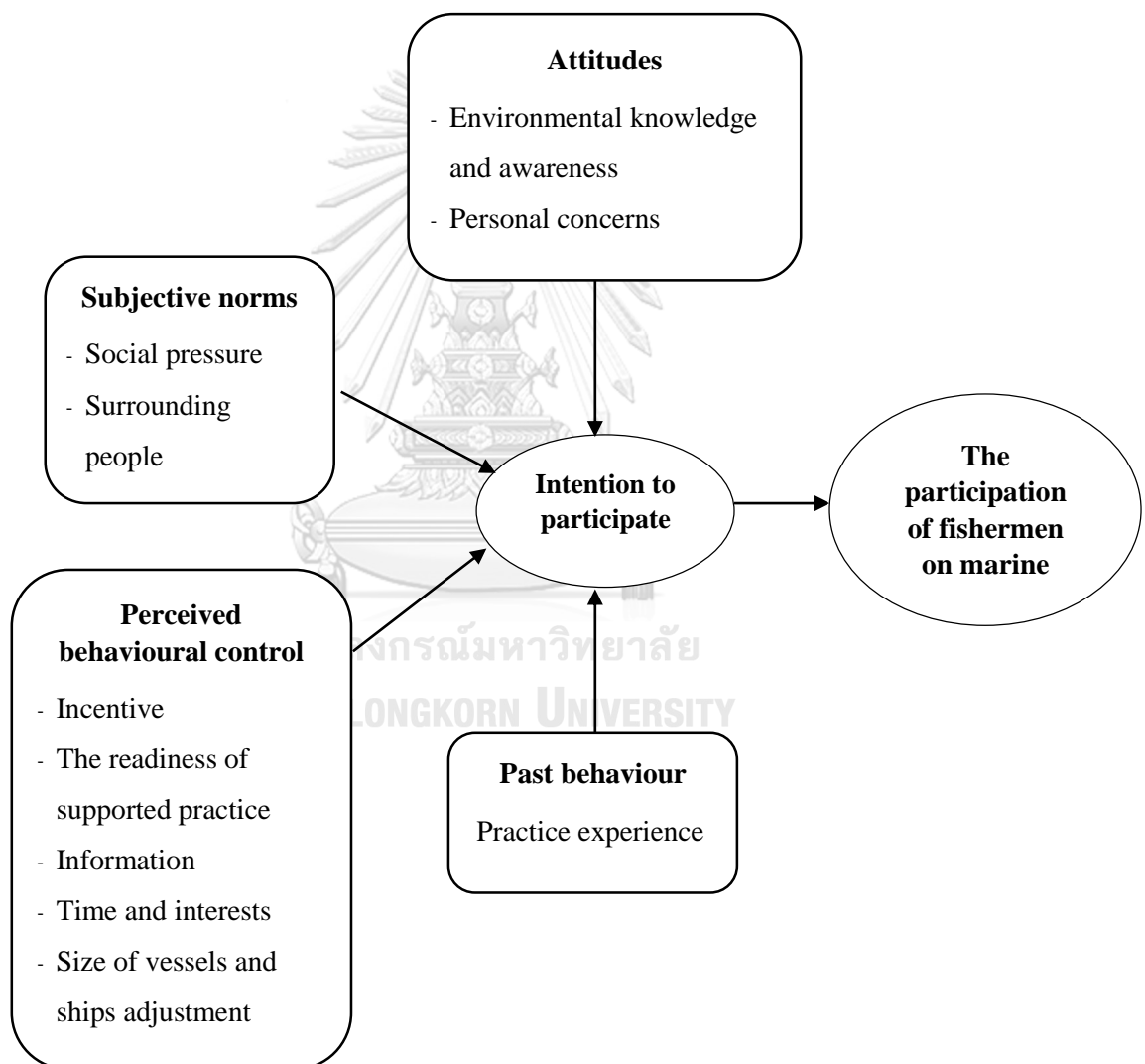
Figure 8 Conceptual framework

Source: Author adapted from Ajzen (1991); Brongers (2017); Wyles et al. (2019); Chen

(2010); Liu et al. (2018)

CHAPTER III
RESEARCH METHODOLOGY

The study of "Fishermen's Participation in Marine Litter Collection Schemes in Thailand" used a questionnaire survey as a main methodology. The study areas were Samut Prakarn, Samut Songkhram, and Phang Nga. Participants and non-participants were approached to do the survey. The data analysis had been performed by the data analysis tools in Microsoft Excel and IBM Statistic Version 22.0 for descriptive analysis. The IBM Statistic Version 22.0 was also used for the the independent sample t-test to explore the potential influencing factors of the participation in marine litter collection schemes.

3.1 Research framework

This study's main objective was to investigate the overall practices and performances of marine litter collection schemes in Thailand and potential factors relating to Thai fishermen's participation in the schemes. The literature part reviewed existing marine litter collection schemes and the previous research finding the influencing factors. This study used a quantitative design to acquire the data. Then, the data collection consisted of the surveys about fishermen's participation in marine litter collection schemes. Consequently, the collected data was analysed by the independent sample t-test and content analysis.

3.2 Study areas

The study areas' selection was based on the report of "Trash Back to Shores: Beautiful Seas with Our Hands" indicating the amount of marine litter bringing back to lands and the fishing gears in each province (Department of Fisheries, 2020). Therefore, this research's selected areas were including three provinces, both side of sea-connected provinces, the Gulf of Thailand and Andaman. The provinces were Samut Prakarn, Samut Songkhram and Phang Nga.

The selection of the studied areas iss that Samut Prakarn is a province located in the central part of Thailand connected to the Gulf of Thailand. Most of the vessels in this province use trawl nets for fishing activities. Samut Songkhram is also locating in the central part. This province has a stand-alone project named "Catching the Trash with Care" for the marine litter collection practice. Lastly, the area of Kuraburi, Phang Nga, is an Andaman connected area. The commercial vessels mostly use surrounding nets as fishing gears.

3.3 Sample size

This study's second objective is to investigate the overall practices and performances of marine litter collection schemes in Thailand and potential factors relating to Thai fishermen's participation in the schemes. This part used surveys to acquire potential influencing factors from fishermen. The sample selection prioritises vessels, both involved and non-involved. Then, the owners of ships and commanders in chief are targeted as population. According to the preliminary interview with the Director of the Fishing and Fleets Management Division, the number of vessels involved in the project is approximately 3,000 (W. Rattanachu, personal communication, May 14, 2020). Table 7 shows the number of Thai commercial vessels and participating vessels in the marine litter collection scheme by the Department of Fisheries.

Table 7 Number of Thai vessels and participating vessels in marine litter collection scheme by the Department of Fisheries

Coast	Number of vessels	Participating Vessels
Gulf of Thailand	8,271	Approx. 3,000 (as of May 2020)
Andaman	1,932	
Total	**10,203**	

As the potential factors influencing fishermen's participation were first planned to be analysed through binary logistic regression, it required large sample sizes. According to Vanichbuncha (2018), the sample size should exceed 30 times of each independent because the small sample size would overestimate the effect measure. Therefore, the number of sample size was 300 because of the ten independent variables that were investigated. Then, the study increased the number of targeted samples to 320 fishermen.

However, the COVID-19 pandemic affected the expected sample size because of the difficulty in finding available fishermen. The number of valid samples were 105 fishermen in three provinces as shown in Table 8.

Table 8 Number of surveyed fishermen

Provinces	Participants	Non-participants	Amount	Note
Samut Prakarn	47	3	50	
Samut Songkhram	29	4	33	2 of participants joined in the local scheme and 2 of participants joined both schemes
Phang Nga	16	6	22	
Total	**92**	**13**	**105**	

3.4 Research tools

In order to explore the potential motivations of fishermen's participation in marine litter collection schemes, two sets of questionnaire survey were designed for participants and non-participants. The questions were derived from the conceptual framework of the study. Each questionnaire was separated into four parts, including demographic data, marine litter management, influencing factors, and suggestions.

Part I Demographic data

This part of the questionnaire acquired demographic data and basic information from fishermen, both participating and non-participating. The questions contained gender, age, income, general vessel information, time in the industry, etc.

Part II Marine Litter Management

This part included the questions regarding the marine litter management behaviour of fishermen. The questions were only those who collect marine litter.

Part III Influencing factors

23 questions were used as means to survey the potential influencing factors of fishermen's participation in marine litter collection schemes. The questions were developed to measure 10 independent variables in four categories, including attitudes, subjective norms, perceived behavioural control and past behaviour as an extended theory of planned behaviour.

Part IV Suggestions

This part was an open-end question, and it is optional for respondents who want to provide additional comments and suggestions to the scheme. A suggestion to the policy and the development of the scheme were examples for this part.

3.5 The validity of the questionnaire

The validity of the questionnaire had been tested for the content validity. The advisor and the presidents of fisheries associations had checked the content of the questionnaire before launching the final version.

3.6 Data collection

The data collection was gathered in both primary and secondary data. Desk-based research was used to identify the existing marine litter collection schemes implementing worldwide, which includes Thai marine litter collection projects. The

desk-based research also had factors motivating participation in marine litter collection schemes by fishermen as well as the factors hindering the participation of the fishermen in the schemes.

The primary data was based on surveys. According to the previous studies of fishermen's participation in the Fishing For Litter schemes in the Netherlands and the United Kingdom, the authors used interviews to ask the fishermen. This study gathered through questionnaire surveys based on factors found to be significant in previous studies. Besides, the observation of the marine litter collection practices was conducted, onshore management in particular. The survey was undertaken during September 2020 – January 2021. Most of the fisherman respondents were interviewed by the author. Some of them were approached by the Fisheries association and PIPO.
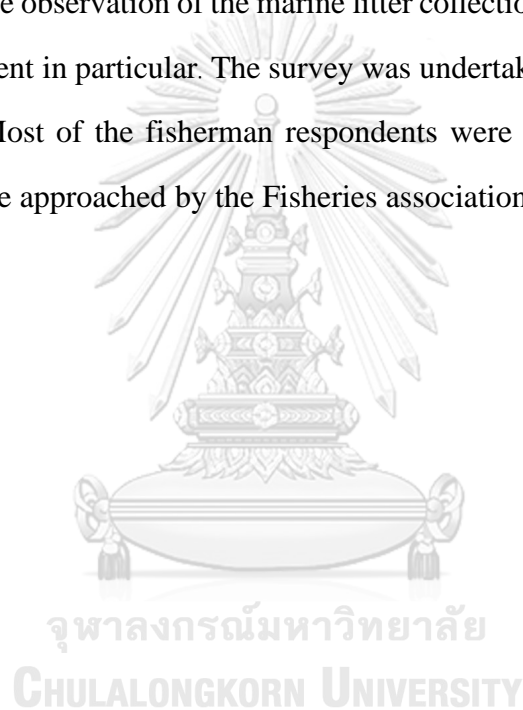
Figure 9 Fishermen doing questionnaire surveys

3.7 Data analysis

As this study investigated the potential influencing factors to participate in the marine litter collection schemes, a questionnaire survey took place for the information to be analysed. In order to analyse the collected data, the descriptive analysis was used to explain the socio-demographic data and marine litter management of respondents. Then, the Independent Sample t-Test was used to compare the means of each potential influencing factor between the different sample groups, participants and non-participants. The purpose of the analysis was to discover the difference between two independent groups, whether it was statistically significant or not. In this regard, the results could help understand the role of each factor, which included environmental knowledge and awareness, personal concerns, social pressure, surrounding people, incentives, the readiness of supported practice, information, time and interests, size of vessels and practice experience, on the participation of fishermen.
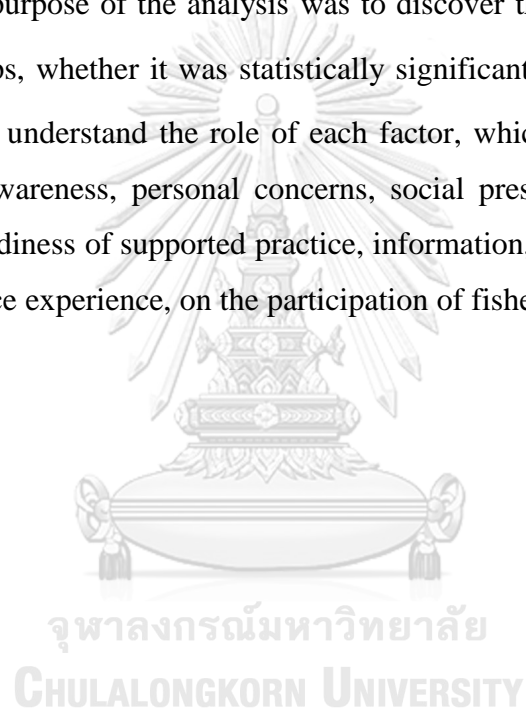
CHAPTER IV
RESULTS

This chapter presents the results of potential influencing factors that drive fishermen to participate in the marine litter collection scheme, Trash Back to Shores: Beautiful Sea with Our Hands. The data collection was done through a questionnaire survey. The analysis of data is shown in the descriptive analysis and independent sample t-test. This chapter presents the results in four parts: the respondents' profile, marine litter management of fishermen, influencing factors, and the fishermen's suggestion for further improvement of the project.

4.1 The respondents' profiles

Several socio-demographic data were collected from participating and non-participating fishermen, including status on the ship, gender, income, types of fishing vessels, size of vessels, and time in the industry. The status on the vessel, gender, income source, and income are shown in Table 9.

Table 9 The demographic data of respondents

Demographic data	Frequency	Percent
Status		
Owner	60	57.14
Commander	38	36.19
Other (manager, crew)	7	6.67
Total	105	100
Gender		
Male	87	82.86
Female	16	15.24

Demographic data	Frequency	Percent
Did not answer	2	1.90
Total	105	100
Sources of income		
Only from fishing activities	95	90.47
Fishing activities and others	3	2.86
Prefer not to tell	7	6.67
Total	105	100
Income per month		
Less than 5,000 Baht	1	0.95
5,001 – 10,000 Baht	5	4.76
10,001 – 30,000 Baht	32	30.48
30,001 – 50,000 Baht	16	15.24
50,001 – 70,000 Baht	9	8.57
More than 70,001 Baht	7	6.67
Prefer not to tell	35	33.33
Total	105	100

These 105 fishermen aged between 24 and 75 years with the average age of 47.54 years (SD = 11.20 years). When asked about time in the fishing industry, it ranged from 2 years to 50 years. The average of their time spent in the industry was 22.23 years (SD = 11.55 years). The general information of vessels was also asked. Most of the respondents had pair trawl as fishing gears, followed by otter board trawl nets, as shown in Table 10. The majority of respondents had large size of vessel (60-149.99 gross tonnage) (n=64) followed by medium size (30-59.99 gross tonnage) (n=35) and small size (less than 29.99 gross tonnage) (n=5). There is one respondent having two ships in medium and large sizes. Two of them did not know the size of their vessels.

Table 10 Types of fishing gears

Types of fishing gears	Frequency	Percent
Pair Trawl	55	52.38
Otter board Trawl	25	23.81
Surrounding nets	5	4.76
Trawl nets (non-specific)	3	2.86
Others (Dredge, Gillnets, lift nets, luring lighted boat, carrier vessel)	9	8.57
Did not answer	8	7.62
Total	105	100

The average time that fishermen spent at sea was 3.51 times per month (SD = 5.27). The average day that they were spending on fishing activities was 14.01 days (SD = 7.01).

The questionnaire survey contained the fishermen's explicit reasons to participate and not to participate in the marine litter collection schemes. The questions requested the respondents to answer not more than two answers. The participating respondents showed that they usually collected litter. Another reason was that marine litter affected the amount of caught up marine life. All of the reasons given by the participants (n = 92) and the total given reasons (158) are shown in Table 11.

Table 11 The explicit reasons to participate in marine litter collection schemes

Explicit reasons to participate	Frequency	Percent
Normally collect marine litter	32	20.25

Marine litter affects the amount of caught up fish	31	19.62
For the good image of fishermen	29	18.35
For the clean sea, fish, and healthy nature	25	15.82
The requirement of cooperation from Fishermen associations and the Department of Fisheries	20	12.66
Collected litter could generate income	12	7.59
Vessel owner commands	9	5.70
Total	158	100

On the side of non-participating respondents (n = 13), most of them indicated that they did not know of the marine litter schemes, so that they did not join. The total reasons given were 13. The other explicit reasons are shown in Table 12.

Table 12 The explicit reasons to not participate in marine litter collection schemes

Explicit reasons to not participate	Frequency	Percent
Did not know of the schemes	6	46.16
No time for litter collection	3	23.08
Normally collect marine litter	2	15.38
The scheme is not clear	1	7.69
Did not answer	1	7.69
Total	13	100

4.2 Fishermen's marine litter management

This part discovered the marine litter management of fishermen. The collection of litter on board (potentially contribute to marine litter) was asked of the respondents. The majority collected marine litter at the time that they joined the Trash Back to Shore: Beautiful Seas with Our Hands scheme. Only a few had done the practice before the launch of the scheme.

All respondents collect litter on board which prevented it from being marine litter. The questions also contained the collection of floating marine litter. 91 of them were also collecting floating marine litter. Most of the collected litter on-board were plastic bottles and plastic bags as the package for their foods while they were at sea. The most collected litter on board is shown in Figure 10. The most found floating marine litter told by the fishermen are discarded nets, plastic bags and plastic bottles as shown in Figure 11.

Most collected litter on board

Plastic bottles: 96, Plastic bags: 78, Glass bottles: 35, Discarded nets: 32, Can/Tin: 11, Others: 5

■ Number of Respondents
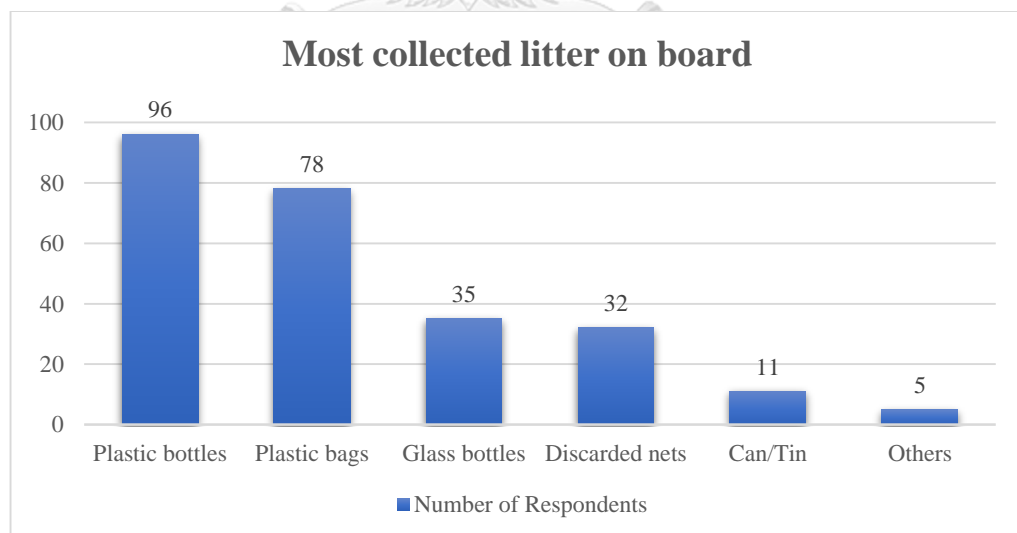
Figure 10 Most collected litter on board

Note:

- The respondents were requested to answer most collected litter on board not exceed three types

- Others included carton boxes, instant coffee package, leftovers, paper.

Most found floating marine litter
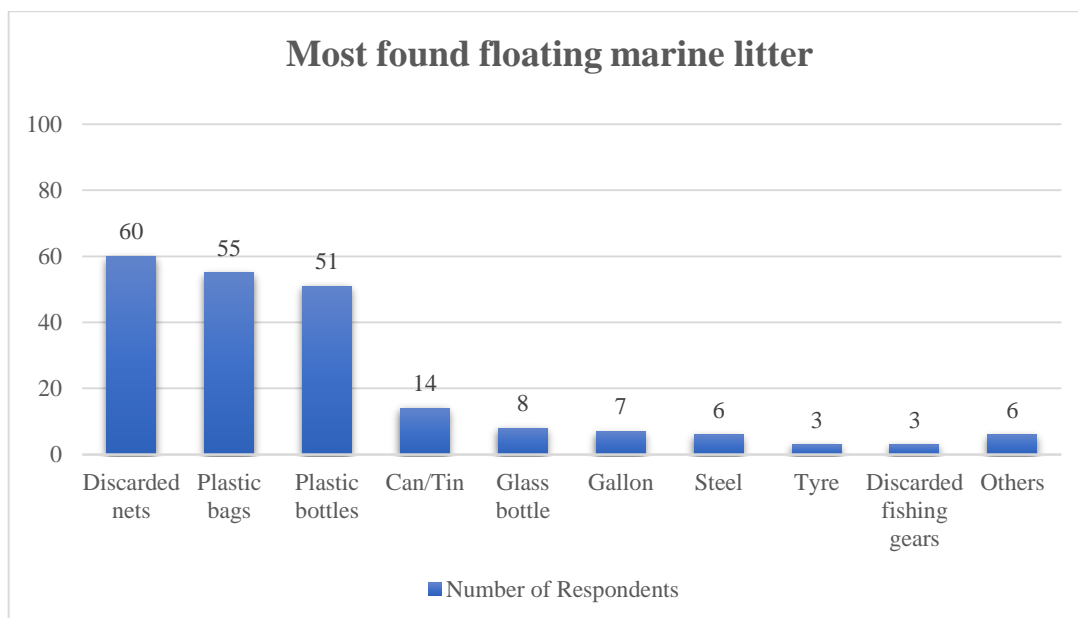
Figure 11 Most found floating marine litter

Note:

- The respondents were requested to answer most collected litter on board not exceed three types

- Other included clothing jar, rope, sanitary napkins, woods

The management of marine litter after docking at harbours was on the list of the survey. 55 threw marine litter away at ports. 42 sold recyclables after conducting waste separation. Ten of the respondents brought them back littering in their nearby home's garbage because non-reception facilities were available or insufficient. Only a few gave them to the garbage collectors, and one reused it for another purpose. Regarding food waste, some respondents mentioned that they had to throw it away in the ocean because of its odour and the belief that it could degrade naturally.

4.3 The Independent Sample t-Test

The analysis of factors thay have the potential to affect fishermen's participation in marine litter collection schemes was derived from the questionnaire surveys. The collected data was filled in IBM SPSS Statistic Version 22.0. The author had reversed data of five negative questions from three factors (personal concerns, social pressure and time) which included:

- Time is a limitation for marine litter collection

- Space of the vessels could cause the marine litter collection practice

- The participation of marine litter collection programmes is difficult, there is a need to adjust my vessels

- Marine litter collection could contaminate the caught-up fish and other marine life

- Marine litter collection poses a danger to you and your crews (injuries)

Before analysing the data, the reliability analysis had been performed for the reliability of the potential influencing factors in the questionnaire, which included 21 questions. The purpose of this analysis was to ensure the reliability of the questionnaire due to the sample size limitation. The reliability analysis was performed from the actual survey. The result of Cronbach's Alpha Coefficient is 0.581 as shown in Table 13.

Table 13 The result of reliability analysis

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.581	.653	21

Source: Calculation on IBM Statistic Version 22.0

Then, the study removed a redundant question (item 3.4 the fishing activities cause marine litter) for the increasing value of Cronbach's alpha. Item 3.4 was not used for the input of further analysis in SPSS. Table 14 shows that the Cronbach's Alpha Coefficient had increased to 0.618. This number made the questionnaire questionable according to the rules of thumbs that George and Mallery (2003) provided.

Table 14 The result of reliability analysis after removing a redundant question

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.618	.690	20

Source: Calculation on IBM Statistic Version 22.0

After that, the Independent Sample t-Test was carried out. The purpose of the use of this analysis was to discover the difference between two independent groups, whether it was statistically significant or not. Consequently, it aimed to discover whether that difference had an impact the participation or not. The independent groups were participants and non-participants. The factors aimed to discover were including environmental knowledge and awareness, personal concerns, social pressure, surrounding people, incentives, the readiness of supported practice, information, time and interests, size of vessels and practice experience. The results of the Independent Sample t-Test analysis are shown in Table 15.

Table 15 Independent Sample t-Test between each factor and participation

Factors		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
environmental awareness	Equal variances assumed	.090	.765	-1.153	103	.252	-.20477	.17763	-.55707	.14752
	Equal variances not assumed			-.999	14.418	.334	-.20477	.20497	-.64319	.23364
personal concerns	Equal variances assumed	1.444	.232	-.917	103	.362	-.25627	.27959	-.81078	.29824
	Equal variances not assumed			-.769	14.208	.455	-.25627	.33335	-.97026	.45772
social pressure	Equal variances assumed	1.340	.250	-.323	103	.747	-.11288	.34947	-.80597	.58021
	Equal variances not assumed			-.414	19.329	.683	-.11288	.27243	-.68241	.45666

Factors		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
surrounding people	Equal variances assumed	.008	.929	-1.140	103	.257	-.35471	.31119	-.97188	.26246
	Equal variances not assumed			-1.080	15.091	.297	-.35471	.32848	-1.05449	.34507
incentives	Equal variances assumed	.483	.489	.074	103	.941	.02634	.35600	-.67971	.73239
	Equal variances not assumed			.065	14.559	.949	.02634	.40245	-.83373	.88641
readiness of supported practice	Equal variances assumed	.505	.479	-2.860	103	**.005**	-.50254	.17573	-.85107	-.15402
	Equal variances not assumed			-2.951	15.916	.009	-.50254	.17032	-.86376	-.14132
information	Equal variances assumed	.450	.504	-2.102	103	**.038**	-.42057	.20010	-.81742	-.02372

Factors		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
	Equal variances not assumed			-2.599	18.571	.018	-.42057	.16179	-.75974	-.08140
time	Equal variances assumed	.242	.624	.646	103	.520	.18060	.27955	-.37382	.73503
	Equal variances not assumed			.636	15.438	.534	.18060	.28396	-.42316	.78436
size of vessels	Equal variances assumed	.000	.986	-.774	103	.441	-.22993	.29725	-.81945	.35958
	Equal variances not assumed			-.757	15.383	.460	-.22993	.30369	-.87583	.41596
Past experience	Equal variances assumed	4.555	**.035**	-2.018	103	.046	-.38043	.18849	-.75427	-.00660
	Equal variances not assumed			-2.191	16.516	**.043**	-.38043	.17362	-.74755	-.01332

According to Table 15, only three factors, the readiness of supported practice, information and practice experience had a significant level lower than 0.05 at 95 percent confidential level. It means that there was statistically significant difference of those three factors between participants and non-participants. The p-value of readiness of supported practice was 0.005. Information had a p-value at 0.038. Lastly, the p-value of practice experience was 0.043. Therefore, the readiness of supported practice, information and practice experience had the possibility to influence the participation of fishermen in marine litter collection schemes.

The study, moreover, had analysed the characteristics of participants and non-participants to investigate further difference between the two groups by comparing the mean ratings of factors. The results could generate beneficial outcomes for the schemes' improvement.

4.4 The characteristics of participants and non-participants

The study, moreover, had analysed the characteristics of participants and non-participants to investigate further difference between the two groups by comparing the mean ratings of factors shown in radar scale, also known as spider web. The results could generate beneficial outcomes for the schemes' improvement. Table 16 shows the mean ratings of each factors from the survey. Moreover, the mean ratings of each factors are shown in Figure 12 as radar scales.

Table 16 Mean ratings of each factors

Factors	All		Participants		Non-participants	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Environmental awareness and knowledge	4.46	0.60	4.49	0.58	4.28	0.71
Personal concerns	1.85	0.94	1.82	0.91	2.08	1.15

Factors	All		Participants		Non-participants	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Social pressure	2.63	0.78	2.65	0.80	2.50	0.58
Surrounding people	3.44	1.05	3.48	1.04	3.13	1.12
Incentives	3.40	1.20	3.40	1.18	3.42	1.38
Readiness of supported practice	4.29	0.61	4.35	0.59	3.85	0.57
Information	4.18	0.69	4.23	0.69	3.81	0.52
Time and interest	2.33	1.37	2.15	1.27	3.62	1.39
Size of vessels	1.95	1.00	1.92	1.00	2.15	1.03
Practice experience	4.33	0.65	4.38	0.64	4.00	0.58
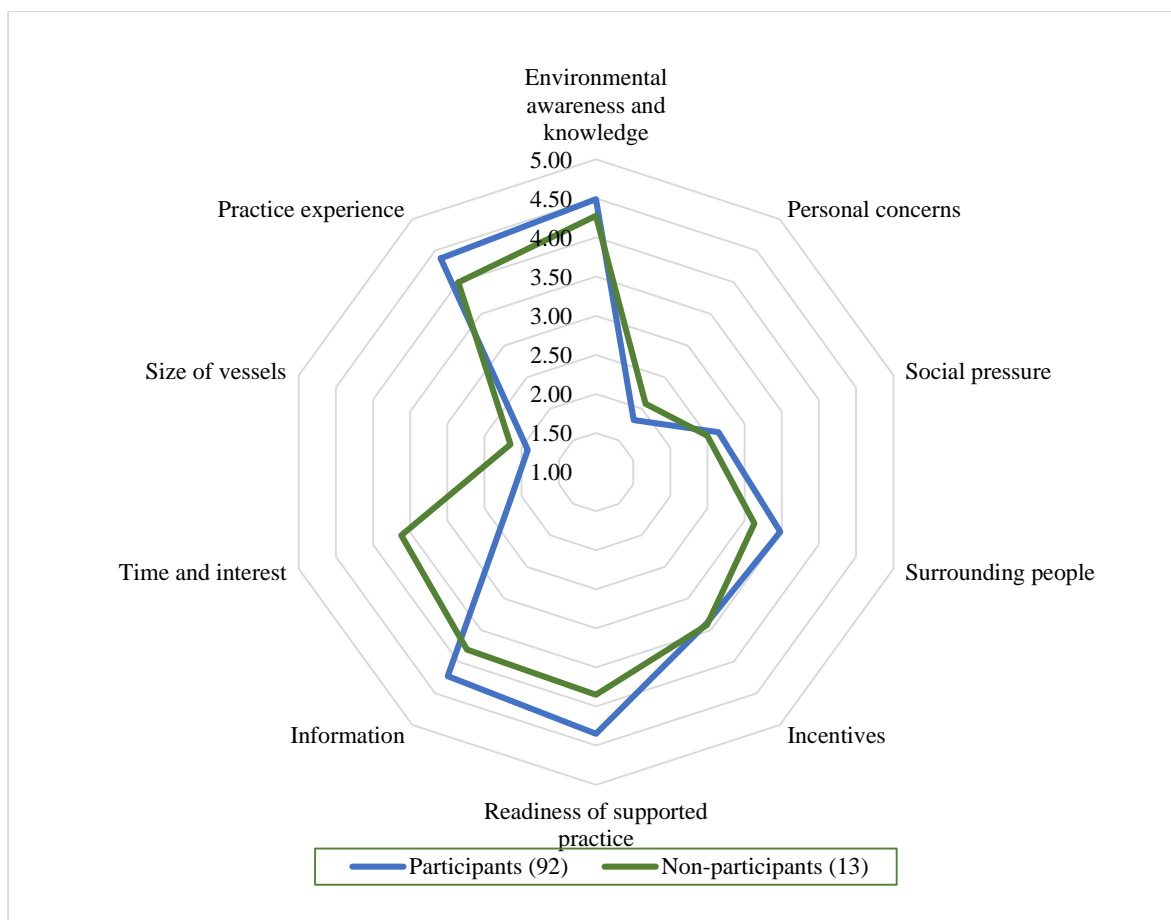
Figure 12 Mean ratings of each factors between participants and non-participants

Attitudes

When asking fishermen about the agreement on the contents of the contribution of negative impacts to marine environment and the marine litter collection practices, the respondents usually gave the high value of agreement. According to Figure 12, the mean ratings show that the environmental knowledge and awareness of both participants and non-participants are in the high values (4.49 and 4.28, respectively). It means that both were having environmental awareness and were aware of the marine litter issues.

Both had a very less personal concern about the dirtiness when pulling and storing marine litter. The fishermen had a little bit less concern about the danger of marine debris that may cause injuries.

<u>Subjective norms</u>

The social pressure had little impacts to the fishermen. However, almost all respondents disagreed that the fishing activities were the marine litter source (mean: 1.48). Most of them stated that marine litter sources were from land-based activities, especially in the coastal areas. Besides, sea-based activities, such as tourism and transportation, were the marine litter sources as well.

The respondents well received the news and media on marine animals injure from marine litter (mean: 3.68).

When asking about surrounding people that invite fishermen to join in the schemes, the fisheries associations were influential institutions to inform fishermen to participate in the schemes. The participants rated the level of agreement at the mean of 4.27 when asked about the influence of the fisheries associations.

<u>Perceived behavioural control</u>

The incentives were not different among those groups. The participants agreed more on the context of non-financial incentives. They stated that pure voluntary could make the schemes last long. The financial incentives could disrupt their ways of life. On the contrary, non-participants agreed more on the use of financial incentives.

The surveyed participants strongly agreed that supported practice, waste reception facilities, and waste management were necessary for maintaining the marine litter collection activities. The non-participants also agreed on those supports.

The information was vital for the schemes' participation. Both participating and non-participating respondents agreed on the power of information.

The time and interests were significant to the non-participants. They did not join the schemes because of their limited time at sea.

The size of vessels and ships adjustment were not necessary matters for joining in the marine litter collection practices and schemes

Past behaviour

Lastly, the participanting and non-participanting respondents mostly agreed that it could contribute to the easiness of participation in the marine litter collection schemes (mean: 4.38 and 4.00).

In conclusion, the characteristics of participants were having environmental awareness and knowledge as a significant basis. Surrounding people that may concern their participation was fisheries associations. They also strongly agreed on the readiness of supported practice which would facilitate their marine litter collection practices. Lastly, participants had practice experience in collection practice which resulted in the easiness for joining in the schemes.

On the contrary, the non-participants mostly agreed on the importance of the readiness of supported practice, the lack of schemes' information and their limited time at sea that associating with their act not to participate in the schemes.

4.4.1 The comparison between the owners and non-owners of vessels' characteristics within the participants group

When compared between the owners and non-owners of vessels in the side of participants, all characteristics were closely the same. However, one of all factors that stood out, the surrounding people as shown in Figure 13.
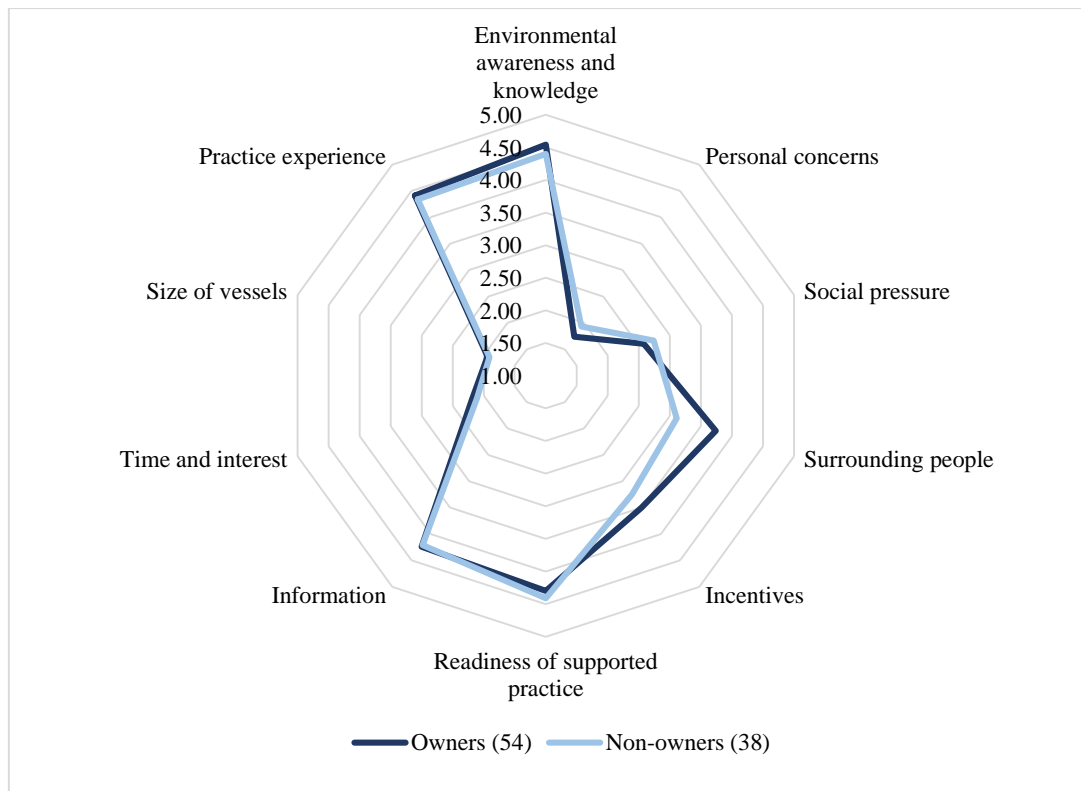
Figure 13 Mean ratings of owners and non-owners' characteristics

The invitation of fisheries associations probably caused the participation of owners. On the contrary, the low value of mean ratings on the side of non-owners indicated that their family, friends, and fisheries association had little involvement on their participation. However, owners were the most influential, as shown in their explicit reasons to participate. Nine of them explicitly stated that their vessel owners commanded them to collect marine litter.

4.4.2 The characteristics of participants in the three provinces

When comparing the difference of means among three provinces, Samut Prakarn (n=47), Samut Songkhran (n=29) and Phang Nga (n=16), the results of comparison was shown in Figure 14 as radar diagram.
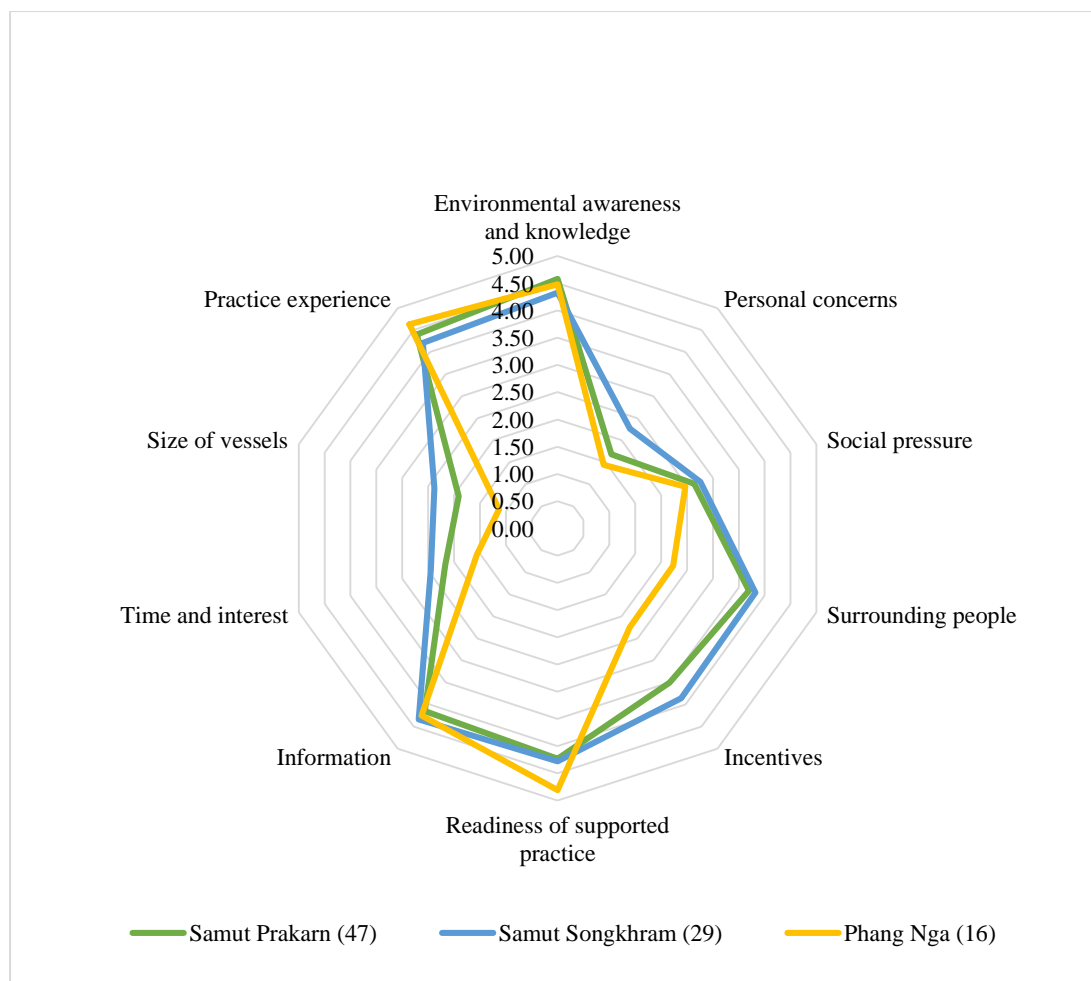
Figure 14 Mean ratings of participants' characteristics in the surveyed provinces

จุฬาลงกรณ์มหาวิทยาลัย

The participants' characteristics in the surveyed provinces had some differences. Surrounding people was obviously different as Phang Nga stood the least means. It probably means that surrounding people do not concern with fishermen's participation and a small number of respondents in Phang Nga. Next, participating respondents in Phang Nga were least interested in any incentive while the fishermen in the other two provinces seemed to be interested in either financial or non‑financial incentives. Moreover, fishermen in Phang Nga recognised the importance of readiness of supported practice more than the others. Lastly, the size of vessels and ships adjustment seemed to be the concerns of fishermen in Samut Songkhram more than others.

4.5 Fishermen' s suggestion for project improvement

The suggestion for an improvement of the scheme was in a part of the survey as an optional. 44 of respondents provided some suggestion for further improvement of the marine litter collection scheme. Most of them suggested the prevention and reduction of litter entering the marine environment. They stated that the sources of marine litter were mostly from the shores. The marine litter generation from the sea-based activities was suggested because of their eyewitness to other vessels' action. Other suggestions had been categorised as shown in Table 17.

Table 17 Suggestions for the marine litter management improvement

Suggestion	Description
1. The prevention and reduction of litter entering marine environment (14)	Raise awareness the public on land regarding marine debris and littering
	Proper waste management on land
	Pay attention to the coastline activities and residents
	The involvement of stakeholders
2. The schemes are good and should continue (11)	
3. Waste management after collection (8)	Increase the waste reception facilities and their availability
	The involvement of stakeholders to facilitate the reception of collected marine litter
4. The promotion of the marine litter collection schemes (4)	The public relations on the fishermen activities in marine litter collection practices
5. Incentives (4)	Some incentives should be provided by the schemes
	The incentives could be in the form of the cost reduction of commercial fishing license
	There should be no financial incentives

Suggestion	Description
6. The awareness-raising among fishermen and their involvement (4)	The need to raise awareness among fishermen, especially the commanders and crews
7. Other types of vessel's involvement (3)	Monitor and focus on the illegal generation of marine litter of other types of vessels such as cargo ships, cruise ship
	The involvement in marine litter collection practices

Note: (number) indicated the number of respondents giving similar comments or suggestions

4.6 The discussion of results

The potential influencing factors to participate in marine litter collection schemes were analysed by comparing the means through the Independent Sample t-Test. These analysis results showed that three factors were having statistically significant difference, including the readiness of supported practice, information and practice experience. It can assume that the three factors were potential drivers of fishermen's participation in marine litter collection schemes. Moreover, the characteristics of fishermen were also discussed in this part.

The **readiness of supported practice** was an important feature for the marine litter collection practices. It included the waste reception facilities and waste management in this study. The Independent Sample t-Test results showed that it was a potential influencing factor in marine litter collection schemes' participation. The result of this study is in accordance with Brongers (2017). When there are available waste reception facilities at docking harbours, fishermen know that they have places to throw away collected litter. Insufficient facilities could discourage participation in the schemes or even doing the practice. Besides, proper waste management is preferred by

fishermen. It can be beneficial if proper waste management or recycling and upcycling activities are available.

Information was also a potential driving factor for participation. Most of the participants joined the schemes because they knew of the existence of the schemes. On the contrary, non-participants did not know of the schemes. They indicated that if they knew, they would join. Chen (2010), Brongers (2017) and Wyles et al. (2019) mentioned the importance of information as well. Moreover, the fisheries associations and the PIPOs could be the media to disseminate the scheme information to the fishermen. It is worth mentioning that fishermen spend most of their time at sea, and when they are back to the shores, they probably go home. The information distribution could face difficulty. Therefore, the two institutions could inform the schemes to the owners of vessels who mostly spend their time on the land.

The **practice experience** was also potentially influential, as shown in the Independent Sample t-Test analysis results. The fishermen joined the schemes because they were already doing the practice of marine litter collection. Interestingly, the Thai marine litter collection schemes had no difference from the usual marine litter collection practice, so that the fishermen felt no more burdens or difficulty from the participation. In previous studies, Brongers (2017) and Wyles et al. (2019) also had this finding. However, their studied areas had some differences, such as supported bags, systematic waste reception facilities and waste management.

As this study further discovered the characteristics of fishermen, the results showed that both participating and non-participating respondents had a high level of **environmental awareness and knowledge.** When fishermen know marine litter issues and its impacts on the marine environment, it could be easier to convince the fishermen to adopt the marine litter collection practice or participate in marine litter collection schemes. This is because of their dependency on a healthy marine environment which can affect their source of income. However, it is worth noting that even non-participants

could have a high level of environmental awareness and knowledge as in the study results. The non-participants adopt the practice of marine litter collection without joining the schemes if they wanted to do so. Besides, if they see no difference in the marine litter collection schemes, they might remain in their practice without joining the schemes.

The results of the study showed that fisheries associations, as **surrounding people**, were important institutions along with Port In-Port Out Control Centers (PIPOs), a localised institution under the Department of Fisheries. These two institutions could inform fishermen's participation procedures and invite them to the schemes because they work closely with the fishermen in many sea-connected areas. They can act as mediators to convey information about the marine litter collection schemes to the fisheries associations and directly to the fishermen.

Lastly, the **time** spending at sea could associate the participation of fishermen. Sometimes, the focus was on fishing activities. Besides, when they dragged the caught up marine lives along with marine litter, they must prioritise the caught up marine lives. However, the study's finding also found that the participants did not agree to the loss of time when their collect marine litter. The **interest** of vessel owners was necessary for those who were not owners. They did the marine litter collection practice only if their owners demanded. The other crews can also deny the marine litter collection practice or the participation in marine litter collection schemes by their owners' commandment. Besides, the crews can ignore it because their owner had shown no interest at all.

CHAPTER V
CONCLUSION

The Thai marine litter collection schemes had many aims which can benefit marine environmental restoration. The low number of participants led to the discovery of the reasons why fishermen did not join the schemes. The research began from reviewing and drawing lessons learned from the existing marine litter collection practices worldwide. Then, an empirical survey was done in Thailand to examine the factors that potentially influence the fishermen's participation in marine litter collection schemes. The data was mostly collected through the questionnaire survey. The analysis of the collected data primarily relied on the Independent Sample t-Test. This conclusion section summarised the findings of the study. Moreover, several policy recommendations are discussed in this chapter.

5.1 Summary of findings

The study reviewed marine litter collection schemes implementing worldwide. Several schemes are in use engaging fishermen for ocean restoration. The marine litter collection schemes have voluntary and incentive models. The voluntary schemes are Fishing For Litter, Fisheries for a Sea Without Litter (Portugal) and Suchitwa Sagaram (India).

The use of money to incentivise fishermen to collect marine litter is an alternative that benefits marine environmental restoration as well as the voluntary schemes. The reviewed schemes using incentives are including the Buy Back programme (South Korea), 4Ocean, Enaleia enterprise (Greece) and Salvamare Bill (Italy).

The lesson learned from reviewed schemes showed that a successful scheme could have a key operator as a pillar in the operation which can coordinate the fishermen

and other stakeholders. The financial inputs are important for the existence and continuation of any design of a scheme, whether incentive-based or voluntary based. It is a must to cover the cost of operation, sources of incentives provided to fishermen, facilities and waste management. Therefore, supporters can help secure the scheme's operation. The supporters could be governments, private sectors, purchasers and the public as the study found in the reviewed schemes. More importantly, the engagement of fishermen who are the main actors in the marine litter collection schemes is inevitable to run the operation.

The voluntary model of marine litter collection schemes is implementing in Thailand. Trash Back to Shores: Beautiful Seas with Our Hands are now operating in all 23 sea-connected provinces. It is initiated by the Department of Fisheries in 2019. The aims are to raise awareness among fishermen about waste management, to encourage fishing fleets to collect their on-board litter and bring it back to shore, to promote fishing ports to provide waste reception facilities and to decrease single-use containers while at sea. Besides, another provincial marine litter collection scheme named Catching the Trash with Care is implementing in Samut Songkhram.

However, the participation of fishermen in the national scheme was at a low rate. Therefore, the study aimed to discover the potential influencing factors on the participation in marine litter collection scheme which mainly focused on the Department of Fisheries' scheme.

This study had discovered the factors that potentially affect participation in marine litter collection schemes. The resulted factors were from ten factors from four categories in the literature review and conceptual framework derived from the Theory of Planned Behaviour (TPB) and previous studies. The conceptual framework had four categories: personal attitudes, subjective norms, perceived behavioural control, and past behaviour. The analysis was mainly based on the Independent Sample t-Test.

The results showed that three factors of ten factors have the potential to influence the participation in marine litter collection schemes in Thailand. The factors were (1) readiness of supported practice (2) information and (3) practice experience. As this study further investigated the characteristics of participants, the results showed that fishermen, both participants and non-participants have high understandings of marine litter sources and impacts. The relevant surrounding people that can drive fishermen to participate were fisheries associations and Port In-Port Out Control Centers (PIPOs). Lastly, time and interests could be an obstruction to the participation of fishermen.

5.2 Policy Recommendation

The results of this study bring the policy recommendation to improve the marine litter collection schemes in Thailand. The recommendations are following:

1. Information about marine litter collection schemes seemed to be the weakest point of the schemes in Thailand. The non-participants did not know of the existence of the schemes. The schemes should improve the dissemination of schemes' information to the fishermen through the fisheries associations and Port-In Port-Out Control Centers (PIPOs). The fishermen have regular contact with them for their business purposes. The two institutions could inform and encourage participation since fishermen mostly follow their instructions, particularly the fisheries associations. The target group of the information provided could be the vessels owners, who mostly live on the shore. The owners also had an influence over their crewmembers for participating in the marine litter collection practices. Moreover, the information that should provide to fishermen includes the available supports such as the waste reception facilities and their locations where fishermen can throw away the collected litter.

2. The readiness of supports to the marine litter collection practices and schemes is a necessity to facilitate participation. The fishermen should have some containers

to store their collected litter on board. More importantly, waste reception facilities at ports and docking harbours are required to avoid the fishermen's burdens of littering away at other sites. Without the waste reception facilities, it can discourage the fishermen from joining in the marine litter collection practice. The locations of the facilities are needed to inform the participants as well. More importantly, there should be financial supports to cover the big bags, waste reception facilities, cost of coordination, waste management and etc.

3. The stakeholders' involvement is important for the scheme's operation. There should be supports for the operation from various sponsors. The government could provide public funds received from taxes for the environmental services or fishermen by financing the schemes. The financial inputs could transform to be the storing bags on-board, waste reception facilities, waste management, cost of coodination and etc. The sponsors can also be recycling and upcycling stakeholders which could transform into recycling or upcycling products. Other private companies could be involved in the scheme by using the Corporate Social Responsibility (CSR) principle to help clean the sea and return benefits to the public. Lastly, the local goverments' involvement is necessary to work closely with port authorities, private ports to collect marine litter that fishermen collected. The local governments should provide any help needed to the scheme because it reduces the responsibility to collect litter and the impacts of marine litter within the territories.

4. Even though the fishermen had high environmental awareness and knowledge, improvement of their understanding of marine litter sources, impacts on the marine environment and the economy should be done. The negative impacts of marine litter that affect the fishermen's way of life could be an easy way to persuade them to be aware of the issues. The advantages of the marine litter collection practices can be discussed, such as the financial advantages, time

savings, fewer damages to their vessels. Then, it could be easier to convince them to participate.

5. The application of incentives could be implemented to attract more fishermen to participate in the programmes. Non-financial incentives are preferred for the continuous provision of reward. It could be some small rewards which focus on behavioural change, such as the exchange for commodity, additional fishing days and insurance. The incentives should be contributed to all participating fishermen regardless of the amount of collected marine litter because it can interfere with the collection by generating more litter.

6. Furthermore, the monitoring of the collected litter should be taken place to keep it on track and see the schemes' progress. After that, the concerned agencies and the public should acknowledge the efforts of the fishermen in marine litter collection, which give social benefits to the society.

7. However, marine litter collection schemes are just downstream solutions to the marine debris problem. The engagement of the public and the government is vital. There should be awareness-raising for the public concerning their consumption and littering behavior, especially plastic waste. The government should focus on proper waste management that can prevent waste leakage to the waterways and marine environment. Moreover, producers should play more role in improving design of the packaging and products by reducing virgin materials and design for reuse or recyclability. These are the recommendation from Emma Watkins in the marine litter management hierarchy, which prioritise the prevention and reduction of waste generation and the prevention and reduction of litter reaching the marine environment, before deploying the marine litter collection, as this study focused (UNEP, 2017).

5.3 Limitation and direction for further study

Although this study has provided several useful findings to the policymakers, the small and unbalanced samples of participants and non-participants to the scheme has limited the use of statistic analysis in this study. Further research could use other statistical tools to analyse which could help more understanding of influencing factors. Study in the future could focus more on the non-participant's side to further investigate the hindering factors. Furthermore, it would be interesting to investigate the attitudes and opinions of the vessel owners in comparison with those of the crews of the vessels.

The study areas are also crucial to the research. As this study had conducted the surveys in three provinces, including Samut Prakarn, Samut Songkhram and Phang Nga, further study could survey other provinces or all 23 sea-connected provinces. Moreover, in-depth interviews could be done to get more insights into the issue as previously done in the study of Brongers (2017) and Wyles et al. (2019) previously conducted.

Lastly, there is no application of incentives in marine litter collection schemes at the moment. A research on the effectiveness of incentives, both financial and non-financial incentives, would be interesting to check the level of participation in the long-term.

REFERENCES

4ocean. (2020a). Mission. Retrieved from https://4ocean.com/mission

4ocean. (2020b). Progress. Retrieved from https://4ocean.com/progress/

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. doi:https://doi.org/10.1016/0749-5978(91)90020-T

Aqua-lit. (2019). Good News From Italy! Fishermen will be allowed to collect plastic at sea. Retrieved from https://aqua-lit.eu/news/19/good-news-from-italy-fishermen-will-be-allowed-to-collect-plastic-at-sea

ASEAN. (2019a, June 22). ASEAN Framework of Action on Marine Debris. Retrieved from https://asean.org/asean-framework-action-marine-debris/

ASEAN. (2019b, June 22). Bangkok Declaration on Combating Marine Debris in ASEAN Region. Retrieved from https://asean.org/bangkok-declaration-combating-marine-debris-asean-region/

Auonauon. (2019, May 19). Responsible Tourism case กับโครงการดีๆ อย่าง Catch The Trash. Retrieved from http://utothailand.com/2019/05/responsible-tourism-case-กับโครงการดีๆ-อย่าง-catch-the-t/

Basurko, O. C., Gabiña, G., Andrés, M., Rubio, A., Uriarte, A., & Krug, I. (2015). Fishing for floating marine litter in SE Bay of Biscay: Review and feasibility study. *Marine policy, 61*, 103-112.

BIM. (2020). A BIM Sustainability Initiative: Fishing For Litter. Retrieved from http://www.bim.ie/fishing-for-litter/

Brodbeck, L. (2016). Mechanisms to support the recycling/reuse of fishing gear and the prevention of gear becoming lost/abandoned at sea. *Barrier Assessment, 43*.

Brongers, B. (2017). *The Participation of Dutch Fishermen in waste collection practices at sea.* (Master's thesis). Wageningen University, Wageningen, the Netherlands. Retrieved from https://edepot.wur.nl/404099

Chen, C.-L. (2010). Factors influencing participation of 'top-down but voluntary'fishery management—empirical evidence from Taiwan. *Marine policy, 34*(1), 150-155.

Cho, D.-O. (2009). The incentive program for fishermen to collect marine debris in Korea. *Marine Pollution Bulletin, 58*(3), 415-417.

Cohen, J. M., & Uphoff, N. T. (1980). Participation's place in rural development: Seeking clarity through specificity. *World Development, 8*(3), 213-235. doi:https://doi.org/10.1016/0305-750X(80)90011-X

de Groot, W. T. (1992). Participation in Environmental Management. In *Environmental Science Theory: Concepts and Methods in a One-World, Problem-Oriented Paradigm* (Vol. 52, pp. 374-407). The Netherlands: Elsevier.

DeFishGear. (n.d.). Derelict Fishing Gear and Fishing For Litter Project Guidelines. Retrieved from https://www.defishgear.net/images/Outputs/WP6DFGFFLguidelines.pdf

Department of Fisheries. (2018, July 5). ประชุมหารือประเด็น "การกำจัดขยะในทะเล". Retrieved from https://www4.fisheries.go.th/index.php/dof/activity_item/1758

Department of Fisheries. (2020). กิจกรรม "ขยะคืนฝั่ง ทะเลสวยด้วยมือเรา".

Department of Marine and Coastal Resources. (2017). *Marine and Coastal Resources Management Master Plan 2017 – 2036*.

Duane, T. P. (1997). Community participation in ecosystem management. *Ecology LQ, 24*, 771.

Ericeira Mag. (2019, November 11). "A PESCA POR UM MAR SEM LIXO" CHEGA À ERICEIRA. Retrieved from http://www.ericeiramag.pt/a-pesca-por-um-mar-sem-lixo-chega-a-ericeira/

European Commission. (2018, December 11). Fishing For Litter: Germany. Retrieved from https://webgate.ec.europa.eu/fpfis/cms/farnet2/on-the-ground/good-practice/projects/fishing-litter_en

Fishing For Litter. (2020a). Fishing For Litter Netherlands. Retrieved from http://fishingforlitter.org/netherlands/

Fishing For Litter. (2020b). Fishing For Litter Norway. Retrieved from http://fishingforlitter.org/%20norway/

Fishing For Litter UK. (2020a). Fishing For Litter Scotland. Retrieved from http://www.fishingforlitter.org.uk/project-areas/scotland

Fishing For Litter UK. (2020b). Fishing For Litter South West. Retrieved from http://www.fishingforlitter.org.uk/project-areas/south-west

Fishing For Litter UK. (2020c). What is Fishing For Litter? Retrieved from http://www.fishingforlitter.org.uk/what-is-fishing-for-litter

George, D., & Mallery, P. (2003). SPSS for Windows step by step: answers to selected exercises. *A simple guide and reference, 63*, 1461-1470.

Il Faro. (2019, April 2019). Ddl "Salvamare", ecco perché "Fishing for litter Terracina" è stato decisivo per l'approvazione. Retrieved from https://www.ilfaroonline.it/2019/04/08/ddl-salvamare-perche-fishing-for-litter-terracina-decisivo-lapprovazione/269239/

ISPRA. (n.d.). Tuscany Fishing for Litter - Arcipelago Pulito. Retrieved from http://www.sinanet.isprambiente.it/gelso/banca-dati/regione/regione-toscana/tuscany-fishing-for-litter-arcipelago-pulito

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., … Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science, 347*(6223), 768-771.

Jeftic, L., Sheavly, S., Adler, E., & Meith, N. (2009). *Marine litter: a global challenge*: UNEP.

KIMO. (2017a, December 24). Fishing For Litter Restarts in Faroe. Retrieved from http://www.kimointernational.org/news/fishing-for-litter-restarts-in-faroe/

KIMO. (2017b). Fishing For Litter Scotland: Final Report 2014-2017. Retrieved from http://www.fishingforlitter.org.uk/assets/file/FFLS%202014%20-17%20Final%20Report.pdf

KIMO the Nederland En België. (2020). Fishing For Litter. Retrieved from https://www.kimonederlandbelgie.org/projecten-2/fishing-for-litter/

Liu, T., Bruins, R. J., & Heberling, M. T. (2018). Factors influencing farmers' adoption of best management practices: A review and synthesis. *Sustainability, 10*(2), 432.

Mannaart, M. (Producer). (2017). The Fishing For Litter Programme: an example of a practical project with international impact that addresses the extensive environmental problem of plastic pollution in the marine environment. [PowerPoint Presentation] Retrieved from http://www.tshe.org/wp-content/uploads/2017/06/KIMO_MikeMannaart-1.pdf

Marinenviron. (2020). Fishing for Litter – a simple solution. Retrieved from https://www.marintmiljo.no/marine-litter/fishing-for-litter-a-simple-solution/

Marlisco. (2020). Fishing For Litter in Germany. Retrieved from http://www.marlisco.eu/fishing-for-litter-in-germany.en.html

Matichon. (2019, December 10). สมาคมการประมงแห่งประเทศไทยร่วมกับพันธมิตรจัดโครงการกำจัดขยะทะเลโดยชาวประมงไทย เพื่อแก้ปัญหาขยะที่มีอยู่ในทะเล. Retrieved from https://local.matichon.co.th/content/23504

Menorifiuti. (2018, March 6). In Toscana la prima esperienza di "fishing for litter", i pescatori potranno raccogliere le plastiche in mare. Retrieved from http://www.menorifiuti.org/2018/03/06/in-toscana-la-prima-esperienza-di-fishing-for-litter-i-pescatori-potranno-raccogliere-le-plastiche-in-mare/

Miner, L., & Karagiorgas, I. (2019, July 3). Greek fishermen paid to collect rubbish caught from the sea for recycling. Retrieved from

https://www.euronews.com/2019/07/02/greek-fishermen-paid-to-collect-rubbish-caught-from-the-sea-for-recycling

Mouat, J., Lozno, R. L., & Bateson, H. (2010). Economics Impacts of Marine Litter. Retrieved from http://www.kimointernational.org/wp/wp-content/uploads/2017/09/KIMO_Economic-Impacts-of-Marine-Litter.pdf

NABU. (2020). Fishing For Litter. Retrieved from https://www.nabu.de/natur-und-landschaft/aktionen-und-projekte/meere-ohne-plastik/fishing-for-litter/index.html

National News Bureau of Thailand. (2019, December 4). รองผู้ว่าฯ สมุทรสงคราม เปิดโครงการรณรงค์จัดเก็บขยะในทะเล. Retrieved from http://122.155.92.12/centerweb/News/NewsDetail?NT01_NewsID=TCATG191204121350923

Newman, S., Watkins, E., Farmer, A., Brink, P. T., & Schweitzer, J.-P. (2015). The economics of marine litter. In *Marine anthropogenic litter* (pp. 367-394): Springer, Cham.

Noh, H., Kim, H., Kim, S., & Han, S. (2010). Buyback program for fishing gear and marine litter from fishery activities. *Marine debris prevention projects and activities in the Republic of Korea and United States: A compilation of project summary reports*, 3-8.

Northwest Pacific Action Plan. (2008). Marine Litter Management: The Approach of Incheon City, Republic of Korea.

Norwegian Ministry of Climate and Environment. (2017). *Update of the integrated management plan for the Norwegian Sea*. Retrieved from https://www.regjeringen.no/en/dokumenter/meld.-st.-35-20162017/id2547988/?ch=4

OSPAR Commission. (2007). *Background report on fishing-for-litter activities in the OSPAR region*. Retrieved from London, UK:

OSPAR Commission. (2014a). *Marine Litter Regional Action Plan*. London: OSPAR Secretariat.

OSPAR Commission. (2014b). *Overview and assessment of implementation reports Fishing for Litter (on Recommendation 2010/19)*. Retrieved from https://www.ospar.org/documents?v=7359

Perisse, M. (2019, October 9). La legge Salvamare sulle bottiglie di plastica arriva in Parlamento. Retrieved from https://www.gqitalia.it/news/article/legge-salvamare-bottiglie-plastica-cosa-dice-quanto-costa

Pollution Control Department. (2016). *National Solid Waste Master Plan*. Retrieved from http://www.pcd.go.th/public/Publications/print_waste.cfm?task=WasteMasterPlan

Pollution Control Department. (2017). *20-Year Pollution Management Strategy and Pollution Management Plan 2017-2021*.

Pollution Control Department. (2018). *Roadmap on Plastic Waste Management 2018 - 2030 and the Action Plan on Plastic Waste Management 2018 -2022*. Retrieved from http://www.pcd.go.th/Info_serv/File/17-09-62/40.pdf

Ras, B. R. (2019, May 1). Greece Pays its Fishermen to Recycle the Plastic Found in their Nets. Retrieved from https://www.goodnet.org/articles/greek-fishermen-are-paid-to-recycle-plastic-found-in-their-nets

Redazione. (2019, April 5). LOTTA ALLA PLASTICA Ambiente, ok del Governo al ddl "Salva-mare" sul recupero dei rifiuti in acqua – VIDEO. Retrieved from https://www.ilfaroonline.it/2019/04/05/ambiente-ok-del-cdm-al-ddl-salva-mare-sul-recupero-dei-rifiuti-in-acqua-video/268722/

Ronchi, F., Galgani, F., Binda, F., Mandić, M., Peterlin, M., Tutman, P., … Fortibuoni, T. (2019). Fishing for Litter in the Adriatic-Ionian macroregion (Mediterranean Sea): Strengths, weaknesses, opportunities and threats. *Marine policy, 100*, 226-237.

RYT9. (2018, September 13). กรมประมง จัดกิจกรรมจิตอาสา #ประมงไทยร่วมใจเก็บขยะทะเลเย็บอวนประมงที่ไม่ใช้แล้วเป็นถุงเก็บขยะทะเล. Retrieved from https://www.ryt9.com/s/prg/2886005

SALT. (2017). *Fishing For Litter som tiltak mot marin forsøpling i Norge*. Retrieved from https://salt.nu/wp-content/uploads/2019/02/FFL-Rapport-2017.pdf

Samutsongkhram Provincial Cooperative Auditing Office. (2019). สตส.สมุทรสงคราม ร่วมโครงการกำจัดขยะทะเลโดยชาวประมงไทย ณ ตลาดปลาสหกรณ์ประมงแม่กลอง จำกัด จังหวัดสมุทรสงคราม. Retrieved from https://www.cad.go.th/ewtadmin/ewt/Samutsongkhram/ewt_news.php?nid=1347

Save the North Sea. (n.d.). Reduce Marine Litter Save the North Sea Project Results. Retrieved from https://www.hsr.se/sites/default/files/content_media/save_the_north_sea_low.pdf

Sherrington, C. (2016). Plastic in the Marine Environment. Retrieved from https://www.eunomia.co.uk/reports-tools/plastics-in-the-marine-environment/

Sudhish, N. (2020, January 2). Suchitwa Sagaram runs out of steam. Retrieved from https://www.thehindu.com/news/national/kerala/suchitwa-sagaram-runs-out-of-steam/article30452603.ece

Surfers Against Sewage. (2014). *Marine Litter Report; 2014-2020 Vision*. St. Agnes.

UN Environment. (2018, May 24). Fishing for plastic from the sea. Retrieved from https://www.unenvironment.org/news-and-stories/story/fishing-plastic-sea

UNEP-IECTC. (2004). Environmental Management and Community Participation: Enhancing Local Programmes. Retrieved from http://www.chilesustentable.travel/wp-content/uploads/2013/08/ENVIRONMENTAL-MANAGEMENT-AND-COMMUNITY-PARTICIPATION-ENHANCING-LOCAL-PROGRAMMES_PNUMA-IETC_INGL%C3%89S.pdf

UNEP. (2017). *Marine Litter Socio-Economic Study*. Nairobi, Kenya: United Nations Environment Programme.

United Nations. (2017, June 1). Expand the project Fisheries for a Sea Without Litter to all fishing ports in the Portuguese mainland. Retrieved from https://oceanconference.un.org/commitments/?id=18169

United Nations Development Programme. (1993). *Human Development Report*. New York: Oxford University Press.

Vanichbuncha, K. (2018). การวิเคราะห์สถิติขั้นสูงด้วย *SPSS for Windows* (พิมพ์ครั้งที่ 13. ed.): ภาควิชาสถิติ คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย.

Vincenti, P. (2019, May 29). Italy approved the "Salvamare" bill: fishermen can collect plastic in the sea. Retrieved from https://www.smartgreenpost.com/2019/05/29/italy-approved-the-salvamare-bill-fishermen-can-collect-plastic-in-the-sea/

Waldron, B. (2019, January 4). Agents of Change: 4Ocean. Retrieved from https://www.surfer.com/blogs/agents-of-change/agents-of-change-4ocean/

Watkins, E., Brink, P., Withana, S., Mutafoglu, K., Schweitzer, J.-P., Russi, D., & Kettunen, M. (2015). *Marine Litter: Socio-economic study: Scoping Report*. Retrieved from

WWF Italy. (2019, October 24). La Camera approva il Salva Mare. Retrieved from https://www.wwf.it/news/notizie/?uNewsID=50241

Wyles, K. J., Pahl, S., Carroll, L., & Thompson, R. C. (2019). An evaluation of the Fishing For Litter (FFL) scheme in the UK in terms of attitudes, behavior, barriers and opportunities. *Marine Pollution Bulletin, 144*, 48-60. doi:https://doi.org/10.1016/j.marpolbul.2019.04.035

ANNEX I

Questionnaire

Instructions

1. This set of survey questionnaire is a part of the Master thesis by Mr. Phornphavit Thongphaijit, Environmental, Development, and Sustainability Programme, Graduate School, Chulalongkorn University
2. The respondents are owners of vessels or commanders
3. Marine litter collection includes the marine litter collection on board and floating marine litter

Part I Respondents' profile

1.1 Status

☐ Owner   ☐ Commander ☐ Other ....

1.2 Gender

☐ Male   ☐ Female

1.3 Age ....

1.4 Sources of income

☐ Only from fishing activities   ☐ There are others such as ....

1.5 Income from fishing activities per month

☐ 1) less than 5,000 Baht/month   ☐ 2) 5,001 - 10,000 Baht/month

☐ 3) 10,001 - 30,000 Baht/month   ☐ 4) 30,001 - 50,000 Baht/month

☐ 5) 50,001 – 70,000 Baht/month   ☐ 6) 70,001 Baht/month

1.6 Vessel name...

1.7 Types of fishing gears..

1.8 Vessel license plate ....

1.9 Time in fishing industry...........................**years (or month)**

1.10 Size of vessel

☐ 10 – 29.99 gross tonnage (S)   ☐ 30 – 59.99 gross tonnage (M)

☐ 60 – 149.99 gross tonnage (L) ☐ More than 150 gross tonnage (X)

1.11 The average time that fishermen spent at sea............ **time (s)/month** **with the average**..........**day (s)/time**

1.12 In the past year to recent, do you collect litter on board?

☐ Always   ☐ Sometimes   ☐ Never

1.13 In the past year to recent, do you collect floating marine litter?

☐ Always   ☐ Sometimes (skip to 1.15)   ☐ Never

1.14 In case you answer "never" in 1.12 or 1.13, Do you have reasons not to collect it? (You can check at most 2 choices)

     ☐ 1) There is no time to collect litter, I must focus on fishing

     ☐ 2) There is no place for litter on the vessel

     ☐ 3) There is no benefits for me

     ☐ 4) It is the governmental responsibility

     ☐ 5) Marine litter collection can cause dirtiness on the vessel

     ☐ 6) Other...

1.15 Are you participating in the marine litter collection schemes by the Department of Fisheries/Fisheries associations?

     ☐ 1) Do not participate

     ☐ 2) I am participating in Trash Back to Shores: Beautiful Seas with Our Hands

     ☐ 3) I am participating in other scheme ....

1.16 Why don't you participate in marine litter collection scheme (s)? (You can check at most 2 choices)

     ☐ 1) Did not know of the schemes

     ☐ 2) There is no time to collect litter, I must focus on fishing

     ☐ 3) There is no place for litter on the vessel

     ☐ 4) There is no benefits for me

     ☐ 5) It is the governmental responsibility

     ☐ 6) Marine litter collection can cause dirtiness on the vessel

     ☐ 7) Other ....

1.17 Why do you participate in marine litter collection scheme (s)? (You can check at most 2 choices)

     ☐ 1) For the good image of fishermen

     ☐ 2) Marine litter affects the amount of caught up fish

     ☐ 3) The requirement of cooperation from Fishermen associations and Department of Fisheries

☐ 4) Collected litter could generate income

☐ 5) Normally collect marine litter

☐ 6) Other....................................

Part II Marine litter management (Only those who collect marine litter)

2.1 How long have you in the marine litter collection practice ...year (S) ... month (S)?

2.2 The marine litter that you collect are

   ☐ litter on board   ☐ floating marine litter

2.3 Please indicate your mostly collected litter on-board (at most 3 boxes)

   ☐ Plastic bottle   ☐ Glass bottle   ☐ Can/Tin

   ☐ Discarded net   ☐ Plastic bags   ☐ Paper

   ☐ Other ....

2.4 Please indicate your mostly collected floating marine litter (at most 3 boxes)

   ☐ Plastic bottle   ☐ Glass bottle ☐ Can/Tin

   ☐ Discarded net   ☐ Plastic bags ☐ Paper

   ☐ Other ....

2.5 Do you sort collected marine litter?

   ☐ 1) Do not sort ☐   Sort for sale   ☐ Sort by type

2.6 How do you manage the collected litter?

   ☐ Throw at ports   ☐ bring back to nearby home's garbage

   ☐ Sale   ☐ Other ....

Part III Influencing factors to participation of marine litter collection schemes

Instruction: Please rate your level of agreement on each provided statement

Table 1 Attitudes towards marine litter collection

Statement	Level of agreement				
	1 Strongly disagree	**2** disagree	**3** neutral	**4** agree	**5** Strongly agree
3.1 Marine litter collection schemes could greatly diminish marine litter					

Statement	Level of agreement				
	1 Strongly disagree	**2** disagree	**3** neutral	**4** agree	**5** Strongly agree
3.2 The participation of marine litter schemes resulted from the understanding of marine litter problems					
3.3 Marine litter contributed to marine environmental problems					
3.4 The fishing activities cause marine litter					

Table 2 Agreement on marine litter collection schemes

Statement	Level of agreement				
	1 Strongly disagree	**2** disagree	**3** neutral	**4** agree	**5** Strongly agree
3.5 Time is a limitation for marine litter collection					
3.6 Space of the vessels could cause the marine litter collection practice					
3.7 The participation of marine litter collection programmes is difficult, there is a need to adjust my vessels					
3.8 Marine litter collection could contaminate the caught-up fish and other marine wildlife					
3.9 Marine litter collection poses danger to you and your crews (injuries)					
3.10 The news and media on marine animals injure from marine litter affects the participation of fishermen					
3.11 The public relations of marine litter collection schemes are important for the participation					
3.12 Your family is an important part for your intention to participate/not-participate					

Statement	Level of agreement				
	1 Strongly disagree	**2** disagree	**3** neutral	**4** agree	**5** Strongly agree
3.13 Other fishermen are an important part for your intention to participate/not-participate					
3.14 Fisheries associations are an important part for your intention to participate/not-participate					
3.15 Do you agree with the context of non-financial incentives in the marine litter collection schemes in the future? (If the marine litter collection schemes have non-financial incentives, you will participate?)					
3.16 Do you agree with the context of financial incentives in the marine litter collection schemes in the future? (If the marine litter collection schemes have financial incentives, you will participate?)					
3.17 Your usual marine litter collection practice contributes to the participation (Your usual marine litter collection practice could contribute to the participation in the future)					
3.18 The readiness of waste reception at ports is essential for marine litter collection practice					
3.19 If the schemes have proper waste management, you will continue do the practice in the schemes? (If the schemes have proper waste management, you will participate in the schemes?)					

Table 3 Satisfaction on marine litter collection schemes

Statement	Level of satisfaction				
	1 completely dissatisfied	**2** dissatisfied	**3** neutral	**4** satisfied	**5** completely satisfied
3.20 Do you satisfy with the governmental policies on marine litter issues?					
3.21 Do you satisfy with the public relations of the marine litter collection schemes?					

Part IV Marine litter issues questions

4.1 Do you know that Thailand is on the 6th rank that littering marine litter?

☐ I know ☐ I do not know

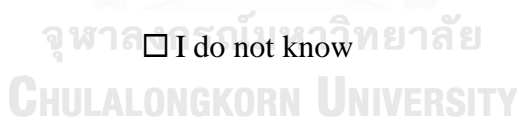**4.2 Do you know that there are schemes that recycle and upcycle marine litter?**

☐ I know ☐ I do not know

4.3 Do you know that marine litter is difficult to naturally degraded?

☐ I know ☐ I do not know

4.4 Do you know that marine litter can degrade into small particles, called micro plastics? It can contaminate and danger you caught up marine lives.

☐ I know ☐ I do not know

Part V Suggestion for the marine litter management improvement

....

....

....

....

Thank you

VITA

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