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# An evaluation of the Fishing For Litter (FFL) scheme in the UK in terms of attitudes, behavior, barriers and opportunities

Wyles, Kayleigh

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1 **Running Header:** FISHING FOR LITTER

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9 **An Evaluation of the Fishing For Litter (FFL) Scheme in the UK in terms of Attitudes,**

10 **Behavior, Barriers and Opportunities**

11

12 Wyles, Kayleigh. J.\*<sup>1,2</sup>, Pahl, Sabine\*<sup>2</sup>, Carroll, Lauren<sup>2</sup>, & Thompson, Richard C.<sup>3</sup>

13 <sup>1</sup> School of Psychology, University of Surrey, Guildford, Surrey, GU2 7XH, UK

14 <sup>2</sup> School of Psychology, University of Plymouth, Drake Circus, Plymouth PL48AA, UK

15 <sup>3</sup> School of Biological and Marine Sciences, University of Plymouth, Drake Circus, Plymouth

16 PL48AA, UK

17

18 \* Please address correspondence to either Kayleigh Wyles or Sabine Pahl

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5 and the Southwest) and participating in the research.

## 6 **Abstract**

7 Marine litter is a global, persistent, and increasing threat to the oceans, and numerous initiatives aim  
8 to address this challenge. Fishing For Litter (FFL) is a voluntary clean-up scheme, where litter is  
9 collected as part of routine fishing operations. We surveyed fishers ( $n=97$ ) and stakeholders ( $n=22$ ) in  
10 the UK to investigate perceptions of FFL, its strengths and weaknesses, and potential co-benefits of  
11 the scheme. Fishers reported being aware of and concerned about the negative impacts of litter.  
12 Overall, FFL was evaluated very positively (7.85/10). In addition, FFL fishers reported less  
13 environmentally harmful waste management behaviors both out at sea and at home than did non-FFL  
14 fishers. Fishers and stakeholders listed strengths and weaknesses of the scheme and made suggestions  
15 for future changes. As well as directly helping to remove litter, this paper demonstrates that clean-up  
16 schemes make a contribution to addressing the underlying causes of marine pollution.

17

## 18 **Keywords:**

19 Passive fishing for litter; fishing industry; behavior change; spillover; motivations; debris

20

## 1. Introduction

Marine litter is widely seen as an important global issue (Potts et al., 2016; Sutherland et al., 2010). Developed by KIMO (Local Authorities International Environmental Organisation), the Fishing For Litter (FFL) scheme focuses on removing litter already present in the marine environment. FFL targets the fishing community specifically that has unique access and a capability to collect litter that is accumulating in the water column and on the sea bed. Evidence about the tonnage collected through FFL and similar schemes have been documented (e.g. Cho, 2005; 2009; KIMO, 2014; Van Breusegem et al., 2015), but little is known about the co-benefits of the scheme: It is currently not known if FFL has additional impacts beyond removing litter from the sea, specifically effects on the participating fishers themselves, their perceptions and waste-related behaviors (both at work and at home). It is also unclear which aspects of the scheme work well and which aspects could be improved. We investigated these questions using quantitative and qualitative social research methods with commercial fishers and stakeholders, comparing fishers that were part of the program and those that were not.

### 1.1 Marine Litter: The Problem and Potential Solutions

Marine habitats are contaminated with human-made debris from the poles to the equator and from shorelines to the depths of the ocean (Thompson et al., 2009). Marine litter (or debris) is defined as any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment (Galgani et al., 2010). While this definition encompasses a wide range of materials, most items, typically around 70%, are plastic (Buhl-Mortensen & Buhl-Mortensen, 2017; Galgani et al., 1995; OSPAR, 2007; Nelms et al., 2017; UNEP, 2005). In addition to being abundant and slow to degrade in the marine environment (Barnes et al., 2009), marine litter can have a range of lethal and sub-lethal effects on wildlife through ingestion, entanglement, and chemical contamination (Gall & Thompson, 2015; Holmes et al., 2012; Kershaw et al., 2011; Mato et al., 2001; Teuten et al., 2009). Its impacts on people are diverse, impacting marine users from recreational visitors (e.g. risk of injury, aesthetic detriment; Santos et al, 2005; UNEP, 2016; Wyles et al., 2016) to economic sectors that are dependent on the marine environment (Beaumont et al., 2019; GESAMP, 2016). For example, considering costs of cleaning up, loss of fishing gear, and damage to vessels and

1 equipment, McIlgorm and colleagues (2011) estimated that marine litter costs approximately  
2 USD1.26bn per year for the Asia-Pacific Economic Cooperation region alone. As well as being  
3 impacted by marine litter, these land-based and sea-based sectors all contribute to the problem. Whilst  
4 the source of marine litter in a particular area is dependent on oceanographic processes, distance from  
5 shore and human activities, the underlying cause is the same: human behavior (Galvani et al., 1995;  
6 see UNEP & GRIDA, 2015 and Veiga et al., 2016).

7 To address this global issue, a combination of actions is needed to reduce quantities of marine  
8 litter in the environment, both in terms of addressing the symptom (litter in the environment) and  
9 original source (before it becomes waste; e.g., Vince & Hardesty, 2018; Willis, Maureaud, Wilcox &  
10 Hardesty, 2018). These can focus on 1) improving product design and recyclability so that items do  
11 not become waste (e.g. a circular economy); 2) improving waste management on land to reduce  
12 quantities entering the sea; 3) removing litter already present in the marine environment; and 4)  
13 behavior change campaigns to empower individuals to engage and behave sustainably either by  
14 following practices that minimize the amount entering the environment and/or engaging in acts that  
15 help remove items already in the environment (Willis et al., 2018). There has been growing attention  
16 on land-based solutions (Hartley, Thompson, & Pahl, 2015; Hidalgo-Ruz & Thiel, 2013; Wyles et al.,  
17 2017); however, an important group of stakeholders, commercial fishers, have been under-researched.  
18 Fishers play a key role in terms of marine litter, as they can easily add to it (e.g. through loss of gear  
19 leading to ghost-fishing, discarding household waste whilst out at sea; Veiga et al., 2016) but also  
20 help address it (they uniquely work in remote areas of the oceans, enabling them to access marine  
21 litter that would otherwise be neglected; Cho, 2009; 2011). Consequently, several schemes have been  
22 devised to engage this group.

23 Schemes involving commercial fishers can be classed as either *passive fishing for litter* that  
24 focuses on collecting marine litter during day-to-day fishing activity with no financial incentive or  
25 *active fishing for litter* where fishers make purposeful trips to collect litter in specific locations and  
26 get paid (UNEP, 2015; Van Breusegem et al., 2015). One established example of the passive fishing  
27 for litter scheme is KIMO's Fishing For Litter (FFL) scheme where fishers volunteer to be part of the  
28 scheme. This scheme works by providing participating fishing vessels with 1m<sup>3</sup> hardwearing bags, to

1 store any litter they pick up in their nets whilst out at sea. Once the bags are full, they are landed and  
2 moved to designated FFL skips. Litter in the skips is taken away for disposal, and, where possible,  
3 sorted, weighed, recorded and recycled (FFL, 2018a). The FFL scheme is now a recognized initiative  
4 internationally, expanded from an original pilot scheme by the North Sea Directorate of the Dutch  
5 Government in co-operation with the Dutch Fisheries Association in March 2000 (Van Breusegem et  
6 al., 2015). In the UK, FFL schemes currently exist in two regions: Scotland (since 2005) and South  
7 West England (since 2007; FFL, 2019). These schemes have been led by KIMO with funding from a  
8 range of sponsors (i.e. national governments, local councils, port authorities, and fishing  
9 organizations). In the latest reports, 214 vessels were part of the Scottish FFL scheme and 177 vessels  
10 were part of the South West scheme, and they could land and collect new bags at 15 harbors in  
11 Scotland and 11 in the South West. As a result, more than 1,000 tons of marine litter has been  
12 collected in these schemes since inception (FFL, 2018a; 2018b).

13 KIMO's FFL scheme has two primary aims: 1) to reduce the amount of marine litter in our  
14 oceans by physically removing litter from the seabed and marine environment, and 2) to increase  
15 awareness amongst the fishing industry that it is not acceptable to throw marine litter overboard, with  
16 the intention to change fishers' attitudes and behaviors with regard to waste disposal. In addition, they  
17 have two more secondary aims: 3) to monitor the marine litter coming ashore (i.e. recording  
18 abundance by weight and composition, usually by the FFL liaison office), and 4) to investigate the  
19 possibility of recycling the litter (FFL, 2018a; 2018b).

20 Drawing on behavioral science literature, behavior change (aim 2) can be motivated by two  
21 types of motives: intrinsic motives are personally meaningful because they are guided by personal  
22 values and norms whereas extrinsic motives are driven by external influences such as a financial  
23 reward (Varotto & Spagnoli, 2017). As demonstrated when comparing different household recycling  
24 schemes, behaviors that have an intrinsic motive are more likely to re-occur than those that are  
25 motivated by a reward or punishment (De Young, 1993; Miafodzyeva, 2013; Varotto & Spagnoli,  
26 2017). In relation to managing waste at sea, Cho (2011) highlighted the risk of active fishing for litter  
27 schemes that taps into extrinsic motivation, arguing that there is a risk that they may create incentives  
28 to litter. Thus, by focusing on fishers' more intrinsic motives rather than financial rewards, the FFL

1 scheme may facilitate changing fishers' behavior (e.g. collecting and retaining waste found) during  
2 the life time of the scheme but potentially also thereafter. As well increasing the chances of more  
3 long-term effects, targeting intrinsic motives and raising awareness has also been found to have  
4 additional 'spillover' effects (where an intervention has an impact on subsequent behaviors not  
5 directly targeted by it; Poortinga, Whitmarsh, & Suffolk, 2013; Thøgersen & Ölander, 2003). In the  
6 context of FFL, whilst the scheme focuses on specific behaviors (keeping litter caught in the hauls and  
7 returning it to port), by learning about the issue and how individuals contribute to the problem and  
8 solution, it may act as an intrinsic motive to also change other behaviors (such as disposing of litter  
9 whilst out at sea, but also waste-related behaviors at home). Thus whilst there is evidence that the  
10 types of approaches FFL have adopted have been effective in behavior change in other contexts and  
11 populations, no work has yet examined the fishing population, explicitly looking at whether the  
12 scheme has promoted greater awareness and a change in behavior within the fishing industry.

## 13 **1.2 Present Research**

14 Whilst KIMO's FFL is being monitored in terms of marine litter retrieved (Basurko, 2015;  
15 Cho, 2009; FFL, 2018a; 2018b), its wider impacts on the fishers themselves has not been investigated.  
16 Thus, assessing fishers' and stakeholders' perceptions, attitudes and behaviors would advance our  
17 understanding of these types of programs and provide pointers for further development. The present  
18 research therefore assessed the association between participation in the scheme and fishers' attitudes  
19 and self-reported behaviors, and we asked fishers and stakeholders about the barriers and  
20 opportunities regarding the scheme in order to make suggestions for its future. Using quantitative data  
21 for general trends across the individuals, the results compare overall ratings of FFL between fishers  
22 that were part of FFL, fishers that were not part of FFL, and other stakeholders; then focus on  
23 commercial fishers' perceptions of litter and the FFL scheme more specifically; and finally using  
24 qualitative data to report more in-depth insights from key stakeholders using interviews.

## 25 **2. Method**

### 26 **2.1 Sites**

27 In 2014, the FFL scheme within the UK was examined. At that time, 6,399 fishing vessels  
28 were registered in the UK, landing £718 million worth of fish (€802 million; Marine Management

1 Organisation, 2014), with the largest ports located in Scotland (e.g. Peterhead, Lerwick, and  
2 Fraserburgh) and the South West of England (Brixham, Plymouth, and Newlyn). Fourteen harbors  
3 and 210 vessels were part of the Scottish FFL scheme (with the majority of vessels registered at  
4 Fraserburgh, Peterhead and Lerwick, and 8 harbors and 130 vessels were part of the South West  
5 scheme (with the majority registered at Newlyn and Brixham (FFL, 2014).

## 6 **2.2 Design**

7 Two different approaches were adopted for fishers and other stakeholders, respectively: 1) a  
8 questionnaire consisting of quantitative and short qualitative questions was used for the fishers; this  
9 was either completed independently online, or used by the researchers in an interview-style when  
10 approaching fishers in person or over the phone, and 2) a similar but separate set of questions was  
11 used in structured interviews with stakeholders. Both approaches followed full ethical protocol and  
12 received ethical approval from the University of Plymouth Ethics Board, following discipline specific  
13 (British Psychological Society, 2009), university and national protocols.

## 14 **2.3 Participants**

### 15 **2.3.1 Fishers**

16 The study was open to all active UK commercial fishers, with greater attention in the harbors  
17 that provide FFL facilities within Scotland and the South West. Due to the difficulty of reaching this  
18 specialized community (e.g. fishers being at sea sometimes 6-10 days at a time), a number of  
19 recruitment approaches were adopted between February and April 2014:

- 20 1) Sending flyers directly to fishers' home addresses
- 21 2) Approaching fishers in person on quayside or in popular cafes or public houses near four harbors  
22 in the South West (Plymouth, Brixham, Mevagissey, Newlyn), and five harbors in Scotland  
23 (Fraserburgh, Peterhead, Eyemouth, St Abbs, Dunbar)
- 24 3) A communication campaign where posters were placed in locations frequented by fishers,  
25 including harbor notice boards and fishing association buildings, as well as online (fishing  
26 websites and social media) and in printed media (in Fishing News)
- 27 4) Seeking personal recommendations by those that had previously helped with the survey  
28 ('snowballing')



1 Due to the variety of approaches, it was not possible to calculate an overall response rate.  
2 One-hundred and thirty-nine people volunteered in the study. After omitting respondents who were  
3 not active commercial fishers in the UK and incomplete responses, the final sample consisted of 97  
4 commercial fishers (see Table 1 for a detailed breakdown). These fishers were all male and between  
5 17 and 70 years old ( $M$  age = 43.00,  $SD$  = 12.17). They had been in the fishing industry, on average,  
6 for 25 years and mainly identified as skipper owners, skippers, or deckhand/crew/mates. The average  
7 size of vessels was 19 meters with 4 crew members. The most common fishing practice reported was  
8 towed demersal fishing. Across the sample, 28 home ports were represented from across the UK (47%  
9 in the South West and 41% in Scotland), with the highest proportion coming from Peterhead (17%),  
10 Mevagissey (13%), and Brixham (11%). Forty-nine fishers said they were actively participating in  
11 FFL; 45 fishers said they were not; 3 did not provide an answer (so could not be included in later  
12 analyses that compare FFL and non-FFL fishers).

13 *[insert Table 1 here]*

### 14 **2.3.2 Other stakeholders**

15 Through initial desk-based research that highlighted the key stakeholders of the scheme and  
16 following informal discussions with FFL staff, purposeful sampling was used to recruit 22  
17 stakeholders (see Table 1 for details on participant profile). Eight stakeholders were directly involved  
18 in the organization of the FFL scheme (either in terms of administration, managing the project, or  
19 liaising with fishers). The remaining 14 stakeholders had roles within harbor authorities, funding  
20 organizations, government, fishing associations, environmental organizations or waste disposal.  
21 Stakeholders had been involved in the scheme for four years on average (0-10 years range).

## 22 **2.4 Questionnaire and Interview Materials**

### 23 **2.4.1 Ratings of the FFL scheme: Fishers and stakeholders**

24 All participants were asked to rate the scheme overall and for each FFL objective: Removing  
25 marine litter, raising awareness, and monitoring marine litter. To increase sensitivity in responses to  
26 enable later analyses (Breakwell et al., 1995), ratings were given on a scale from 1 (*very poor*) to 10  
27 (*very good*).

### 1   **2.4.2   Questionnaire for fishers**

2           Four sets of questions focused on 1) marine litter, 2) waste management, 3) the FFL program,  
3   and 4) demographics. To yield quantitative social data, agreement to a range of statements based on  
4   psychological frameworks were used on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*;  
5   Ajzen, 1985). For example, within the waste management section, statements examined a variety of  
6   behaviors, from FFL targeted behaviors (*If I find rubbish at sea, I keep hold of it so it can be disposed*  
7   *of on land*) to work-related waste behaviors (*I sometimes throw unwanted stuff over board when at*  
8   *sea*) to more private behaviors (*I reduce rubbish going into the sea wherever I can, both whilst at*  
9   *work and during my leisure time*). This facilitated greater understanding of waste management  
10   behaviors and enabled us to examine potential spillover (Poortinga et al., 2013; Thøgersen & Ölander,  
11   2003)

12           Qualitative data were gathered by asking all fishers that had heard of the scheme what was  
13   good about it and how it could be improved (open response). For those actively participating in the  
14   scheme, additional open questions queried their motive for joining and whether their attitude and  
15   behavior about waste had changed since joining. For those not part of the scheme, two open questions  
16   examined their reason for *not* joining and asked what would encourage them to become involved. Due  
17   to the interviewing conditions (e.g. loud harbor workings) and the brevity of fishers' responses,  
18   qualitative responses were verbatim noted by the researchers rather than audio-recorded. See  
19   Supplementary Materials for the full questions.

### 20   **2.4.3   Structured interview for stakeholders**

21           Similar to the fishers' questionnaire, the interviews included questions about 1) perceived  
22   barriers or problems to the current running of the FFL scheme, and potential solutions to these, 2)  
23   good things about the scheme, 3) general recommendations, and 4) monitoring procedures in terms  
24   recording amount and composition of litter being deposited. Participants were asked to explain the  
25   length and nature of their involvement, and demographic data were obtained at the end (see  
26   Supplementary Materials for the full interview schedule) . All interviews were audio recorded and  
27   later transcribed. Interviews varied in length from 7 minutes to 1 hour.

## 1 **2.5 Analysis**

2 In order to examine general trends across participants' responses, average scores (and  
 3 standard deviations) were calculated for the quantitative ratings, in order to run a number of  
 4 descriptive and inferential statistical analyses. To examine whether responses statistically differed  
 5 from the mid-point of the scale, one-sample t-tests were used. Differences between subgroups (1.  
 6 stakeholders, 2. fishers who participate in the FFL scheme, and 3. fishers not involved in the scheme)  
 7 were analyzed with parametric and non-parametric tests, depending on whether statistical assumptions  
 8 were met (i.e. analysis of variance and Games-Howell post-hoc tests compared stakeholders, FFL  
 9 fishers and non-FFL fishers). To be able to provide complementary more detailed analyses, the  
 10 qualitative responses were analyzed according to thematic analysis procedures (Braun & Clarke,  
 11 2006). This involved examining responses initially to identify prominent recurring themes, these  
 12 themes were then developed further by re-reviewing the data, developing a clear summary of what  
 13 that theme addresses, and highlighting illustrative quotes for each one whilst maintaining the  
 14 anonymity of the individuals. This gave a rich in-depth account of this particular sample's views.

## 15 **3. Results**

### 16 **3.1 Ratings of the FFL scheme: Fishers and stakeholders**

17 When collapsing across all groups of participants, the rating data showed that the FFL scheme  
 18 was evaluated positively overall and for the individual aspects:  $M = 7.85$  ( $SD = 1.90$ ) overall,  $M =$   
 19  $6.89$  ( $SD = 2.22$ ) for removing rubbish,  $M = 6.43$  ( $SD = 2.26$ ) for raising awareness, and  $M = 6.05$  ( $SD$   
 20  $= 2.29$ ) for monitoring litter (all out of 10). When we compared the different groups (see Figure 1),  
 21 analyses of variance (ANOVAs) found the three groups gave similar responses for rating the latter  
 22 aspects (raising awareness and monitoring litter;  $ps > .17$ ) but did statistically differ for the overall  
 23 rating of the scheme,  $F(2,92) = 5.51$ ,  $p = .004$ , partial  $\eta^2 = .11$  (small effect size, Cohen 1992); and  
 24 when evaluating removing of rubbish,  $F(2,87) = 13.49$ ,  $p < .001$ , partial  $\eta^2 = .24$  (medium effect size).  
 25 Specifically, post-hoc analyses found that stakeholders and fishers who were part of FFL rated the  
 26 scheme overall more highly than did fishers who were not part of FFL ( $ps < .02$ ). The same pattern  
 27 was found for the objective to remove litter, again stakeholders and FFL fishers thought this was more  
 28 successful than non-FFL fishers did ( $ps < .04$ ). No other significant differences were found.

1 [Figure 1 here]

## 2 3.2 Fishers' Perspectives on Litter and the FFL Scheme (Quantitative data)

### 3 3.2.1 Overall awareness and FFL participation

4 Fishers were asked whether they had heard of the FFL scheme and how much they knew  
5 about it. Eighty-three fishers (86%) had heard of the scheme, 14 had not (14%). Of those that had  
6 heard of the scheme, 47% said they knew the basic idea of the scheme, 31% knew a bit about the  
7 scheme, and 22% knew a lot about the scheme. This analysis shows that there is good awareness of  
8 FFL in fishing communities, even if not everyone actively takes part in the scheme.

### 9 3.2.2 Similarities and differences in perceptions between fishers that were part of FFL and 10 those that were not

11 **Similarities.** When examining fishers' ratings of specific statements (from *strongly disagree*  
12 (1) to *strongly agree* (5)), it was found that fishers responded similarly to the majority of the  
13 statements regardless if they were participating in the FFL scheme or not (see non-boldface in Table  
14 2;  $ps > .06$ ). Overall, fishers did not agree nor disagree on the impacts marine litter can have on the  
15 wildlife or on their fishing boats and equipment, nor did they state they challenge other people's  
16 littering and waste-related behaviors (see Table 2; statements (i), (j) and (x)). However, for the  
17 remaining 22 statements, fishers expressed strong views, with one-sample t-tests finding that the  
18 scores were statistically different to the neutral mid-point of the scale ('3', see asterisks in Table 2).  
19 We found that fishers were concerned about the impacts of marine litter and saw it as a serious  
20 problem with probably lasting damage (Table 2 (a), (d), and (f)). Both groups significantly agreed that  
21 marine litter is often seen in their hauls (Table 2 (b)). Fishers believed that commercial users such as  
22 fishers, shipping, or off-shore industries are responsible for dealing with marine litter, but that others  
23 can and should contribute to the solution (Table 2 (r) and (s)). They reported that it was extremely  
24 important to manage waste responsibly at sea and on the coast, and keeping the sea and coasts clean  
25 was important to them (Table 2 (l) and (q)). They believed that similar attitudes were held throughout  
26 the fishing industry and said that most fishers cared about disposing of waste in a responsible manner  
27 (Table 2 (o)). As demonstrated by the high average scores ( $M = 4.82$ ,  $SD = 0.48$ ), fishers strongly  
28 agreed that it was up to them what happened with rubbish produced whilst out at sea, indicating they

1 assumed responsibility (Table 2 (m)). They stated that, in general, it was not time consuming nor  
 2 effortful to manage the waste on-board (Table 2 (n)). These ratings show that the fishers surveyed  
 3 overall care about, are aware of and feel responsible for marine litter. On all these aspects, fishers who  
 4 were part of FFL did not differ from those who were not part of FFL.

5 *[Table 2 here]*

6 **Differences.** There were also four differences between those that were actively participating  
 7 in FFL and those that were not (Table 2, boldface). As would be anticipated, in line with the FFL  
 8 scheme's objectives, FFL fishers reported that they keep hold of any rubbish they found at sea on-  
 9 board, more than the non-FFL fishers did,  $U = 505.00$ ,  $Z = 4.70$ ,  $p < .001$  (Table 2 (u)). However,  
 10 further differences were found. First, non-FFL fishers believed that the presence of marine litter was  
 11 increasing,  $U = 819.50$ ,  $Z = 2.05$ ,  $p = .04$ , more so than the FFL fishers (Table 2 (e)). In terms of  
 12 behavior, FFL fishers more strongly disagreed that they sometimes throw things overboard,  $U =$   
 13  $671.00$ ,  $Z = 3.61$ ,  $p < .001$  (Table 2 (t)), and reported they reduced rubbish going into the sea more,  
 14 both at work and during their leisure time, than did non-FFL fishers,  $U = 835.50$ ,  $Z = 2.78$ ,  $p = .005$   
 15 (Table 2 (w)). Open-ended comments explore these differences further and are reported next.

### 16 **3.3 Fishers' Perspectives on the FFL Scheme (Qualitative data)**

#### 17 **3.3.1 Fishers who were part of FFL ( $n = 49$ ) – motivations, positive change and barriers**

18 The motives for joining the scheme fell within five reasons (or themes): Fishers wanted to  
 19 reduce litter in the seas; were already bringing back rubbish and therefore the scheme made it easier  
 20 and more convenient; and to promote the benefits of cleaner seas (see Table 3 left hand column for  
 21 examples of quotes). Other reasons noted were because it was a socially accepted practice and helped  
 22 raise the profile and reputation of their industry. Linked to these motives, fishers also noted numerous  
 23 benefits of the scheme, both in terms of raising awareness about marine litter in the industry but also  
 24 the impact the scheme is having on the presence of litter in their waters. Fishers told us they observed  
 25 less litter being retrieved in their catch. This was directly associated with mentioning "*cleaner and*  
 26 *more attractive beaches*", "*stops wildlife and that getting harmed from it*", and "*...improving my*  
 27 *fishing, less rubbish and more fish being caught. Definitely year on year we're seeing less and less*  
 28 *litter...*"

1 *[Table 3 here]*

2 As well as noting impacts on the environment, fishers also reflected on impacts participating  
3 in the scheme has had on themselves that the salience of the issue and their behaviors had changed  
4 since volunteering for the FFL scheme. For example, fishers noted that the scheme was seen to make  
5 themselves more conscious of their actions, the FFL-branded bags on the harbor were seen as a  
6 continuous reminder, and as a result, fishers reported changing their behaviors both at sea and at home  
7 (see Table 3), in line with the quantitative ratings in Section 3.2.2.

8 Whilst FFL fishers recognized the positive impacts of the scheme, we also gave them the  
9 opportunity to identify ways for the scheme to go forward. One theme highlighted that participants  
10 did not identify areas of improvement and were generally satisfied with the running of the scheme  
11 (Table 3). However, other suggestions fell within four themes: 1) to continue raising awareness about  
12 the issue and the scheme among the industry, with some groups specifically identified, such as  
13 skippers and the young generation of fishers; 2) practical solutions (e.g. more secure bags, and smaller  
14 bags for smaller ships); 3) to increase the scope of the scheme to include other marine users; and 4) to  
15 improve port facilities and involvement (either by providing more recycling facilities in the ports or  
16 simplifying the process further by not requiring any form of sorting to encourage more waste to be  
17 retrieved and retained on board).

### 18 **3.3.2 Fishers who weren't part of FFL ( $n = 45$ ) – reasons for not participating and what** 19 **would encourage them**

20 When asked the reason for not participating in the scheme, three reasons (themes) were  
21 expressed. Two reasons were due to lack of information or that the scheme was seen to not be  
22 applicable to their fishing practices (e.g. they never catch litter in the first place using their fishing  
23 methods and sites, or their vessels were too small to accommodate the scheme; see Table 3). Other  
24 reasons involved a lack of choice (such that it is the skippers' responsibility to sign up to the scheme),  
25 time and/or interests (see Table 3 right hand column).

26 In terms of methods of encouragement to consider the scheme, six themes emerged (see Table  
27 3). One was that the scheme was not applicable to their practices, therefore could not suggest any  
28 motives for joining in the future. The remaining fishers made numerous suggestions (see Table 3).

1 Similar to the fishers already engaged with the scheme (Section 3.2.3), there was an emphasis on the  
2 provision of more information about the problem, the scheme itself, and the benefits (and ease) of  
3 volunteering. The suggestion of monetary and non-monetary incentives was also noted (Table 3).  
4 Linked to this, getting more external support was also noted, for example, by making the FFL  
5 compulsory or part of a certification, which in turn will promote their sales.

### 6 **3.4 Stakeholders' Views of the FFL Scheme (Qualitative data)**

#### 7 **3.4.1 Strengths of the FFL scheme**

8 When asked what worked well, stakeholders pointed out a clear growing momentum as  
9 overall evidence for success. Specific good points fell within four themes: The organization of the  
10 project, the ability to raise awareness, reducing litter in the marine environment, and producing a feel  
11 good factor for those participating (see Table 4 for illustrative quotes).

12 *[Table 4 here]*

13 The **organization of the project** was seen as a positive aspect due to its simplicity, and the  
14 passive approach (fishers retaining marine litter caught in their hauls) was seen as a key advantage.  
15 Stakeholders noted that the FFL scheme is already part of the Responsible Fishing Scheme  
16 (contradictory to the non-FFL fishers noted above who were evidently unaware of this link),  
17 stakeholders perceived this certification might be useful in motivating fishers to participate. The  
18 decision *not* to pay the fishers was also noted as an advantage of the scheme. The stakeholders felt  
19 this made the scheme more affordable but also meant fishers engaged for reasons other than monetary  
20 compensation, building intrinsic rather than extrinsic motivation.

21 Stakeholders reported successful **awareness raising** as a key positive aspect. They reflected  
22 on their personal experiences, that the scheme helped to inform and make fishers aware of the  
23 ecological and economic importance of marine litter impacts. This awareness raising was thought to  
24 extend to the general public and improve the image of the fishing industry. They noted that as the  
25 fishing community often receives negative press, FFL was seen to help to show this community in a  
26 more positive light and demonstrate to the public the level of concern and proactive response to the  
27 issue of marine litter.

1           Unsurprisingly, as the primary aim of the FFL scheme, another positive aspect explicitly  
2 noted by stakeholders was the **reduction of litter in the marine environment**. This included noting  
3 that the FFL scheme is helping to clean up the marine environment, and that the scheme was unique  
4 as it focuses on often neglected areas inaccessible to anyone else but fishers. As well as removing  
5 rubbish, the scheme was also felt to help discourage rubbish entering the marine environment. Linked  
6 with raising awareness and the lack of payments to fishers, it was suggested that the scheme facilitates  
7 behavior change in the fishers themselves. Stakeholders reported that fishers were less likely to litter  
8 after joining the scheme and being more aware of the prevalence, impacts and importance of marine  
9 litter (as directly supported by our data on the fishers themselves above). In addition, a reduction in  
10 the risk of litter-related vessel damage and an improvement in fish landings were mentioned as a  
11 positive outcome.

12           The final theme related to a general feel-good aspect, FFL being a **good thing to do**,  
13 emphasizing that the scheme was something to be proud of and feel good about by being involved.  
14 This emotional ‘warm-glow’ effect could be linked to intrinsic, long-term motivation, and potentially  
15 even to increased well-being in the fishers themselves.

### 16 **3.4.2 Barriers and problems**

17           Responses around barriers fell into five key themes: Resources, participation, raising  
18 awareness, waste monitoring, and waste disposal (see Table 4).

19           The first theme related to **resources**. While specific elements of the scheme were noted to  
20 take up considerable resources (e.g. publicizing and recruitment), the biggest cost was thought to be  
21 associated with the waste itself (the FFL bags, waste collection and disposal). The greatest emphasis  
22 was on landfill tax, seen not only as a significant and increasing cost, but also an unfair cost (see  
23 example in Table 4). Stakeholders believed that FFL waste should not be subject to the same tax as  
24 other rubbish, as it has been voluntarily removed, and was not necessarily produced by fishing  
25 industries. Financial resources were a key concern and seen as an important limitation to expanding  
26 the scheme. For example, it was noted that more fishers and ports have expressed an interest in the  
27 scheme but had to be declined due to lack of funds.



1           Whilst there was noted interest in the scheme in other ports, the second theme related to  
2 difficulties encouraging **participation in the scheme** (both initial and continued involvement).  
3 Demands on fishers were seen as an influential barrier (space on board, work load and conditions).  
4 For example, stakeholders reflected that when out at sea for five to ten days at a time, the crew have  
5 to sort fish (and marine litter) in uncomfortable conditions for each haul every few hours. Second,  
6 harbor characteristics may prevent vessels from joining, e.g. if harbor staff are not visibly engaged in  
7 FFL. Smaller ports (e.g. in the South West) were seen to have more difficulties in engaging. Finally,  
8 stakeholders mentioned barriers relating to the fishers, such as their motivation and understanding of  
9 the scheme and marine litter. Stakeholders observed that fishers were sometimes skeptical of  
10 environmental campaigns, and disliked registering their details. For example, it was explained that  
11 fishers are targeted by the media as fishing practices can damage the environment and threaten fish  
12 stocks. This could lead to a feeling of victimization, and to avoiding any publically visible  
13 engagement in campaigns. It was noted that skipper owners were more likely to be pro-active due to a  
14 greater motivation to protect the environment and to be associated with a scheme that helps them look  
15 positive.

16           Stakeholders highlighted some barriers relating to **raising awareness** of the scheme. Fishers  
17 can be difficult to communicate to due to being based at different harbors, and frequently being out at  
18 sea. It was also noted that the scheme relies largely on skippers passing on the information and  
19 instructions to the crew. It was voiced that it is not possible to really know if and how information is  
20 passed on.

21           A weakness relating to the **litter data FFL collects** was also noted, specifically the two forms  
22 of data collected: overall tonnage and a more detailed record of composition. Stakeholders stated that  
23 the data gathered by the scheme were not very rigorous and systematic, for example the tonnage may  
24 be underestimated, e.g. if fishers take items with a resale value out of skips (e.g. steel), or  
25 overestimated, e.g. if there is non-FFL litter in the skips. It was also noted that FFL lacked useful  
26 information about the origin (location & depth) and potential sources of the litter, and that there was  
27 ambiguity about what constitutes as marine litter and thus should be retained and brought back to the  
28 harbor.

1           In terms of the **disposal of the waste**, comments discussed what should be done with the  
2 waste. Stakeholders noted that the majority went to landfill and questioned the appropriateness of this.  
3 They expressed a desire to recycle more of the waste; however this was accompanied by further  
4 barriers, such as the consequential demand for fishers to pre-sort the waste, the need for additional  
5 space, and the appropriateness to recycle the materials as they are often too contaminated and  
6 degraded or can damage recycling machinery (see Table 4).

### 7 **3.4.3 Suggestions**

8           Suggestions focused on five primary themes that reflect observations reported above: Greater  
9 funding and stakeholder involvement; improving waste disposal; continuing and increasing the  
10 promotion of the scheme and communicating the importance of marine litter; maintaining and  
11 improving the current running of the scheme; and developing the monitoring of the marine litter to be  
12 more rigorous (see final column of Table 4).

13           The first theme emphasized increasing **funding and stakeholder involvement**. First,  
14 stakeholders suggested that FFL should be even more strongly embedded within the fishing industry,  
15 e.g. by combining the scheme with compulsory fishing training programs (e.g. health & safety, first  
16 aid etc.). Second, it was suggested that other industries should be involved in the FFL scheme (in  
17 terms of active involvement and/or financial support), for example the tourist industry, retail,  
18 shipping, and oil. Third, greater governmental involvement was noted. This included encouraging  
19 appropriate waste management through enforcement of existing legislation and penalties, as well as  
20 making removal of rubbish a condition for any grants. Stakeholders elaborated that if more core  
21 funding was available, other funders would be encouraged to contribute, and this would support  
22 current legislation (e.g. the Marine Strategy Framework Directive). The landfill tax was noted to be a  
23 fundamental obstacle for the FFL scheme, and stakeholders suggested reducing or eliminating this.

24           Another suggestion focused on **improving the waste disposal facilities on land**, e.g.  
25 increasing recycling rates. Stakeholders suggested more research is needed on what can be recycled  
26 but also a need to change society's more general attitudes about recycled goods, increasing the  
27 acceptance of potentially lower-quality plastics resulting from marine litter recycling for example.

1 Stakeholders praised FFL's promotion efforts, but suggested that further investment was  
2 needed in **promoting the scheme and importance of marine litter**. These comments identified that  
3 the most effective ways to engage fishers in the scheme was face-to-face, through peers and by  
4 increasing the visibility of the scheme. The message to fishers should be i) that FFL is a very simple  
5 scheme with very little extra workload, and ii) to emphasize the benefits to the fishers themselves.  
6 The importance of media coverage was also emphasized, in terms of advertising the scheme to fishers,  
7 and in demonstrating to the general public the fishing industry's efforts (which stakeholders then  
8 noted can aid political and financial pressure to support this scheme). There was also counter  
9 arguments about paying fishers: that fishers could be paid for the waste that they bring in, and that this  
10 would act as an incentive for fishers to take part in the scheme; versus the fear that monetary  
11 incentives would have a negative effect on the scheme, reducing the power of the media coverage,  
12 being counterproductive to long-term attitude and behavior change, and that this could even tempt  
13 fishers into throwing *more* waste overboard as they would be paid to retrieve it (e.g. see Table 4).

14 Another theme concerned the practical **running of the scheme**. It was suggested that the  
15 scheme could be made even simpler, for example by allowing both boat-produced waste (e.g.  
16 operational and domestic waste) and FFL litter to be disposed together. Buying bags in bulk between  
17 regions could save money, bags could be designed to be seabird-proof, and smaller bag sizes would  
18 help smaller vessels. Increasing reach of the scheme was also advocated (e.g. including involving  
19 additional harbors in the South West that had expressed an interest).

20 In terms of developing the monitoring data, suggestions focused on **making the data more**  
21 **scientific**. It was suggested that FFL schemes could have increased levels of management (e.g. more  
22 secure skip facilities to reduce fly-tipping), that litter could be monitored in a more standardized way,  
23 and that more information could be gathered (e.g. location where items were caught, size of net used).  
24 However, stakeholders simultaneously acknowledged problems with these suggestions (e.g. the  
25 increased demand on fishers at the risk of discouraging engagement), concluding that FFL funding  
26 was better spent on facilitating and expanding the scheme rather than improving the litter monitoring.

## 4. Discussion

The focus of the present research was the Fishing For Litter (FFL) scheme in the UK. Using Willis et al.'s (2018) classification of waste abatement interventions, FFL intervenes right at the end when litter has reached the open ocean. This was the first study to examine fishers' and stakeholders' views of FFL exploring any benefits it may have in addition to collecting waste from the marine environment. Specifically, best-practice qualitative and quantitative social research methods (interviews and questionnaires) were applied to understand how FFL may contribute to raising awareness and encouraging behavior change in the industry, a primary aim of FFL, as well as to analyze the strengths and benefits of the scheme, listening to those most involved.

### 4.1 Overall Evaluation of FFL and wider perception of marine litter issues

Overall, fishers and stakeholders were satisfied with the current running of the scheme and rated it highly (an average of 7.85 on a 10-point scale from very poor to very good). However, stakeholders and fishers who took part in the scheme rated it more positively than did fishers outside the scheme (see Section 3.1), and thought it was more successful at removing litter than did non-FFL fishers. So was this difference associated with lower concern about marine litter or lack of perceived responsibility in non-FFL fishers? The data provide no evidence for this: Fishers, whether they were part of FFL or not, agreed that marine litter was a serious problem, they were very concerned, they felt responsible and saw the importance of correct waste management at sea (see Section 3.2.2 and Table 2; reporting similar findings to Hartley et al., 2018). These data indicate that overall, fishers were aware of the issues but non-FFL fishers were less positive about FFL results. So how can we bring more fishers into FFL, and/or make the scheme work better? A first factor is related to the motivations which underlie the decision to join FFL.

### 4.2 Motivations for joining FFL (or not)

Removing marine litter from the oceans was noted as an important motivator for participating in FFL, in line with both the collective tonnage collected so far (validated by FFL reports, FFL 2018a, 2018b) and also FFL fishers' stating they find less litter in their catches compared to non-FFL fishers (see Section 3.2.3 and Table 3). While it is impossible within this study to establish whether the FFL-fishers really experienced less litter on their trips, this difference in perception indicates a sense of

1 making a difference. In the behavioral science literature, *perceptions* of control are predictors of  
 2 action even when *objective* levels of control are the same (Pahl & Wyles, 2017). Also in line with the  
 3 behavioral science literature, fishers referred to social norms and social approval processes as  
 4 motivators. They described how everyone in the community got ‘behind the scheme’ and how being  
 5 part of FFL contributes to improving the image and reputation of the fishing industry. When the FFL  
 6 fishers gave reasons for joining the scheme, responses were centered around intrinsic motives, and  
 7 ‘feeling good’ about being part of the scheme was explicitly mentioned. The ‘feel-good-factor’ or  
 8 ‘warm-glow’ was also mentioned in the stakeholder interviews, showing consistency between  
 9 different samples obtained in our study. This is promising for potential spillover effects (see also 4.3)  
 10 because intrinsic motivation has previously been linked to behavior change that transfers to other  
 11 issues and is sustained over time (Poortinga et al, 2013; Thøgersen & Ölander, 2003).

12 On the other hand, non-FFL fishers explained that lack of information, never catching litter in  
 13 their hauls, and lack of space were reasons for not joining. Future analysis could identify those fishers  
 14 for whom joining would make sense (in terms of fishing methods and space) and highlight the  
 15 benefits as well as provide practical information on implementing it. Perhaps buddying up with a  
 16 FFL-fisher could be a method of benefitting from a colleague who is knowledgeable and trusted and  
 17 would encourage social influence processes. The behavioral science literature shows that expertise  
 18 and trust are predictors of persuasion (Cialdini, 2009). Also, any successful innovation process starts  
 19 with specific people (‘early adopters’) before spreading out more widely, whereby a social  
 20 multiplication processes could be supported to help speed up this process (see below). Finally, non-  
 21 FFL fishers also mentioned a range of incentives would encourage participation. These were not  
 22 necessarily financial but rather included prizes and other forms of recognition, in line with the social  
 23 approval that was mentioned as a motivation by the existing FFL fishers.

#### 24 **4.3 Awareness and Behavior change related to the FFL Scheme**

25 Fishers provided examples of how their behavior has changed over time since joining the  
 26 scheme (from no longer throwing waste produced on board overboard to doing more pro-  
 27 environmental acts on land and at sea such as recycling, see Section 3.2.3) and some differences were  
 28 found between FFL fishers and non-FFL fishers. For example, FFL-fishers agreed more than non-FFL

1 fishers that they reduce rubbish both at work and in their leisure time. This is a positive finding in  
2 terms of FFL's aims and also suggests a spillover effect may be occurring by leisure behaviors also  
3 being influenced, thus helping to address the waste system more broadly (Poortinga et al., 2013;  
4 Thøgersen & Ölander, 2003).

5         However there was also the notion that the scheme helped fishers continue to do what they  
6 were doing before, so rather than change practices, for these fishers the FFL scheme reinforced and  
7 validated good practice. Fishers did not report that they challenged others in their littering and waste-  
8 related behaviors. While this could be related to cultural characteristics in this particular sample  
9 (British people being stereotypically rather reserved and averse to interfering), this is an area that  
10 could have potential for targeting in future interventions. Social multiplier effects are achieved when  
11 social processes lead to the adoption of change beyond the immediate target group, for example, FFL-  
12 fishers could encourage colleagues to join the scheme (see buddy suggestion above), or FFL-fishers  
13 may talk to their wider family and friends about littering effects on the ocean (Kahn, 2007).  
14 Encouraging people who are already acting on environmental issues to adopt a wider social role has  
15 the potential to create even greater commitment and social 'ripple effects', and could translate the  
16 widely expressed concern (see Section 4.1) and motivations (see Section 4.2) into action.

17         Finally, while it could be argued that the biggest sources of marine litter originates on land  
18 (Jambeck et al., 2015), fishers' behaviors still play an important role to this global problem and can  
19 act as change agents (or 'stewards') within the ocean-related industry overall. Moreover, improved  
20 behavior of fishers has the potential to influence other important problems the industry encounters  
21 such as ghost-fishing, by reducing loss of fishing nets in the first place or contributing to greater  
22 efforts in retrieving lost nets (Veiga et al., 2016).

#### 23 **4.4 Barriers and Opportunities for FFL (and Other Related Schemes)**

24         In terms of identifying barriers and opportunities for the FFL scheme, some points were  
25 common to fishers and other stakeholders. Barriers were the limited time and space fishers have, lack  
26 of understanding (e.g. how simple it is, which ports are involved etc.) and fishers' other competing  
27 priorities. Stakeholders also emphasized the stretch of limited resources and the financial expense of  
28 the project (especially the landfill tax, which was seen as unfair) along with the difficulty of accessing

1 fishers to help inform them of the issue and the scheme, and the obstacles of disposing of the resulting  
2 waste sustainably and collecting scientifically robust data. From a social sciences perspective, many  
3 of these map onto concepts that have been found to predict behavior, such as perceived behavioral  
4 control and social norms noted above (Ajzen, 1985; Pahl & Wyles, 2017).

5 In line with these observations, fishers' and stakeholders' ideas on solutions were also similar  
6 (see Table 5): greater promotion of the issue and the scheme (emphasizing its ease and impacts),  
7 increasing the scope to other ports, regions and also involving other industries, the improvement in  
8 design and availability of bags (e.g. making them seagull proof), and establishing the scheme more  
9 firmly by linking it to compulsory training or certifications (e.g. the Responsible Fishing Scheme).  
10 This last point demonstrates some discrepancies within our sample, with the stakeholders  
11 complimenting that Responsible Fishing Scheme member vessels are encouraged to take part where  
12 FFL facilities are available in fishers' landing ports (e.g. Seafish, 2015); however, from the qualitative  
13 comments (Section 3.2.4) fishers were unaware of this. Thus, it is also important to ensure any such  
14 links are explicitly promoted to produce synergistic effects and efficient use of resources.

15 *[Table 5 here]*

16 Both fishers and stakeholders discussed monetary and non-monetary incentives. This  
17 highlighted two different perspectives among our participants: on one side, incentives were seen as an  
18 easy way to engage fishers, whilst on the other side, stakeholders highlighted the risks of using  
19 incentives (compromising the image of the scheme in the media and reducing the effect on attitude  
20 and behavior change), as touched on above. For example, schemes that pay fishers (e.g. active fishing  
21 for litter schemes) may not be as successful as FFL in terms of long-term behavior change as: (i)  
22 fishers may only take part as long as the incentive exists; (ii) they will likely attribute their actions to  
23 the incentive, which prevents a more general attitude and behavior change; and (iii) fishers may even  
24 be tempted to litter more if collecting waste is seen as a source of income. These perceived risks of  
25 using incentives are mirrored in the scientific literature. Monetary incentives can be a useful tool to  
26 focus people's attention on a behavior (e.g. Poortinga et al., 2013); however evidence indicates that  
27 other interventions and campaigns can have stronger, broader and more long-lasting impacts,  
28 especially those that target more intrinsic motivations (De Young, 1993; Miafodzyeva, 2013; Varotto

1 & Spagnolli, 2017). This appears to be in line with Cho (2011)'s observations and Willis et al.'s  
2 (2018) review of waste abatement policies. Willis et al (2018) point out that investment in campaigns  
3 and outreach programs (typically education, information and behavior change campaigns) decreased  
4 waste in the environment more than did investment in policies, according to interviews with waste  
5 managers in Australia. It could be speculated that such campaigns focus more on intrinsic motives  
6 than do policies on the whole although this was not explicitly tested in Willis et al.'s paper.

#### 7 **4.5 Can FFL help monitoring and recycling efforts?**

8 Stakeholders and fishers discussed wanting to recycle more of the waste, but also emphasized  
9 the need to prioritize keeping the scheme simple to maintain voluntary involvement. This is  
10 reminiscent of differences between collection of co-mingled (where all waste is disposed of together  
11 and later sorted) versus separated waste (where the households are responsible for sorting it). If  
12 increased recycling was a target in future iterations of the scheme, a scoping study should investigate  
13 the typical composition of litter retrieved as well as options for efficient recycling. Stakeholders did  
14 consider improving the monitoring component of the scheme. In terms of collecting scientific data,  
15 there is a need for more and standardized monitoring programs to further understand marine litter (the  
16 composition, the sources, the distribution etc., GESAMP, 2019). Fishers could provide a valuable  
17 contribution by accessing difficult to reach areas relatively cheaply compared to existing monitoring  
18 programs (GESAMP, 2019). However, stakeholders noted barriers relating to this component of the  
19 scheme that compromises the reliability of the monitoring (risks of under- and over-reporting) as well  
20 as the expense and resources needed to conduct this systematically. Thus, the stakeholders in this  
21 study concluded this was a more secondary part of the scheme and therefore funding and effort should  
22 focus on the collection of waste and engagement with fishers instead. If there was renewed interest in  
23 using FFL for monitoring, the practicalities and sensitivities over geo-locating sources would need to  
24 be explored in a pilot study with fishers. Other research, albeit it on land, has shown that beach  
25 cleaning undertaken with minimal training can yield useful data on coastal litter (Nelms et al., 2017)  
26 so this should perhaps not be ruled out entirely even if responses in our study indicate that this was  
27 not seen as a priority.



## 1 **4.6 Limitations and Future Research**

2 Human decisions and actions are at the core of most environmental issues, and it is important  
3 to consider this human dimension systematically and collect good-quality social data. This study used  
4 best-practice social research methods consisting of surveys and interviews, implemented by trained  
5 researchers. For this type of research, a relatively large sample of fishers was achieved, and the use of  
6 qualitative and quantitative methods allowed us to triangulate responses and compare perspectives of  
7 different samples. A conscious decision was taken to use thematic (deriving meaning from similar  
8 statements) rather than content analysis (converting responses to numerical data) for the qualitative  
9 responses, and open-ended responses were designed with that in mind. Either analysis method is  
10 common and valid but the thematic analysis remains qualitative in the sense of not providing  
11 quantification (counting) of different statements. Instead it allowed us to focus on the in-depth  
12 meaning in responses, and use this to add richness and depth to the rating method used elsewhere in  
13 our tools.

14 This research also stimulates a need for further scientific research. To understand and develop  
15 interventions based on evidence and to maximize their impacts, more systematic evaluation and  
16 monitoring should be implemented (Brennan & Portman, 2017). For example, baseline data is  
17 necessary to evaluate change over time. Ideally, groups of fishers or harbors / regions should be  
18 randomly allocated to either the intervention or control group. This would allow the testing of causal  
19 effects. As this work was conducted after the inception of the scheme, we were only able to compare  
20 fishers who were part of the scheme to those who were not and ask individuals to reflect on any  
21 change over time. Thus, future interventions or campaigns should integrate an evaluation program  
22 from the onset to maximize their success.

23 In addition to further examining the direct impact of schemes, future work may also want to  
24 examine differences in perceptions and behavior in greater detail (for example, comparing the level of  
25 fisher such as crew and skippers, comparing the type of fishing practice used), as this would help  
26 tailor interventions to the appropriate audiences. For instance, whilst this study was able to look at UK  
27 fishers more generally and compare those who are part of the FFL scheme with those that are not, it  
28 would be worth examining in greater focus those fishers who have a greater potential to contribute to

1 the abundance of marine litter (e.g. greater chances of losing fishing gear that provides greater risks to  
2 wildlife and society such as trawling nets, and fish in waters that have greater contamination).

### 3 **4.7 Conclusions**

4 This research was the first to examine commercial fishers' and other stakeholders' views of  
5 the FFL scheme specifically. Respondents rated the scheme highly overall, especially if they had  
6 direct experience of it as fisher or stakeholders. Fishers were found to care about, be aware of and feel  
7 responsible for marine litter, which are important antecedents for pro-environmental behavior, with  
8 the FFL fishers reporting better waste behavior than the non-FFL fishers. Whilst numerous  
9 suggestions were given on how to develop FFL further, respondents concentrated on supporting and  
10 extending the existing scheme. These findings have practical implications for further developing the  
11 FFL scheme and similar interventions to ensure synergies in the context of a wide array of measures  
12 from local to global (Vince & Hardesty, 2018). It also demonstrates how social and behavioral  
13 sciences can provide insights, methods and data that help maximize the success of interventions  
14 targeting awareness raising and/or behavior change. Overall it is concluded that FFL is an exemplary  
15 scheme that makes use of people in the right place at the right time, builds on best practice and social  
16 norms, and empowers fishers to do something about a problem that directly affects them. FFL is a  
17 voluntary scheme that supports change in fisher attitudes and behavior and the fishing community  
18 practices and culture. Thus it can make an important contribution in the context of this transboundary,  
19 global issue where strict enforcement of policies may be difficult.

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6. Figures

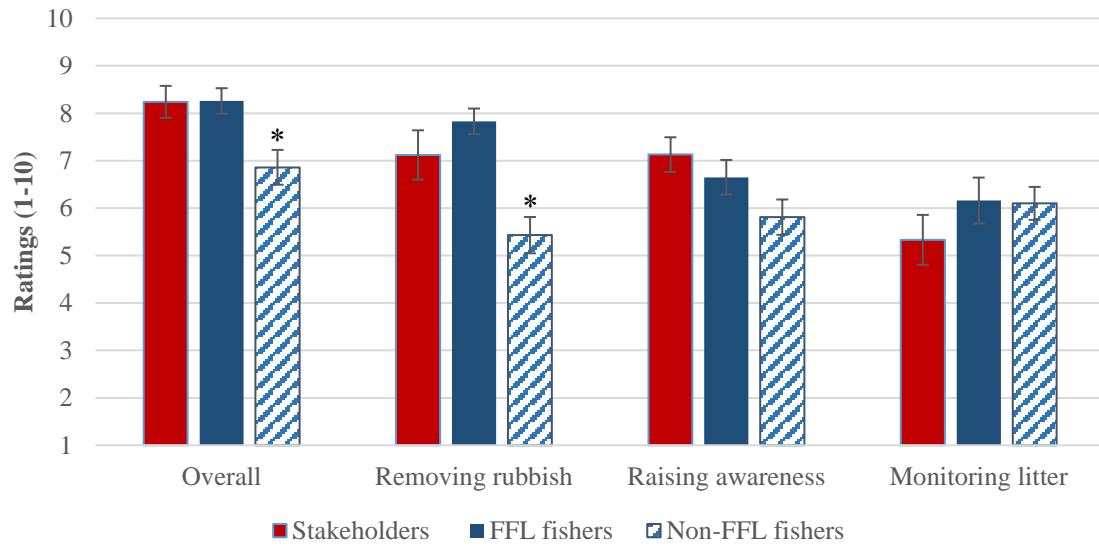


Figure 1. The average ratings (with standard error bars) for the scheme overall and for each of the objectives for the Stakeholders, Fishers taking part in FFL, and Fishers NOT taking part in FFL

## 7. Tables

1

2 Table 1. Participant profile for the Fishers ( $n = 97$ ) and Stakeholders ( $n = 22$ )

Fishers		Stakeholders	
<b>Age</b>	$M = 43.00$ $SD = 12.17$	<b>Age</b>	$M = 47.81$ $SD = 9.21$
<b>Gender</b>	97 male (100%)	<b>Gender</b>	16 male (72.7%)
<b>Time in industry</b>	$M = 25.21$ $SD = 11.62$	<b>Time involved in the scheme</b>	$M = 3.94$ $SD = 2.69$
<b>Role</b>		<b>Organizational profile*</b>	
- Skipper owner	36 (37.1%)	- FFL level – admin	1
- Skipper	33 (34.0%)	- FFL level – project manager	5
- Boat owner	2 (2.1%)	- FFL level – liaison officer	2
- Deckhand/crew/mates	30 (30.9%)	- Other – sponsor / funder	6
- Other	2 (2.1%)	- Other – harbor authorities	3
<b>Size of vessel</b>	$M = 19.39\text{m}$ $SD = 15.42\text{m}$	- Other – fishing associations	3
<b>Fishing gear</b>		- Other – NGO	2
- towed demersal fishing gear	44 (45.4%)	- Other – Government affiliation	2
- fixed / static fishing gear	20 (20.6%)	- Other – Waste contractors	1
- towed pelagic	9 (9.3%)		
- other	16 (16.5%)		
<b>Number of Crew on Vessel</b>	$M = 4.06$ $SD = 2.90$		
<b>Fishing territory (from port)</b>			
- < 10nm from home port	22 (22.7%)		
- 10-50nm from home port	31 (32.0%)		
- 50-100nm from home port	10 (10.3%)		
- > 100nm from home port	30 (30.9%)		
<b>FFL participant</b>			
- FFL fisher	49 (50.5%)		
- Non-FFL fisher	45 (46.4%)		

3 Note. Some participants chose to not answer some questions (thus the % does not always total 100%).

4 The categories for the “stakeholders” are not mutually exclusive, as individuals could belong to more  
5 than one category (e.g. works for an organisation that is a funder and also a fishing association).

6

FISHING FOR LITTER

1 Table 2, Fishers' average (and standard deviation) level of agreement to statements relating to  
 2 marine litter and waste management (n = 97).

Questionnaire statements	All fishers		FFL fishers (n = 49)		Non-FFL fishers (n =45)	
	M	SD	M	SD	M	SD
<b>Marine Litter Perceptions</b>						
a) Marine Litter is a serious problem.	3.82***	1.14	3.78***	1.21	3.89***	1.07
b) Marine litter is often present in my hauls.	3.38**	1.35	3.29	1.35	3.44*	1.39
c) Marine litter poses a danger to myself and my crew when handling it	2.73*	1.29	2.84	1.18	2.60	1.44
d) I am very concerned about the impacts of marine litter.	3.85***	1.19	3.90***	1.21	3.82***	1.17
e) The amount of litter on the coast and in the sea is increasing.	3.42**	1.38	<b>3.20</b>	<b>1.40</b>	<b>3.80***</b>	<b>1.23</b>
f) Marine litter will probably not cause lasting damage. (N)	2.37***	1.44	2.36**	1.42	2.30**	1.49
g) Litter found on the coast and in the sea is mainly coming from inland sources.	3.27*	1.23	3.13	1.18	3.53**	1.20
h) Litter found on the coast and in the sea is mainly as a result of passing vessels dumping their waste.	3.39***	1.12	3.33*	1.06	3.36*	1.18
i) Fish and other marine wildlife are rarely harmed by marine litter. (N)	2.67	1.49	2.84	1.46	2.40*	1.50
j) Marine litter often damages fishing boats and equipment.	3.13	1.38	3.10	1.42	3.09	1.36
k) What % of marine litter do you think is made up of plastic? +	63.01	23.70	59.15	25.38	68.44	20.77
<b>Waste Management Perceptions</b>						
l) It is very important to manage waste responsibly at sea and on the coast.	4.78***	0.52	4.88***	0.33	4.67***	0.67
m) It is up to me what happens with the rubbish produced on board whilst out at sea.	4.82***	0.48	4.85***	0.51	4.78***	0.47
n) Managing waste takes a lot of time and effort. (N)	2.03***	1.20	1.96***	1.25	2.09***	1.08
o) Most fishermen don't care about disposing of waste in a responsible manner. (N)	2.29***	1.44	2.09***	1.38	2.53	1.50
p) The amount of non-galley waste I bring back to port depends on the will of others, for example other crew, port reception facilities. (N)	3.71***	1.33	3.65**	1.33	3.71**	1.35
q) Keeping the sea and coast as clean as possible is important to me.	4.76***	0.47	4.80***	0.41	4.71***	0.55
r) The main individuals responsible for dealing with marine litter (collecting and disposing of the litter) are commercial users (e.g. fishermen, shipping, off-shore industries).	4.26***	0.98	4.35***	0.80	4.16***	1.17
s) People other than commercial users are responsible for dealing with marine litter (collecting and disposing of the litter). (N)	3.74***	1.28	3.60**	1.30	3.91***	1.21
t) I sometimes throw unwanted stuff over board when at sea. (N)	1.95***	1.31	<b>1.43***</b>	<b>0.76</b>	<b>2.51*</b>	<b>1.53</b>
u) If I find rubbish at sea, I keep hold of it so it can be disposed of on land.	4.32***	1.09	<b>4.81***</b>	<b>0.45</b>	<b>3.76**</b>	<b>1.32</b>
v) I do my best to separate and recycle waste.	2.63*	1.68	2.39**	1.66	2.80	1.66
w) I reduce rubbish going into the sea wherever I can, both whilst at work and during my leisure time.	4.66***	0.78	<b>4.80***</b>	<b>0.71</b>	<b>4.49***</b>	<b>0.84</b>
x) I often challenge other people's littering and waste-related behaviors.	2.86	1.61	3.10	1.65	2.52*	1.50

1 *Note.* + average %, all other responses were on a scale from 1 = *strongly disagree*, 3 = *neutral*, to 5 =  
2 *strongly agree*. (N) = negatively worded item to avoid response bias. \* implies when scores were  
3 statistically significantly different to the neutral mid-point of the scale (\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p <$   
4  $.001$ ). Boldface signifies where the two groups of fishers significantly differed  
5

Table 3. Illustrative examples of the fishers' responses regarding their experiences of the FFL Scheme.

FFL Fishers (n = 49)				Non-FFL Fishers (n = 45)	
Reason for Volunteering	The Strengths of the FFL Scheme	Influences of the FFL scheme on themselves	Ways to Go Forward	Barriers to Participating in the Scheme	Methods of Encouragement
<p><b>To reduce litter in the seas</b> – [To] clear everything up I suppose. Fed up of catching the same things (participant ID: Fisher 96)</p> <p><b>Convenience of the scheme</b> – ... Kept litter anyway so easy to do (participant ID: fisher 65)</p> <p><b>Social</b> – community thing: everyone got behind it so there wasn't a place to not be on it (participant ID: fisher 61)</p> <p><b>Improve reputation</b> – trying to get as good a name as possible (participant ID: fisher 24)</p> <p><b>For the benefits</b> – Surprising how much it decreases once you've started to bring it in. Made lives easier in the long run. Less rubbish in hauls (participant ID: fisher 80)</p>	<p><b>Making a difference</b> – See the benefits: improving my fishing, less rubbish and more fish being caught. Definitely year on year we're seeing less and less litter. When we started it was quite common to fill two, three or four bags in one trip. Sometimes now on a trip, going back to a regular area, we'd be lucky if we get a quarter of a bag so we're obviously doing some good. (participant ID: Fisher 18)</p> <p><b>Raising awareness</b> – 1) Educates fishermen who previously would throw stuff overboard. 2) Removes pollutants from the sea. 3) Raise profile of fishermen as being more environmentally sensitive. (participant ID: fisher 45)</p> <p><b>Resources available</b> – Bags for somewhere to put it. Easy to dispose and so more convenient now. (participant ID: Fisher 92)</p>	<p><b>Changed behavior on board</b> – Used to throw everything over not any more though (participant ID: fisher 97)</p> <p><b>Changed other behaviors</b> – Made me more 'anti-packaging'. Long-life bags, buy things with less packaging, farm shop not supermarket. (participant ID: fisher 55)</p> <p><b>Increasing salience</b> – ... It's like someone's watching you, so you try to do something about it. (participant ID: fisher 61)</p>	<p><b>Good as it is</b> – Not really. It's working well. Use bags and put them in skip. (participant ID: fisher 74)</p> <p><b>Raising awareness</b> – some kind of campaign to make other fishermen realize it's not that much more effort to take part (it's actually easier to) (participant ID: fisher 68)</p> <p><b>Design &amp; availability of bags</b> – Noticed that seagulls attack rubbish on the quay, it can be blown around as there's no weight in plastic. Could be good to put in a lidded container or secure a bit faster. (participant ID: fisher 61)</p> <p><b>Increase the audience / scope</b> – It's currently targeting fishermen, should be open to broader groups (e.g. commercial users, pleasure boats). Should focus on any seafarers, looking further afield... (participant ID: fisher 61)</p> <p><b>Ports facilities</b> – If ports [not FFL necessarily] had recycling facilities available, they would be used. For instance being out at sea for days, fishermen go through many bottles of milk, tins of food which goes in the normal waste. (participant ID: fisher 61)</p>	<p><b>Lack of information</b> – I had no information about it and no encouragement to join it. (participant ID: fisher 32)</p> <p><b>Not applicable</b> – I fish with hooks not nets so do not catch enough to take special rubbish bags to sea. (participant ID: fisher 34)</p> <p><b>Lack of choice / time / interest</b> – Had no time to join. Have three different jobs. (participant ID: fisher 6)</p>	<p><b>Raising awareness</b> – More local level to raise awareness, demonstrate the benefits and effectiveness (participant ID: fisher 50) You only find out about schemes if you go out hunting for them. Would be good if someone came down in person to the boats to tell you about it and give a leaflet or something (participant ID: fisher 4)</p> <p><b>Incentives</b> – Pay us for the litter brought ashore! (participant ID: fisher 41)</p> <p><b>Not applicable</b> – Don't see litter. Way we fish, wouldn't actually be able to contribute. Not worth joining (participant ID: fisher 49)</p> <p><b>Facilities within &amp; engagement of port</b> – Guaranteed facilities in every port (participant ID: fisher 47)</p> <p><b>Involving the skippers</b> – If the boat was to start getting involved in the scheme (participant ID: fisher 21)</p> <p><b>Support</b> – Make it an accreditation part of RFS. Make it compulsory in order them to fish. Competition to make them bring more litter. (participant ID: fisher 55)</p>

1 *Table 4. Illustrative examples of the responses from the stakeholder interviews (n = 22).*

The Strengths of the FFL Scheme	Barriers Facing FFL	Ways to Go Forward
<p><b>Organization of the project –</b>  <i>I'm not sure I would support the idea of paying fishermen to go out and fish for litter however, I don't think that would be a good use of money, but the fact they take part voluntarily, the ports give their time and support voluntarily, it's a really positive fishing community story really.</i> Participant ID: stakeholder 8</p>	<p><b>Resources –</b>  <i>the landfill tax is based around the principle that the producer pays, well, we're not essentially the producer necessarily - the fishing industry are not the polluter, they're the ones collecting it, so why should they have to pay such a huge amount to get rid of the rubbish, so I think there's an argument there really. I mean a lot of the costs, especially the cost that builds, is around the waste disposal</i> Participant ID: stakeholder 8</p>	<p><b>Funding and stakeholder involvement –</b>  <i>It would be very nice if we could overcome the landfill tax barrier. I guess some conversations need to be had with treasury or HMRC as to whether it would be possible to weave those costs given the social benefit derived from the scheme</i> Participant ID: stakeholder 18</p>
<p><b>Raising awareness –</b>  <i>Well it certainly highlights best practice or good practice of the fishing industry does. You know I guess it's improving, educating the public perception that fishermen aren't just contributing to it, that they're actually trying to do something to clean it up. That's a positive image PR sort of thing</i> Participant ID: stakeholder 15</p>	<p><b>Participation –</b>  <i>Ideally [you] want to be working with a fisherman who possibly owns his own boat - they tend to be slightly more willing to engage in the project. It's their business, they're passionate about their business so they tend to be more interested in participating in schemes like this 'cos it obviously for various reasons, not only are they removing litter from the environment but it's also something that they can use to demonstrate good practice for their own business. You may have some, say of the larger fleets where you have skippers that are employed sometimes they're not quite as cooperative and it takes a lot more effort to continuously encourage them to take part in the scheme because often it's sort of something that they are being told to do by their boss so to speak. And it's another thing on their list of things that they have to do so really it just seems to take a bit longer to engage and continue to encourage them to take part in the scheme</i> Participant ID: stakeholder 9</p>	<p><b>Improving the waste disposal facilities on land –</b>  <i>I think it's about a question of acceptability. So, if you use more downgrade plastic in your bottle then they can't necessarily be sparkling and see-through and shiny and all those sort of things, and you'd probably come up with something more colored or darker, so I think, how do you make that call and make it relevant? It sounds awful, but people basically want something of the moment, or they want you to feel like they're doing the right thing, so it's about creating a whole, sort of, cachet if you like.</i> Participant ID: stakeholder 22</p>
<p><b>Reducing litter in the marine environment –</b>  <i>We have fishermen coming up to me at annual fishing exhibitions in Glasgow, which they didn't realize how much was thrown over side, and once they had a bag on board they could really see how much rubbish was in it, then the penny dropped, you could actually see that people are starting to think about it and starting to get through to them. And I mean it wasn't just that you were removing litter but that they realized they shouldn't be throwing stuff over the side, so was a double win situation.</i> Participant ID: stakeholder 5</p>	<p><b>Raising awareness –</b>  <i>I think that, sometimes, it's quite easy to get to some captains... On whether that necessarily feeds through to the crew is a challenge. Need to get the crew involved, which isn't something easy for the project coordinator to know on how much they're getting involved</i> Participant ID: stakeholder 5</p>	<p><b>Continuing and increasing the promotion of the scheme –</b>  <i>It's down at the end of the day to the pennies isn't it. Um, would I stick my neck out if I was to say that the levee that sea fishing gets that they could make a certain amount available to help because it's for everyone benefit.</i> Participant ID: stakeholder 10</p>
<p><b>Feel good factor –</b>  <i>I think it's something that we can all sort of stand up and be proud about and say 'look what we're doing to improve the environment in [location]' and it's something that's really positive when we're taking to visitors and residents. It's another string to our bow to say this is how we try and reduce this problem in [location]</i> Participant ID: stakeholder 12</p>	<p><b>Waste Monitoring / Litter Data –</b>  <i>Because some of it is potentially very valuable. One guy found an anchor, looked on the net and was from 1840, highly sellable, it was in the skip for about a day [laugh]</i> Participant ID: stakeholder 11</p>	<p><i>You have to be careful that you don't pay for fishermen to go out hunting for litter unless it's a hotspot or something, as if you pay them for example as they're not allowed to fish, you lose the awareness aspect as there's no reason for them to not throw the rubbish overboard, cos they're being paid to recover it.</i> Participant ID: stakeholder 4</p>
	<p><b>Waste Disposal –</b>  <i>The challenge you have with plastic from the sea is the state that it's in when you take it out, so the degradation of it has already started, so the identification of each type of plastic is practically impossible, so you then have to recycle it as the lowest common denominator, and so what you're essentially doing is downgrading your plastic rather than maintaining it...</i> Participant ID: stakeholder 20</p>	<p><b>Maintaining and improving the running of the scheme –</b>  <i>I would recommend that the government look at rolling it out across the whole country</i> Participant ID: stakeholder 12</p>
		<p><b>Make the monitoring data more rigorous–</b>  <i>...It [monitoring onboard] would be very very difficult because of the situation, and the conditions that they're out there in. They don't want to...it's no good having 30 bags all around the boat, one for that type of plastic one for that, it's just not going to do it and actually log the lat and long and where you started to tow and where you finished it, you know I just don't think it's practical to do. Unless there was an incentive, but then I still don't think it would work.</i> Participant ID: stakeholder 16</p>

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1 *Table 5. A summary of the recommendations based on the stakeholder interviews.*  
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<b>General Suggestion</b>	<b>Specific Suggestion</b>
Maintain and develop resources (time and money) to support FFL	Waive landfill tax on material collected via FFL Provide core funding from Government Have sponsors from other industries who contribute to the litter but are less able to do anything about it (e.g. retail / shipping)
Increase involvement of other stakeholders	Commercial industry involvement Continue to integrate with harbor authorities / harbor staff to build relationship Continue to link with other schemes (e.g. RFS) More support from Government (in terms of legislation and as a condition for any governmental grants)
Maintenance & improvement in facilities	Improve bags (e.g. seagull proof) Adapt FFL for smaller boats (e.g. smaller bags) Maintain provision of facilities (harbor side)
Development of the project	Expand coverage (smaller ports, local councils, whole country, aquaculture industry, Scandinavian countries) Consider prioritizing some ports
Waste disposal	Recycling Change people's attitudes about recycled goods / increasing the acceptance of recycled plastics
Promoting the scheme (e.g. PR, increasing awareness)	Raise awareness and importance of FFL (within the public and fishers) Face-to-face recruitment for FFL participation (peer pressure) Video to raise awareness (a video is now available)
Maintain and improve the simplicity of the scheme (for fishers)	Facilitate waste disposal (make easier) Make as easy as possible
Tackling the initial act of littering – could be linked with stakeholder engagement and PR...	Reduce litter entering the environment (target potential sources, based on data from FFL) Behavior change measures to reduce littering
Improving the data (however, this was seen as a low priority)	Increase monitoring Collect wider range of information about the litter (mass, number of items etc.) Stricter regulation on what is allowed in the skips, to reduce non FFL dumping

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