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# Participation, catches and economic impact of sea anglers resident in the UK in 2016 & 2017

## Annex 1. Estimating the participation rate, numbers, and days fished by sea anglers resident in the UK from the Watersports Participation Survey

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Issue Date: 3 July 2020



## Executive Summary

To estimate catches and releases by sea anglers in the UK, it is necessary to carry out independent surveys of effort and catch per unit effort. In 2016 and 2017, this involved the combination of a nationwide survey of UK residents (Watersports Participation Survey) to estimate the effort in terms of numbers of people who went sea angling, and a separate nation-wide panel of sea anglers that recorded all their marine recreational angling activities and catches from which average catch per unit effort in the UK population could be inferred. Here, the Watersports Participation Survey methodology is described and the sea angling results for 2015 to 2017 are presented in the context of previous studies.

The Watersports Participation Survey has been done on an annual basis since 2002 to monitor engagement in watersports. A face-to-face omnibus survey is undertaken of 12000 households across the UK in September each year. Areas were selected for sampling based on the 2011 Census small area statistics, postcode address file, government office region, and social grade. Targets based on interview participants' gender and employment status were used to ensure a representative sample. Interviewers were given scripts and respondents were asked about participation and frequency of sea fishing. The results were raised to the total population based on demographics and location, using information on the UK population from the Office of National Statistics.

The surveys estimated that, on average, 823000 people over 16 years old in the UK went sea angling in 2015-2017, representing a participation rate of 1.6%. England had the most sea anglers in the UK. Participation rates and numbers of sea anglers were reasonably consistent from 2015 to 2017, but although appearing lower than in 2012, were unlikely to represent a significant difference as the confidence intervals overlapped. Sea anglers fished in the UK for an average total of 7.0 million days each year, with most fishing done from the shore. There were larger estimates of total effort and days fished per angler in 2015-17 than in 2012. These differences were likely to be due to sampling errors and the different survey methods used. Improvements to future surveys are discussed including increasing sample sizes and using separate years together to improve the precision of the Watersports Participation Survey estimates.

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# 1 Introduction

Several studies have been done that included estimation of the numbers of sea anglers and participation rates in the individual countries of the UK (e.g. Armstrong et al., 2013; Drew, 2004; McMinn, 2013; Radford and Riddington, 2009; Simpson and Mawle, 2005; 2010). These have generally involved omnibus surveys of differing geographic coverage where data on a wide range of subjects is collected using face-to-face interview methods. In 2003, there were an estimated 1.1 million sea anglers in England and Wales equating to a participation rate of 5% for over 16 year olds (Drew, 2004, from an omnibus survey of 10,200 households). Surveys to assess public attitudes to angling in England and Wales found that the numbers of people who had been sea angling in the preceding year was 2 million or 5% of individuals aged 12 years or over in 2005 and 1.9 million or 4% in 2010 (Simpson and Mawle, 2005; 2010). The most recent survey of participation and effort in Great Britain in 2012 found that 2.2% or 1.08 million people of 16 years or older had been sea angling in the preceding year, with 884000 from England, 12500 from Scotland, and 76000 from Wales (Armstrong et al., 2013, from an Office of National Statistics omnibus survey of 12619 households). In 2009, there were an estimated 125000 sea anglers in Scotland (Radford and Riddington, 2009) and 64,800 or 3.6% participation in Northern Ireland in 2012 (McMinn, 2013).

To estimate catches and releases by sea anglers, it is necessary to carry out independent surveys of effort and catch per unit effort, along with collection of biological information on the catch (lengths or weights) (ICES, 2010). The choice of survey methods depends on factors such as logistics, budget, and the ability to control and evaluate sampling errors and biases (ICES 2010). To estimate sea angling catches in the UK, the outputs from two separate surveys were combined. Firstly, a nationwide survey of UK residents was done to estimate how many people go recreational sea fishing, how often they do this using different methods and what effort they expend (Watersports Participation Survey). Secondly, a panel of sea anglers completed an online diary to record all their marine recreational angling sessions, methods, duration and catches during the year, or their 'catch per unit effort'<sup>1</sup>. Additional surveys linked to the diary gathered data on angler expenditure. This annex describes the Watersports Participation Survey methodology and presents the sea angling results for 2015 to 2017. Regional, social grouping, gender, and gear differences in participation and effort for different gears are reported and reviewed in the context of existing studies of sea angling in the UK. Complete descriptions of the other components of the UK 2015-17 Marine Recreational Fisheries surveys can be found in the Annexes covering the diary panel survey (Annex 2), economics (Annex 3), and catches (Annex 4).

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<sup>1</sup> <http://www.seaangling.org>

## 2 Methods

The Watersports Participation Survey started in 2002 with the aim of monitoring participation in watersports and has run each year since. Currently, this is funded by a consortium including: Royal Yachting Association<sup>2</sup>; British Marine Federation<sup>3</sup>; Royal National Lifeboat Institution<sup>4</sup>; British Canoeing<sup>5</sup>; Maritime & Coastguard Agency<sup>6</sup>; and Cefas<sup>7</sup>.

The Watersports Participation Survey is delivered by the market research consultancy Arkenford (now part of The Nursery Research & Planning Ltd<sup>8</sup>). The survey consists of two parts: 1. a face-to-face omnibus survey of 12000 UK households to estimate participation and trends in watersports activities; and 2. additional questions in the omnibus survey in 2015 on sea angling to generate information on effort (numbers of anglers and days fished) that could be used, in conjunction with data from a separate diary panel of anglers reporting their fishing activities and catches, to calculate total national catches and releases by sea anglers in the UK. The purpose of this document is to provide a detailed methodology of the omnibus survey.

### 2.1 Sampling

The sampling frame was created from the '2011 Census small area statistics and the Postcode Address File (PAF)'. This was used to identify non-overlapping areas of similar population sizes within each Government Office Region (GOR) that then became the sample points in the sampling frame. Sample points were included in the sampling frame accounting for driving time and coverage of the GOR. Each year, 605 sample points were identified across the UK, with 600 south of the Caledonian Canal (Figure 1). Sampling points north of the Caledonian Canal differed in size from those south of the canal and from each other, in order to ensure that the highlands and Scottish Islands were adequately covered (Akenford 2017a).

Sampling points were stratified by GOR and social grade and then subjected to random systematic selection. In 2017, 285 points south of the Caledonian canal, one point north of the canal and sixteen points in Northern Ireland were selected for sampling. These were checked to ensure they were representative of urban and rural classification. Sampling points south of the Caledonian Canal were split into two replicates, with the first group being sampled in one week and the second group being sampled in the subsequent week. Sampling occurs in September each year, with sequential waves of fieldwork across sample sites on the mainland of the UK to ensure all time periods were sampled and good geographical coverage was achieved. Sample points in Northern Ireland were divided into four replicates that are used in rotation to ensure that all time periods in all provinces were sampled equally.

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<sup>2</sup>RYA - [www.rya.org.uk](http://www.rya.org.uk)

<sup>3</sup>BMF - [www.britishmarine.co.uk](http://www.britishmarine.co.uk)

<sup>4</sup>RNLI - <https://rnli.org/>

<sup>5</sup>BCU - <https://www.britishcanoeing.org.uk/>

<sup>6</sup>MCA - <https://www.gov.uk/government/organisations/maritime-and-coastguard-agency>

<sup>7</sup>Cefas - <https://www.cefasc.org.uk/>

<sup>8</sup>The Nursery Research & Planning Ltd - <https://the-nursery.net/>

Equal populations in two geographically distinct clusters were selected, with complete GORs maintained within each segment meaning that a single GOR cannot be in both clusters. Different GORs in each cluster were selected on a weekly basis and a census output area within each GOR is sampled. Each census output area was selected from the PAF and had over 125 address.

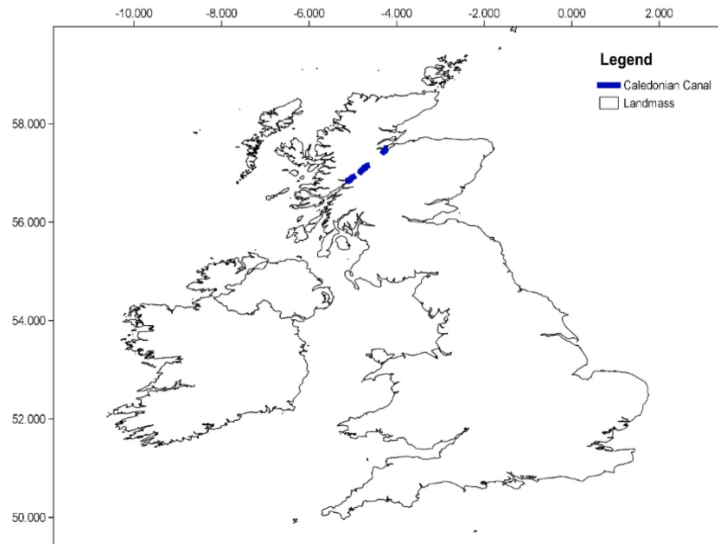


Figure 1. The location of the Caledonian Canal (blue) used to define different methods for allocating sampling points.

## 2.2 Interviews

The addresses selected for sampling at each selected sampling point were issued to achieve an adult sample of 13, 15 or 17 in London and 15, 17 or 19 elsewhere per sampling point, depending on the questionnaire length. Sampling was conducted between 14:00 – 20:00 on all days of the week. Interviewers were set quotas based on gender. These quotas ensured equal gender ratios within the sample. Three doors between each successful interview were not sampled.

Each interviewer was given an interview script that included background information and a full set of questions to read from. This included information and a simple set of questions about recreational fishing activity. Initially, each respondent was asked if they have taken part in any of 32 different watersports activities. For recreational fisheries, the following categories were defined:

- Sea angling (rod and line\handline) from a kayak.
- Sea angling (rod and line\handline) from a private or rental boat.
- Sea angling (rod and line\handline) from a charter boat.
- Sea angling (rod and line\ handline) from the shore.
- Recreational sea fishing (using pots, traps, nets, spears).

If the respondent answered yes to any of these categories, they were then asked how many times that they had participated in these activities in the UK in the last year. Initially, there was concern that the number of times (or ‘occurrences’) might not equate to numbers of days fished. It was not possible to change the questions as this would impact of the consistency of the time series, so an additional

question was added to the survey in 2015 that specified days fished rather than times fished. The results were very similar, so number of times was assumed to be the same as days fished.

A minimum of 10% of surveys was checked by trained validators to ensure consistency of data collection and identify issues with survey approaches. This was done by telephone where possible, but validation was done by post if telephone failed. All aspects of the interview were checked and the interviewer was graded, with feedback provided to improve quality and identify where additional training or support was required. A systematic methodology was used to select interviews to validate, with more regular testing where issues were identified, and all interviewers validated at least once in each three-month period. In addition to checking the data recorded, validation included confirmation that the interview took place, an ID card was shown, the information on the survey was provided, and the correct questions were selected.

### 2.3 Analysis and Reporting

Questionnaire responses were weighted based on the interviewee location, age, sex, and social grade, and the responses were entered into a weighting matrix (Table 1). For the purpose of weighting, Scotland and Northern Ireland were included with the North of England, and Wales with the Midlands (Table 1). A breakdown of demographics published by the Office of National Statistics (ONS) were used to raise the weighted samples (questionnaire responses) to the entire population of the UK over the age of sixteen.

Standard errors were calculated for the activities. As the WPS did not use a simple random sampling approach, computation of a design effect was necessary to adjust the standard errors for each category of respondent. This adjustment was based on an approximation of difference between expected sampling error using simple random sampling and sampling method used in the WPS. The overall design effect ( $D$ ) was a combination of the design effect due to unequal inclusion probabilities ( $D_p$ ) and design effect due to clustering ( $D_c$ ).  $D_p$  was based on the weightings of individual respondents relative to the whole UK population ( $w_i^*$ ) and the number of individuals surveyed ( $n$ ) and was calculated by:

$$D_p = n \frac{\sum_{i=1}^n w_i^{*2}}{(\sum_{i=1}^n w_i^*)^2} \quad (1)$$

$D_c$  was calculated from the average cluster size ( $\bar{b}$ ) and intercluster correlation coefficient ( $\rho$ ) as:

$$D_c = 1 + (\bar{b} - 1)\rho. \quad (2)$$

The overall design effect ( $D$ ) was then calculated from the product of these two individual effects as:

$$D = D_p \times D_c \quad (3)$$

and can be applied to individual errors for each stratum, leading to generate the weighted standard error ( $SE(\bar{X})$ ) based on the mean ( $\bar{X}$ ), weighting ( $w_i^*$ ) and design effect ( $D$ ), following:

$$SE(\bar{X}) = \sqrt{D\bar{X}(1 - \bar{X}) \sum_{i=1}^n w_i^{*2}}. \quad (4)$$



The Watersports Participation Survey is conducted on an annual basis and reported in three ways: a summary report available online (Arkenford, 2017b); a full report is available to funded organisations (Arkenford, 2017c); and an interactive tool to view the results at different levels of aggregation (i.e. each stratum, region, activity, etc.) (Arkenford, 2017d)

Table 1. The sample weighting matrix used by the Watersports Participation Survey in 2017 to raise the samples to the entire population of the UK.

Social group	Age	Males:			Females:		
		North	Midlands	South	North	Midlands	South
ABC1	16-24	1.21	1.00	1.82	1.16	0.88	1.67
	25-34	1.28	1.09	2.17	1.34	1.03	2.21
	35-54	2.78	2.22	4.54	3.19	2.47	4.76
	55+	2.58	2.06	3.71	3.07	2.37	4.23
C2	16-24	0.47	0.44	0.50	0.45	0.36	0.44
	25-34	0.63	0.42	0.72	0.50	0.39	0.67
	35-54	1.43	1.15	1.54	1.17	0.94	1.22
	55+	1.36	1.10	1.29	1.16	1.00	1.21
DE	16-24	0.73	0.50	0.69	0.83	0.57	0.75
	25-34	0.65	0.41	0.65	0.70	0.51	0.74
	35-54	1.43	1.00	1.19	1.49	1.01	1.39
Total	All	12.32	20.06	17.32	13.14	21.14	16.00

## 3 Results

### 3.1 Participation

Participation in all watersports activities estimated in this survey increased from 23% in 2012 to 31% in 2017 (Arkenford, 2017b), with 16.3 million individuals over the age of 16 taking part in watersports in 2017. The most popular activities were spending time at the beach, coastal wading, and outdoor swimming. From 2015-17, an average of 823000 people over the age of 16 went sea angling in the previous 12 months, a participation rate of 1.6% (Table 2). Numbers of sea anglers were greatest in England (Table 2; Figure 2A), but participation rates were highest in Northern Ireland and the South West (Table 2; Figure 2B; Figure 3). Due to the lower sampling rates in Northern Ireland and Scotland, these results were very uncertain (Table 2; Figure 2B; Figure 3).

Table 2. Sea angler numbers, participation rates, days fished by platform, and days fished by an individual in 2012, and 2015-17. The numbers for 2012 were from surveys of Great Britain (Armstrong et al., 2013) and Northern Ireland (McMinn, 2013). UK indicates resident in the UK. In 2016, some postcodes were missing making assigning location impossible for around 6,000 sea anglers, but were assigned to England for this analysis. Average is the mean of the 2015-17 results. Standard errors are given in brackets.

Measure	2012	2015 (UK)	2016 (UK)	2017 (UK)	Average
<b>A. Numbers (thousands)</b>					
Total sea angling UK	1,145	694 (99)	874 (128)	902 (149)	823
England	884	525 (87)	601 (101)	677 (103)	603
Wales	76	46 (24)	99 (49)	69 (33)	72
Scotland	125	75 (31)	88 (46)	81 (40)	81
Northern Ireland	65*	47 (24)	80 (37)	75 (38)	67
Total non-angling methods	---	104	131	242	159
<b>B. Participation (%)</b>					
Total sea angling UK	2.2	1.4	1.7	1.7	1.6
England	2.2	1.3	1.4	1.5	1.4
Wales	3.1	1.9	3.8	2.6	2.8
Scotland	2.4	1.8	2.0	1.7	1.8
Northern Ireland	3.6*	3.2	5.2	4.8	4.4
Total non-angling methods	---	0.2	0.2	0.5	0.3
<b>C. Effort (million days)</b>					
Total sea angling UK	4.8	6.7	7.5	6.7	7.0
Kayak	---	0.2	0.3	0.3	0.3
Private	0.5	1.3	1.2	1.6	1.3
Charter	0.4	0.2	0.2	0.3	0.3
Shore	3.9	5.0	5.8	4.5	5.1
Total non-angling methods	---	0.2	0.6	0.6	
<b>D. Effort (days/angler)</b>					
Total sea angling UK	4.2	9.7	8.6	7.4	8.5

\*Northern Ireland numbers are from McMinn (2013)

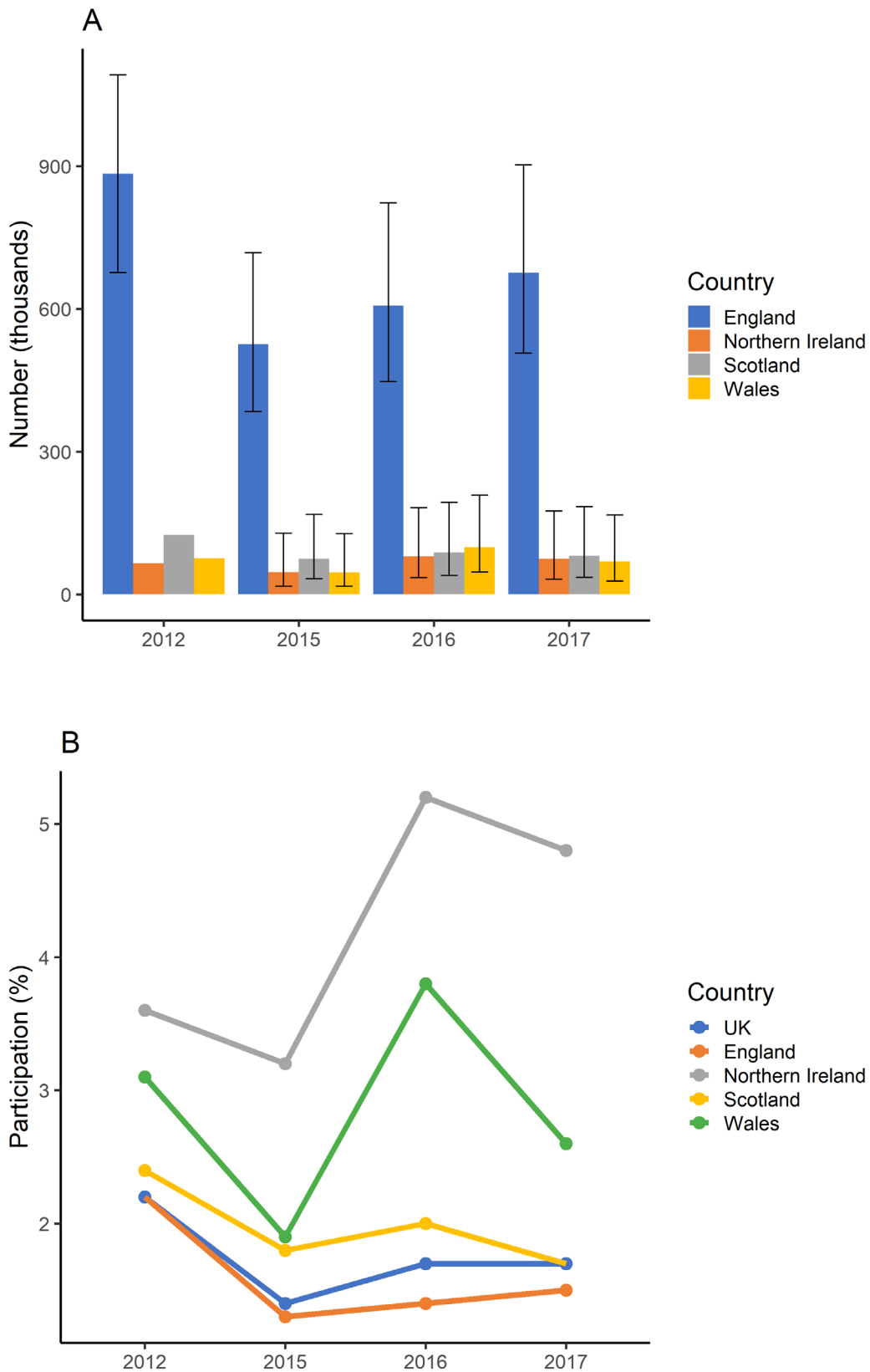


Figure 2. Numbers (A) and participation rates (B) of sea anglers in UK (2012 GB data from Armstrong et al. (2013) and Northern Ireland from McMinn (2013)). Errors in numbers represent 95% confidence intervals.

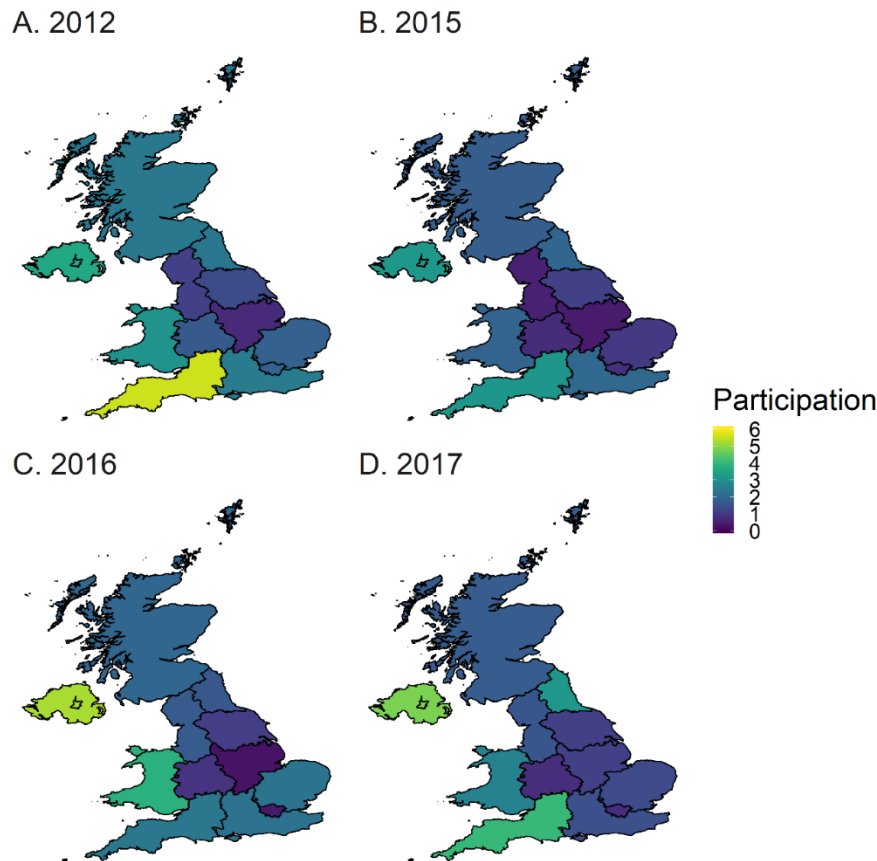


Figure 3. Participation rates (%) in sea angling by region in 2012 (A), 2015 (B), 2016 (C), and 2017 (D).

The majority of sea anglers were between 25 and 64 years old (Figure 4A), and there were similar participation rates across age groups apart from a lower rate for those over 65 years old (Figure 4B). Most sea anglers were male, but the percentage of males was lower than in most previous surveys at 80% (Figure 4C) and a higher participation rate for males (Figure 4D). Sea anglers were mainly from socio-economic groups B, C1 and C2, with a lower portion from A and E (Figure 4E)<sup>9</sup>. Participation rates were reasonably consistent except for a lower rate for group E (Figure 4F).

From 2015 to 2017, the numbers and participation rates in sea angling estimated by the Watersports Participation Survey have been relatively consistent over time (Figure 2 to Figure 4). Comparison with results from different surveys done in 2012 (Armstrong et al., 2013) showed fewer sea anglers and a lower participation rate between 2015-17. However, the confidence intervals overlap for all years meaning that these differences in participation between years from the different surveys are more likely to be due to sampling error than representing real differences (Figure 2A&B). Proportions of sea anglers by age, gender, socio-economic groups were similar (Figure 4).

### 3.2 Days Fished

From 2015 to 2017, sea anglers fished using rod and line and handline in the UK for an average total of 7.0 million days each year, ranging from 6.7 to 7.5 million days (Table 2). This represented around

<sup>9</sup> [https://en.wikipedia.org/wiki/NRS\\_social\\_grade](https://en.wikipedia.org/wiki/NRS_social_grade)

an average 8.5 days fished each year by an individual and varied between 7.4 and 9.7 days per year over the three years (Table 2; Figure 5A). The majority of days were fished from the shore, with private or rental boat the next most common, and charter boats and kayaks least used (Table 2; Figure 5B). Other gears were used, with around 0.5 million days sea fishing with spears, nets, pots, traps or hand gathering (Table 2; Figure 5B), but was not considered further due to the low participation rates. The patterns were consistent across all years of the Watersports Participation Survey (Table 2; Figure 5). However, the estimates of total effort and days fished by each angler in the Watersports Participation Survey were higher than found using a different survey approach in 2012 (Armstrong et al., 2013) (Table 2; Figure 5).

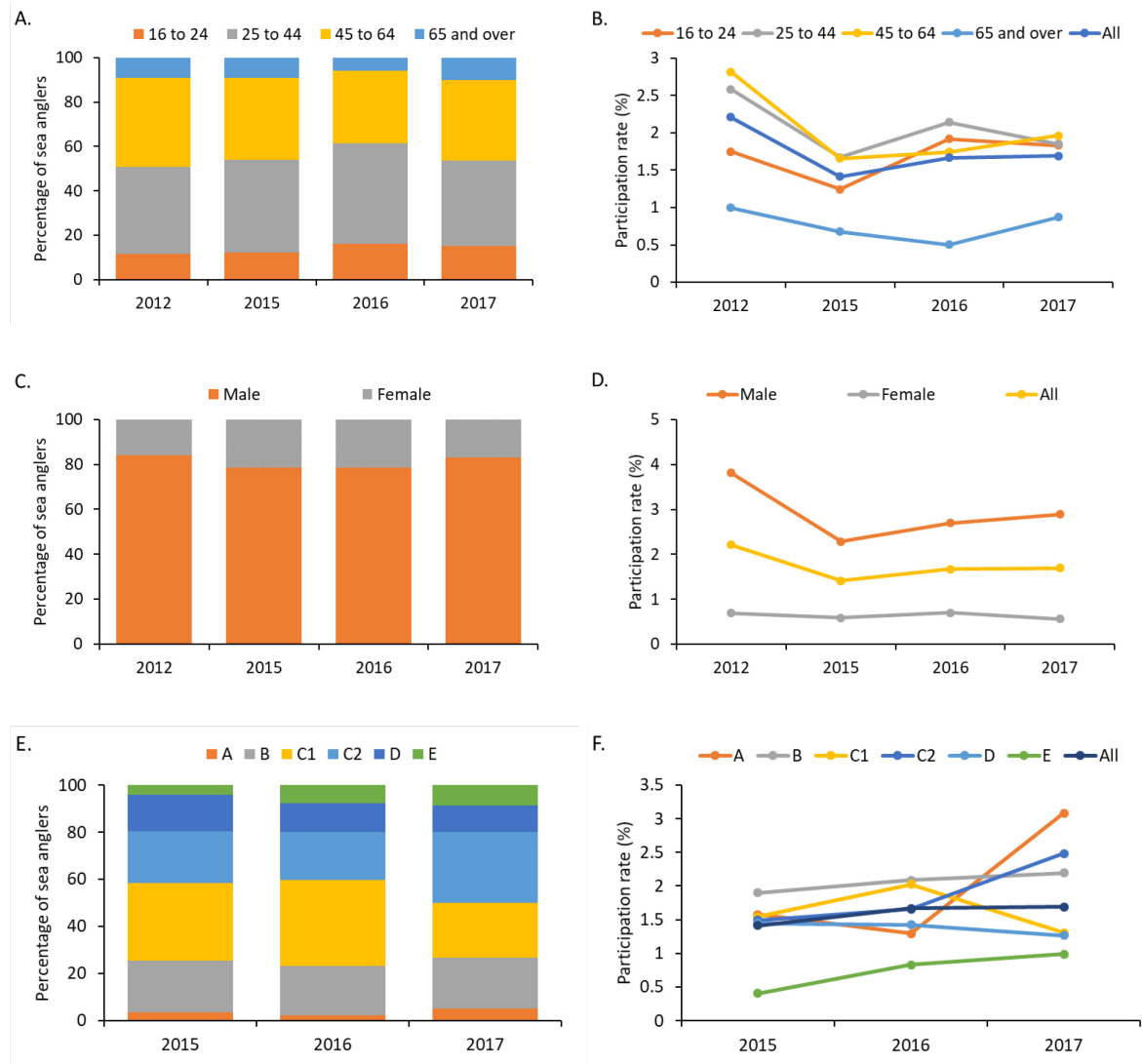


Figure 4. The percentage (A, C, E) and participation rates (B, D, F) of sea anglers by age (A&B), gender (C&D) and socio-economic group (E&F).

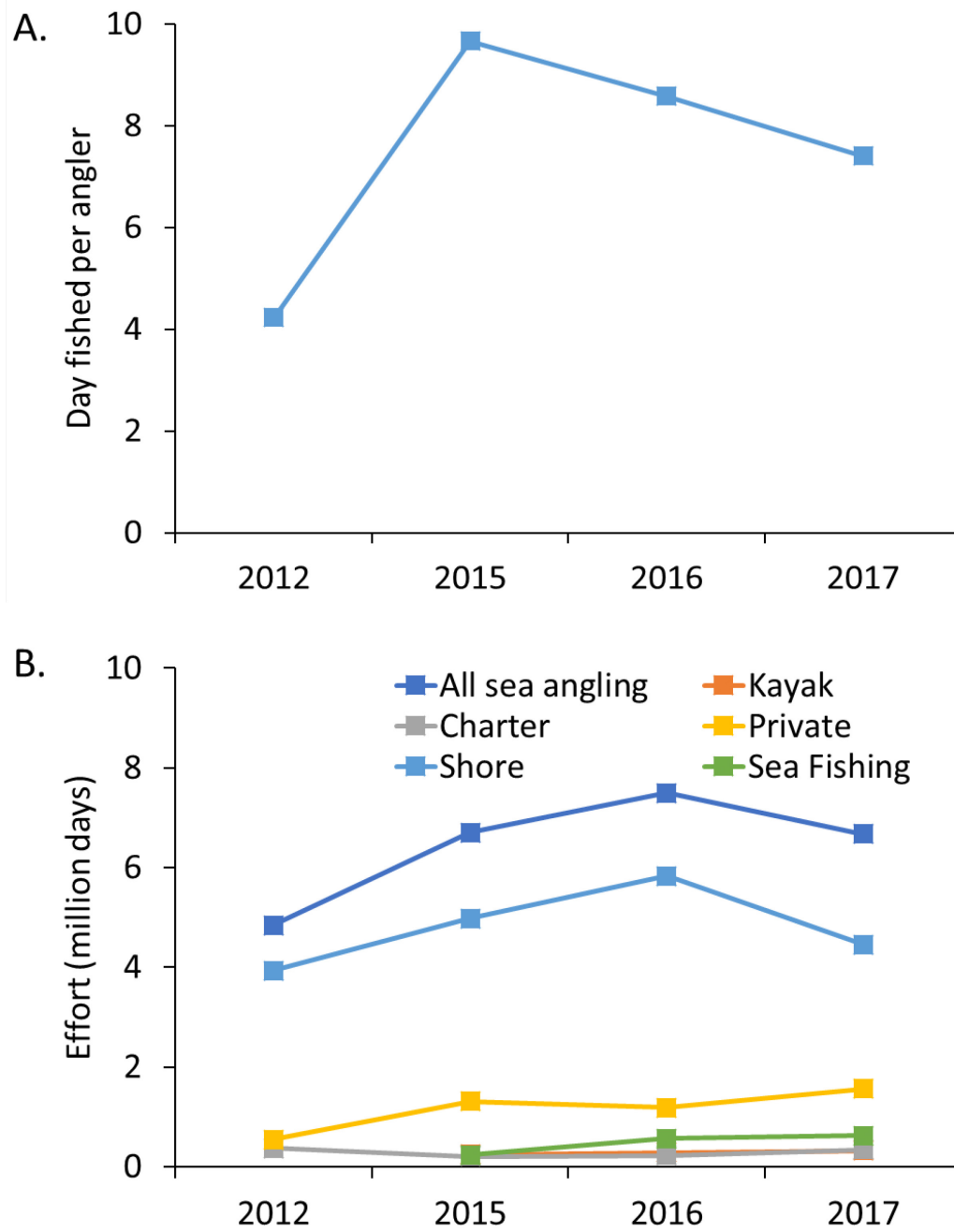


Figure 5. Days fished by an individual (A) and total days fished by platform (D) by sea anglers in Great Britain (2012) and the UK (2015-17).

## 4 Discussion

The Watersports Participation Survey indicates that participation in watersports activities in the UK has increased in the past 5 years from 22.7% to 30.6%, representing about 16.3 million individuals of 16 years or older in 2017. The results from the questions on sea angling were reasonably consistent between years. On average from 2015-17, 823000 people representing 1.6% of the UK population of 16 years or older went sea angling each year, with the largest numbers being residents of England. Most sea anglers were males between 25 and 64 years old from socio-economic groups B, C1 and C2. There was also consistency in effort between years for total days fished, days fished by an individual, and effort on different platforms. Generally, sea angling from the shore had the highest effort, followed by private then charter boats and kayaks. The large popularity of shore fishing is likely to reflect the easy access to fishing sites and the generally lower cost per trip compared with fishing from boats whether rented or owned.

Given the small annual numbers of survey respondents that had been sea angling, the results for individual regions and demographic characteristics are imprecise due to the sample sizes being even smaller at these scales. The sample sizes for Northern Ireland and Scotland are particularly small, meaning that the estimates of numbers of sea anglers and days fished in these countries are likely to be unreliable in any year. Combining estimates over a series of years would be expected to provide more robust results depending on the extent of any trends over time in variables of interest.

Previous studies found higher numbers of sea anglers and participation rates than given by the Watersports Participation Survey (e.g. Armstrong et al., 2013; Drew, 2004; McMinn, 2013; Radford and Riddington, 2009; Simpson and Mawle, 2005, 2010), despite similar demographic breakdown of the target population. These differences could be due to a real change in the sea angling population, measurement error or a difference between survey approaches. Participation rates vary in both time and space, with large differences between countries (Hyder et al., 2017; 2018). Many factors have been shown to influence participation rates (Arlinghaus et al., 2015; Edwards, 1989; Heberlein et al., 2002), but it is likely that complex interactions between factors drive differences in participation rate and vary between countries. Participation rates have been suggested to decline with population density and gross domestic product, indicating a potential negative effect of urbanisation and post-industrialisation on fishing interest (Arlinghaus et al., 2015).

Recreational sea fishing using nets, pots, traps, and spears was found to be a low-participation activity compared with sea angling, with a participation rate of 0.3% and around half a million trips. This level of participation makes a diary approach very difficult due to the challenge of obtaining a sufficient, representative sample of fishers using each of the different gears. As a result, catches by these sea fishing gears are recorded in the catch diary, but excluded from catch estimates. It would be useful in future to assess participation for each of the different gears, as there is likely to be a large difference in the importance of this catch depending on the gear used (e.g. speargun versus net). However, some gears such as pots are unlikely to have a substantial overall impact on UK fish or shellfish stocks as the number of pots that recreational fishers can use and the size of their catch is limited (this does not preclude the possibility of more localised effects). A specific question on non-angling sea fishing gears could be included in future Watersports Participation Surveys to improve understanding of the use of these gears for recreational purposes.

There are additional changes that could be made to improve the quality of sea angling data produced by the Watersports Participation Survey. For example, it would be beneficial to change the description to 'rod and line' to remove any confusion with handlines and crabbing. In addition, it needs to be made clearer that only those that have been angling themselves should respond positively, rather than people who have accompanied the angler on some trips without fishing themselves. Some changes to survey questions are simple to implement, with changes to some questions planned for 2019 survey, but others are integral to the continuity of the survey (e.g. changes from numbers of times a person went fishing to numbers of days). Increasing the level of sampling in Northern Ireland and Scotland to increase the precision for those regions is unlikely to be implemented due to the additional cost, and the fact that the main benefits will be to increase precision for lower participation activities as there will little impact on estimate for more popular activities. As the sampling effort is unlikely be increased, error estimates have been provided for the participation and numbers, so that this can be considered in the interpretation of the data. This will also help to understand the level of uncertainty in the economic (Annex 3) and catch (Annex 4) outputs, as this is likely to contribute significantly to the uncertainty in national estimates.

To conclude, the Watersports Participation Survey has been used to estimate participation rates and demographic characteristic of UK sea anglers from 2015-17. There are some differences with previous surveys, but further investigation is needed to ascertain the relative importance of changes in participation rates, measurement error, and survey design effects. The Watersports Participation Survey has provided relatively consistent estimates of numbers and participation for sea angling over time, so is robust and can be used to raise catch estimates and economics for the whole of the UK. However, there are challenges with interpreting the results for specific countries (e.g. Northern Ireland and Scotland), and estimates of uncertainty are provided to help interpret these results.



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Centre for Environment  
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# Cefas

*World Class Science for the Marine and Freshwater Environment*

## About us

We are the Government's marine and freshwater science experts. We help keep our seas, oceans and rivers healthy and productive and our seafood safe and sustainable by providing data and advice to the UK Government and our overseas partners.

We are passionate about what we do because our work helps tackle the serious global problems of climate change, marine litter, over-fishing and pollution in support of the UK's commitments to a better future (for example the UN Sustainable Development Goals and Defra's 25 year Environment Plan).

We work in partnership with our colleagues in Defra and across UK government, and with international governments, business, maritime and fishing industry, non-governmental organisations, research institutes, universities, civil society and schools to collate and share knowledge.

Together we can understand and value our seas to secure a sustainable blue future for us all, and help create a greater place for living.

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Innovative, world-class science is central to our mission. Our scientists use a breadth of surveying, mapping and sampling technologies to collect and analyse data that are reliable and valuable. We use our state-of-the-art Research Vessel Cefas Endeavour, autonomous marine vehicles, remotely piloted aircraft and utilise satellites to monitor and assess the health of our waters.

In our laboratories in Lowestoft and Weymouth we:

- safeguard human and animal health
- enable food security
- support marine economies.

This is supported by monitoring risks and disease in water and seafood; using our data in advanced computer models to advise on how best to manage fish stocks and seafood farming; to reduce the environmental impact of man-made developments; and to respond to serious emergencies such as fish disease outbreaks, and to respond to oil or chemical spills, and radioactivity leaks.

Overseas, our scientists currently work in Commonwealth countries, United Kingdom Overseas Territories, South East Asia and the Middle East.

Our customer base and partnerships are broad, spanning Government, public and private sectors, academia, non-governmental organisations (NGOs), at home and internationally.



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