Exploring recreational water use in England

Chief Scientist's Group report

July 2025

Version: SC230022/R

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Dr Robert Bradburne
Chief Scientist

Contents

Abbreviations & Glossary

AIS	Automatic Identification System
BW	Bathing water
CS&PF	Channel Swimming & Piloting Federation
DTM	Digital terrain model
HTML	Hypertext markup language
FIO	Faecal indicator organisms
GIS	Geographic information system
GPS	Global positioning system
GPX	GPS exchange format
JSON	JavaScript object notation
KDE	Kernel density estimation
KML	Keyhole markup language
MENE	Monitor of Engagement with the Natural Environment survey
MMO	Marine Management Organisation
OS	Ordnance Survey
PANS	People and Nature Survey
PRoW	Public Rights of Way
RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
SSRS	Safer Seas & Rivers Service

UKCEH	United Kingdom Centre for Ecology & Hydrology
URL	Uniform resource locator
WFD	Water Framework Directive
WQA	Water Quality Archive

Water recreation report	A geolocated point where a form of water recreation was indicated either by physical infrastructure or a report of recreational activity.
Water recreation zone	A polygonal area constructed from the intersection of multiple water recreation reports each within a 500m radius buffer circle.
Water recreation location	An aggregated, geolocated point at the centroid of a water recreation zone.

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Executive summary

The Environment Agency is responsible for monitoring water quality at designated bathing waters during the bathing season. As part of this monitoring, we also consider the number of water users present when the water samples are taken. However, there are a range of activities taking place at other locations for which we have no data. This includes some sites that are likely to be, or have been, proposed as new sites for designation. With an aim to improve our understanding of the nature and extent of recreational water use across England we set out to explore data from external organisations such as member led associations and national governing bodies.

In this research project we collated data from 17 organisations (including 14 non-governmental organisations) on where and when water recreation takes place across England. Through this evaluation we developed a new national overview and identified a considerable number of distinct water recreation locations. At least 3,347 locations were found, of which 1,727 were used for swimming. Whilst this number is significantly higher than the 451 presently designated bathing waters, water recreation was not identified everywhere. In fact, reports of water recreation were only identified in 1,558 of the 4,261 waterbody catchments (37%) in England.

In this project, more than three times as many inland freshwater sites (2,521) were found in comparison to coastal and estuarine sites (826). Activities considered at inland freshwater and coastal sites included swimming, multi-activity sports which included an open water swimming element (such as triathlons), paddling, rowing and sailing in addition to surfing at coastal areas. Overall, 15,089km of waterways accessible by paddling craft were identified, including 11,954km of rivers and 3,136km of canals. Locations of wild swimming spots were determined and notably found to cluster (33%) within National Parks and National Landscapes where the waterside is more often publicly accessible.

Where data existed regarding the times of year when water recreation takes place, the collated results provided a mixed picture regarding anecdotal reports of water recreation increasing in recent years. The Environment Agency's own bather and beach user data showed a modest increase compared to levels before the coronavirus (COVID-19) pandemic, however, this has recently fallen again in 2024. Event listings for open water swimming, triathlons and other multisports appeared to show an approximate 15% drop in occurrence and attendance. On the other hand, unpowered paddle boat registrations and swimming across the English Channel have notably increased since 2020 (by 127% and 5%, respectively).

Nonetheless, there is evidence of organised activities taking place outside of the designated bathing water season. It was observed that freshwater events involving open water swims tended to commence prior to the season in the spring, whereas coastal events continued later into the autumn. Conversely, rowing events appeared to take place almost all year round. An unknown factor is the usage of wild swimming locations for which there is an increasing level of media attention but no suitable participation data available.

The number of multisports and swimming events which took place between 2017 and 2023 have been appraised in terms of frequency of occurrence and the expected numbers of competitors. As exemplars, at Dorney Lake in Eton (a 2012 Summer Olympics open water site) 95 events took place over the seven-year period (with 19 events held in 2023). Whilst at the annual London Triathlon in the Royal Victoria Dock up to 11,000 water users were expected at each single day event.

The participation numbers at open water events far exceed the numbers measured routinely by the Environment Agency at designated bathing waters. The maximum density of people recorded at any designated bathing water site between 2017 and 2024 was 600 bathers and 3,000 beach users (per 100m), with bathing water usage most concentrated in the South West.

Many locations along the south-western, southern and north-eastern coastlines were identified with a high consensus among the 17 data sources (in particular, three locations were indicated independently by 12 of the sources). Standout inland areas which ranked highly for water recreation included waterbody catchments around the Thames, Great Ouse, Cam, Nene, Tyne and Trent rivers and the natural lakes of the Lake District National Park.

Overall, whilst the collated dataset does have its limitations, a national picture and new dataset of the spatial distribution of water recreation in England has been produced as a snapshot of the data as of 2024.

1 Background

In England, the Environment Agency is responsible for monitoring and classifying water quality to inform bather protection at designated bathing waters during the bathing season. This is done through the enumeration of *Escherichia coli and* intestinal *Enterococci* bacteria as faecal indicator organisms (FIOs). At present, 451 locations in England are designated by the Secretary of State and Department for Environment, Food and Rural Affairs (Defra) under the Bathing Water Regulations 2013 [1], [2].

The number of potential new bathing sites being proposed has increased in recent years and public campaigns are increasingly promoting concerns about water quality at non-designated sites [3]. In the 2021 bathing season, the river 'Wharfe at Cromwheel, Ilkley' became the first riverine site to be designated for bathing in England. This was followed by 'Wolvercote Mill Stream' in 2022 and a further 12 riverine sites in 2024 [4]. These successful designations for the 2024 bathing season were amongst 27 new bathing water applications meeting new guidance issued by Defra with the inclusion of surveys which showed usage by more than 100 bathers per day (adults/children swimming or children paddling) on two non-event days [5]. In March 2025 Defra announced the response to a public consultation on bathing regulations, which included moving the fixed bathing season dates from legislation to guidance and to consider wider reform of the definition of 'bathers' to include other recreational water users such as surfers, paddlers and rowers [6].

In the UK, the types and ways vessels are permitted to operate on an inland waterway are defined by the requirements of a navigation authority [7]. Navigation authorities oversee management and maintenance of navigable waterways and most require paid boat registration licences to cover their operation costs. These licences cover both powered vessels (motor cruisers, houseboats) and unpowered watercraft (open vessels), including rowing boats, canoes, stand-up paddleboards and sailing dinghies.

The Environment Agency acts as the navigation authority for the Rye and Lydney harbours, as well as the Wye, Thames, Medway and Anglian waterways, with the latter three navigations requiring paid licences to operate vessels [8]. Joint registration agreements are also in place with British Rowing [9] and Paddle UK [10] (for unpowered watercraft) and the Canal & River Trust [11] (for powered vessels) allowing members to directly purchase navigation licences for Environment Agency waterways. Paddle UK through its membership further provides a broader waterways licence for paddling covering multiple navigation authorities [10].

The water industry has committed to supporting new bathing water applications, especially in rivers, through the National Storm Overflows Plan for England (initially announced as support for 100 communities) [12], [13]. Furthermore, in the £14.5 million 'Access for All' programme within Defra's Environmental Improvement Plan 2023 was a commitment that 'everyone should live within 15 minutes' walk of a green or blue space' [5]. The number and developing coordination of new bathing water applications could mean an increased monitoring requirement for the Environment Agency. Therefore, having a spatially and

numerically appraised overview for the water recreation landscape would be beneficial for planning and prioritisation purposes.

In 2024, Defra published the “Access to green space in England” official statistic in development and highlighted the lack of a blue space access point dataset [14]. There is currently a lack of robust data describing the number, frequency and sociodemographic characteristics of people engaging in water recreation. This prevents analysis of any potential geographical trends, such as if there are any particular catchments where large numbers of people access the water environment. Further, temporal trends of when activities take place and anecdotal increases in recreational water use cannot be validated.

2 Aims

This project aimed to produce a spatial and temporal understanding of English water bodies used for recreation, especially where immersive activities, which carry a potential chance of ingestion of water, were undertaken. Activities conducted at-water or on-water (except where there is a reasonable chance of falling into the water) were mostly excluded. Furthermore, the aim was to gain an understanding of the time of year when these activities take place and to scope and scale of activity at these locations.

To achieve these aims, the objectives were to:

- Identify and collate data at identified locations (including designated bathing waters) which provide information or indicate:
    - where the water environment is used recreationally,
    - what recreation activities take place,
    - when and the times of year sites are used,
    - how much usage and the number of water users.
- Combine and classify collated data sources to map, explore and highlight water recreation intensive areas across England.

3 Approach

At the project outset the scope was defined for the questions on where, what, when and how much water recreation takes place. Following this scope, relevant datasets were identified, captured, processed, collated, and analysed.

3.1 Scope definition

3.1.1 Water recreation locations

Locations were constrained to those within England as the Environment Agency remit. All environmental surface water body types were included; saline coastal, transitional estuarine, and freshwater rivers, lakes and canals (regardless of bathing water designation status).

Whilst some data sources dealt exclusively with environmental surface waters, others included indoor (e.g. swimming pools) or non-environmental outdoor waters (e.g. chlorinated lidos). In the case of combined data where no appropriate classifications were made, location names including terms with ambiguous usage, such as ‘pool’, ‘lido’ or ‘spa’ (opposed to ‘river’ or ‘lake’), were inspected manually and removed where necessary. This data treatment step may have discarded some legitimate natural waters but was a necessary step for the spatial appraisal of outdoor recreation.

For designated bathing waters, the locations were already known, and the focus was on the collation of usage data (e.g., how many people used these areas). However, for most inland and non-designated waters the first step was to identify the locations before additional information was collected.

3.1.2 Water recreation activities

To set the scope for the project a list of recreation activities considered within scope was produced (Table 1) [15]. This included activities involving immersion in the water or where there was a likelihood of submersion (i.e. due to falling in).

It was recognised that there are different definitions of ‘water recreation’ varying in scope and that most definitions extend beyond the ‘bathing’ activities defined for the Bathing Water Regulations 2013 [1]. Certain recreation activities (including diving and angling) were not included in this study due to unavailability of permitted data and/or immersive scope. Furthermore, a comprehensive mapping of locations for these activities already exists through Finstrokes [16] for diving and the Angling Trust [17] for angling.

Table 1: Sports and activities included within scope of this project. Data from the Natural England MENE and PANS national surveys was also captured but the water recreation activity could not be specified from the aggregated data.

Activity grouping	Included activities
Swimming	• Bathing / casual swimming / paddling • Competitive swimming • Wild swimming
Multisports (involving an open water swimming element)	• Triathlon (Swim + Cycle + Run) • Ironman (2.4 mile Swim + Cycle + Run) • Aquathlon (Run + Swim) • Aquabike (Swim + Cycle) • Swimrun (Swim + Run)
Paddling	• Canoeing • Kayaking • Stand-up Paddleboarding • Adventure Race (Orienteering + Paddling)
Rowing	• Rowing
Sailing	• Dinghy sailing • Windsurfing
Surfing	• Surfboarding • Bodyboarding

3.1.3 Water recreation time of year and participants

Data was sought which linked exact locations (by grid reference or geographic coordinates) to exact times, dates, months or (sporting or calendar) seasons. Data was largely constrained to the 2017 to 2023 calendar years with a limited coverage on the 2024 bathing season and the scheduled 2024/25 events season. Participation data was also sought which linked exact locations to numbers and/or cohorts of water users.

3.2 Data sources

Data was obtained from the following data sources as listed in Table 2.

Table 2: Data sources, datasets and attribution details for data used for water recreation reports used in this research.

Data source	Dataset source	Data attribution
British Rowing	Consolidated list of clubs, their locations, and declared number of members [provided]	Data provided © British Rowing 2024.
	Rowing activity finder website (clubs and competitions) [18]	Data sourced with permission © British Rowing 2024.
British Triathlon	'Find an Event' website (past events 2017-2023 and scheduled events 2024-25) [19]	Data sourced with permission © British Triathlon 2024.
British Triathlon (Beyond Swim)	'Venues Archive' website (Beyond Swim accredited venues) [20]	Data sourced with permission © British Triathlon 2024.
Channel Swimming & Piloting Federation	'CS&PF Swims' website (swim records and tracks) [21]	Data sourced with permission © Channel Swimming & Piloting Federation 2024.
Environment Agency	'Swimfo' website (bathing water profiles) [2]	Contains Environment Agency information licensed under the Open Government Licence v3.0.
	'Water Quality Archive' website (bather and beach user counts) [22]	Contains Environment Agency information licensed under the Open Government Licence v3.0.
	Environment Agency Navigation and waterways data (boat registration statistics and shapefiles) [provided]	Data provided © Environment Agency 2024.
Marine Management Organisation	'MMO1163 Mapping Sea Angling' data (slipways) [23]	© Marine Management Organisation copyright and/or database right 2023. All rights reserved. [Open Government Licence v3.0]
	'MMO1064 Marine recreation potential model outputs' data (beach activities, surfing, sailing, paddle sports, scuba diving) [24]	© Marine Management Organisation copyright and/or database right 2023. All rights reserved. [Open Government Licence v3.0]

Data source	Dataset source	Data attribution
Natural England	'Monitor of Engagement with the Natural Environment (MENE)' (2009-2019)	Contains Natural England information licensed under the Open Government Licence v3.0.
	'People and Nature Survey (PANS) for England' (2020-2023)	Natural England. (2024). People and Nature Survey for England, 2020-2023: Open Access. [data collection]. 5th Edition. UK Data Service. SN: 9092, DOI: http://doi.org/10.5255/UKDA-SN-9092-5 Contains Natural England information licensed under the Open Government Licence v3.0.
	Accessible waterside by PRoW and access land data [25], [26]	Contains Natural England information licensed under the Open Government Licence v3.0.
Paddle UK	'PaddlePoints' website (launches, clubs, hire centres and waterways) [27]	Data sourced with permission © Paddle UK 2024.
Royal National Lifeboat Institution	RNLI lifeguard units data [28]	Contains RNLI Open Data licensed under the GIS Open Data Licence.
	RNLI return of service data (callouts from 2019-2023) [29]	Contains RNLI Open Data licensed under the GIS Open Data Licence.
Royal Life Saving Society UK	'Aqua Parks' website [30]	Data sourced with permission © Royal Life Saving Society UK 2024.
Royal Yachting Association	RYA Club, Marina data (point data within 'RYA UK Coastal Atlas of Recreational Boating') [31]	© Data reproduced under licence from the Royal Yachting Association.
	'General Boating Areas' data (polygon data within 'RYA UK Coastal Atlas of Recreational Boating') [31]	© Data reproduced under licence from the Royal Yachting Association.
	AIS intensity data (raster data within 'RYA UK Coastal Atlas of Recreational Boating') [31]	© Data reproduced under licence from the Royal Yachting Association.
Surfers Against Sewage	'Safer Seas and Rivers Service' location information [provided]	Data provided © Surfers Against Sewage 2024.
Surfing England	'Surf Schools Archive' website [32]	Data sourced with permission © Royal Life Saving Society UK 2024.

Data source	Dataset source	Data attribution
The Rivers Trust	'River Bathing Sites' data [33]	Contains The Rivers Trust data licensed under the CC BY-NC-SA 4.0 license.
TimeOutdoors	'Events calendar 2024/2025' website (scheduled events) [34]	Data sourced with permission © TimeOutdoors 2024.
Water Buoy Ltd	'WildSwim' application data (locations and club information) [provided]	Data provided © Water Buoy Ltd 2024.
***2000 Wild Swims* by Rob Fryer**	'Wild Swim database' book index [provided]	Contains data sourced with permission from *2000 Wild Swims* by Rob Fryer (2022). https://www.wild-swimming.com

3.2.1 Data processing

For brevity in the main report, the individual processing steps involved in data collection from each of the included data sources are given in the Appendix section 7.1.

3.3 Data extraction and aggregation

Selected fields of interest from each dataset were renamed to a common naming scheme, assigned a data category and activity type and combined into one dataset table of 'water recreation reports' using Python v3.9.13 and the modules 'pandas' [35] and 'geopandas' [36].

The combined recreation report dataset was intersected against the Environment Agency public facing administrative boundaries [37] which included a seaward region and matched with existing bathing water information. This resulted in retention of only English data as some datasets covered the whole UK or beyond.

3.3.1 Waterbody attribution

There was challenge in associating recreation report data points to the relevant waterbody as some reports (such as canoe launch points and GPS data) were exactly geolocated to the waterbody, whereas others were located at site-specific locations (e.g. an event registration point or the site entrance some distance from the waterbody) and potentially in closer proximity to a different waterbody. For example, in some cases a large lake could have entry points spaced far from the waterbody happening to be next to a small stream, conversely, in other cases the recreation site was intended to be a minor stream nearby a major waterbody. This meant the attributed waterbody could not be automatically assigned as the 'nearest'. To overcome this, recreation reports were intersected against waterbodies within 500m according to the five waterbody types below.

- Coastal
- Estuarine
- Lake
- River
- Canal

Additionally, waterbody attributions within the source data which were given to a higher level of detail (e.g. ‘stream’, ‘dock’, etc) were converted into the relevant type of the four typical bathing water designations (coastal, estuarine, lake, river) and superseded the programmatically assigned waterbody. As an exception, canal attributions were kept as these could be programmatically assigned based on the ‘OS MasterMap Water Network’ data. Water recreation locations which did not intersect with any waterbodies within 500m and did not have a source waterbody attribution (e.g. a sailing club) were removed from the analysis as they may have related to off-site locations or non-environmental waters (e.g. a swimming pool).

Many water data sources only had coverage for inland or coastal waterbodies and in some cases the waterbody types (i.e. rivers, lakes) were not differentiated. A master dataset of classified English waterbodies was created from combining various datasets to cover the full area (Table 3).

Table 3: Data sources, datasets and attribution details for data used for waterbody attribution used in this research.

Dataset source	Data attribution and/or licence
Environment Agency 'Water Framework Directive (WFD) coastal and transitional waterbodies Cycle 2 (England)' [38]	© Environment Agency copyright and/or database right 2015. All rights reserved. Contains Ordnance Survey data © Crown copyright and database right 2013. Open Government Licence
Natural Resources Wales 'Water Framework Directive (WFD) transitional waterbodies Cycle 2 (Wales)' [39] (Severn Lower and Dee water bodies)	Contains Natural Resources Wales information © Natural Resources Wales and Database Right. All rights Reserved. Contains Ordnance Survey Data. Ordnance Survey Licence number AC0000849444. Crown Copyright and Database Right. Open Government Licence v3.
Marine Management Organisation (MMO) 'Marine Plan Areas' [40]	Contains Marine Management Organisation information licensed under the Open Government Licence.
UK Centre for Ecology & Hydrology (UKCEH) 'Spatial inventory of UK waterbodies' [41]	© Contains data supplied by UK Centre for Ecology & Hydrology. © Contains Ordnance Survey Data. Acknowledgement: Taylor, P.J. (2021). Spatial inventory of UK waterbodies. NERC EDS Environmental Information Data Centre. (Dataset). https://doi.org/10.5285/b6b92ce3-dcd7-4f0b-8e43-e937ddf1d4eb Open Government Licence v3.
Ordnance Survey 'OS MasterMap Water Network' [42] (lines buffered to 1m to create polygons with underground watercourses removed)	© Crown copyright and database rights 2024, OS AC0000807064. Licenced under the Public Sector Geospatial Agreement (PSGA).

The classified estuarine region was created by combining Environment Agency and Natural Resources Wales WFD transitional waterbody polygons and the 'OS MasterMap Water Network' stretches of the form 'tidal water' and 'foreshore'.

For the coastal region the Environment Agency WFD coastal polygons were first included. To capture the seaward area between these regions and the Environment Agency public facing area outer limits, the labelled inshore MMO marine plan areas were also included (after taking the difference from the WFD coastal and transitional reaches and selecting only the largest remaining polygon in each plan area (to remove artifact polygons along the shoreline).

Lake polygons were sourced from the UKCEH 'Spatial inventory of UK waterbodies' dataset with the addition of lines from the 'OS MasterMap Water Network' stretches of the form 'lake', 'reservoir' and 'marsh'. Riverine line stretches were selected from the network of the form 'inland river'. Canal regions were selected from the network of the form 'canal',

‘transfer’ or ‘lock or flight of locks’. This combined dataset result meant that all waterbodies were classified, and major waterbodies were represented by more accurate polygonal areas (Figure 1).

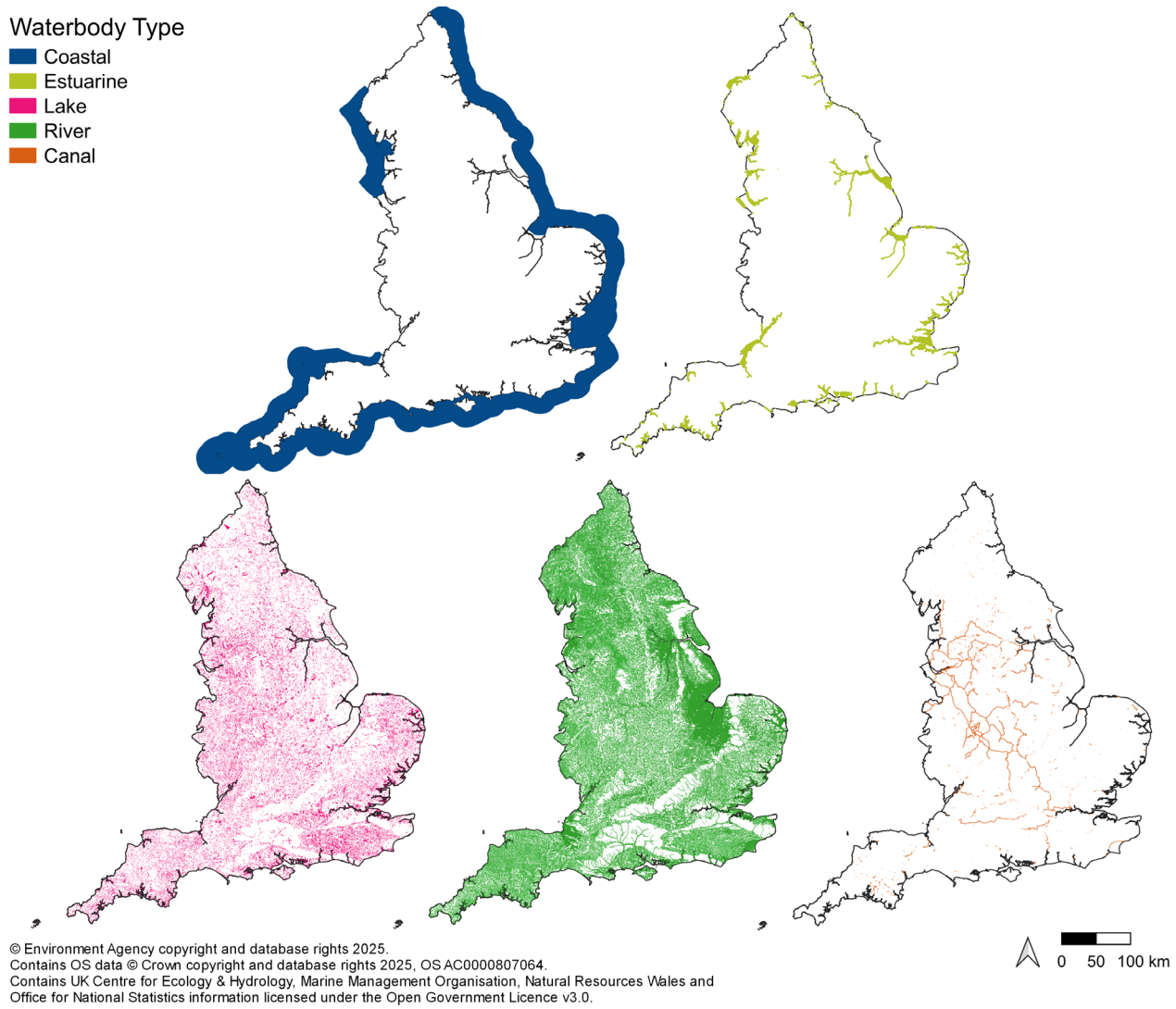

Figure 1: Maps of English waterbody types considered in this project within the Environment Agency public facing area.

3.3.2 Rationalised locations

To avoid double counting of replicate points, such as reports associated with the same waterbody but with slightly different geocoordinates, a buffer of 500m around each point was used. Each recreation report point was combined with other buffered points which intersected into a recreation ‘zone’. Overall, this rationalisation step allowed an enhanced classification of the data pertaining to the usage of waterbodies (e.g. to understand if events are held multiple times per year). Furthermore, at the national level this step did not affect the summary statistics, although it must be noted that this approach led to certain stretches of some waterbodies with closely spaced recreation reports ‘chaining’ together to create one large location zone (Figure 2) or potentially adjacent waterbodies being combined.

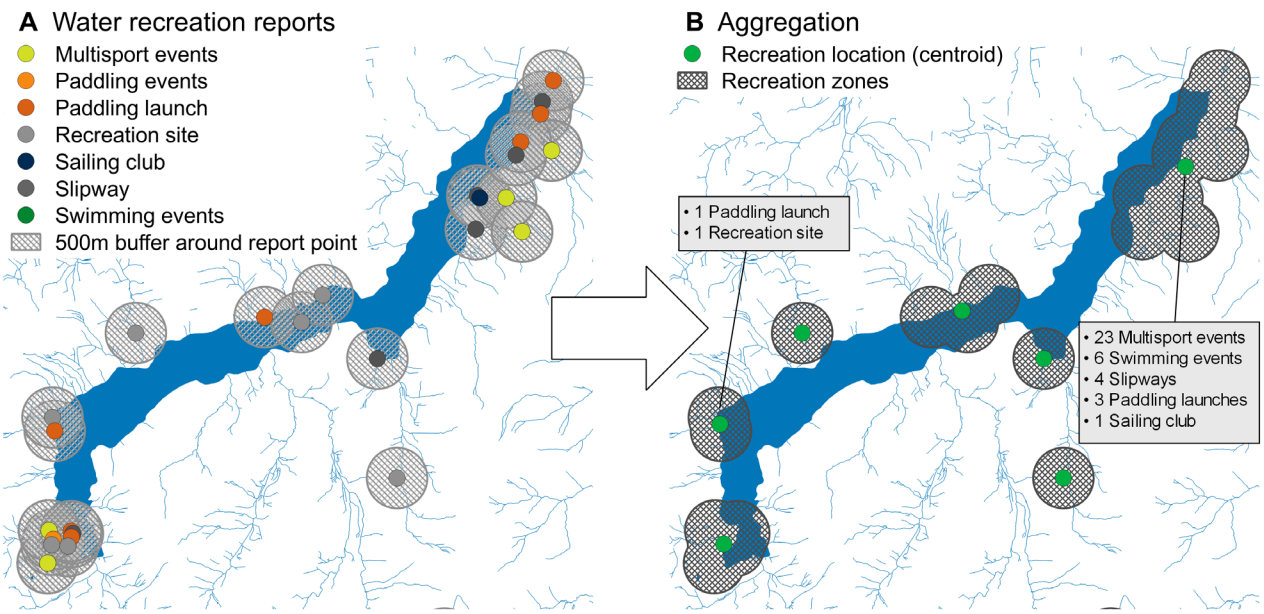

Figure 2: Maps of (A) 61 water recreation reports mapped onto 27 sites (coloured circles) surrounded by buffer zones of 500m radius (light grey hashed circles), and (B) aggregated data displayed in 8 irregularly shaped recreation zones (dark grey hashed) created from intersecting buffer zones, with centroid points (green circles) hereon referred to as recreation locations.

To determine the elevation of each water recreation location, the QGIS 'drape' algorithm [43] was used to assign a height to each point based on the values from the 'Lidar composite elevation digital terrain model (DTM) 1m raster' dataset [44].

Further the land use (UKCEH aggregate class) within each recreation zone was determined by intersecting the recreation zones with the UKCEH land cover map 2023 [45] using the QGIS 'zonal histogram' raster analysis algorithm [43] and the predominant (non-aquatic) land use at each location was calculated.

3.3.3 Catchment summaries

Recreation locations were intersected against the water catchment areas of the Water Framework Directive (WFD; cycle 2 water body catchments [39], [46] within the Environment Agency public facing area) to enable the collation to a lower spatial resolution and tabulation. Locations were also attributed within National Parks [47] and National Landscapes (formerly Areas of Outstanding Natural Beauty) [48].

Data collated in seaward WFD waterbody catchments was further enhanced with marine data from RYA general boating areas and AIS intensity (from the 'RYA UK Coastal Atlas of Recreational Boating' [31]), the number of RNLI callouts (from the RNLI return of service 2019-2023 [29] dataset) and the Marine Management Organisation models of marine recreation potential (MMO1064; [24]) (Appendix sections 7.1.10, 7.1.8 and 7.1.5, respectively).

Inland catchments were intersected against the Natural England accessible waterside (by public rights of way (PRoW) and access land) dataset [25], the total waterside (derived from ‘OS Open Local’ water stretches) and the percentage accessible waterside was calculated per catchment (Appendix section 7.1.6).

Catchment heatmaps were produced with classes clustered using a Jenks natural breaks optimisation in QGIS to reduce within class variation and highlight between class variations [43].

4 Results and discussion

4.1 Water recreation locations in England

4.1.1 Designated bathing waters

The Environment Agency monitors water quality at designated bathing waters up to 20 times per year during the bathing season. As of 2024, there were 451 designated bathing water sites across England (Figure 3) [12]. These sites are mostly coastal (n=369), with some estuarine waters (n=50) but only a limited number of designated freshwater sites with 18 lakes and 14 rivers.

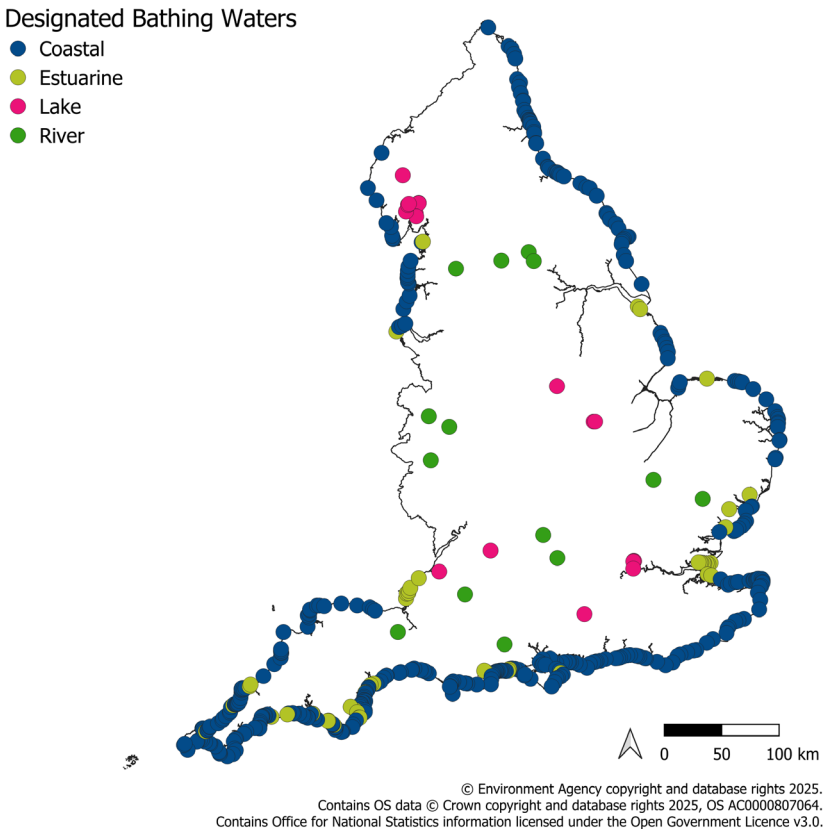

Figure 3: Map of designated bathing waters in England as of 2024 (coloured by waterbody type).

4.1.2 Navigable waterways

The Environment Agency acts as navigation authority for four riverine areas (Figure 4A) [8]. The river Thames waterway is 221km and covers the non-tidal river between Cricklade Bridge and Teddington Lock and smaller stretches of the tidal river and river Kennet. The river Medway navigation is 32km between Allington Lock and the Leigh Barrier at Tonbridge. The Anglian waterways cover 557km over multiple rivers in the Anglian region including the rivers Ancholme, Black Sluice, Glen, Welland, Nene, Great Ouse System

and Stour. The river Wye waterway is 211km including the river Lugg navigation, however does not require a navigation licence [49].

From the Paddle UK 'PaddlePoints' website [27] a total of 15,089km of waterways (including 11,954km rivers and 3,136km canals) were identified in England accessible by recreational paddling craft regardless of licence requirement (Figure 4B). Of these waterways, 8,033km required a licence from a navigation authority (53%) comprising 44% of navigable rivers (5,247km) and 89% of canals (2,786km).

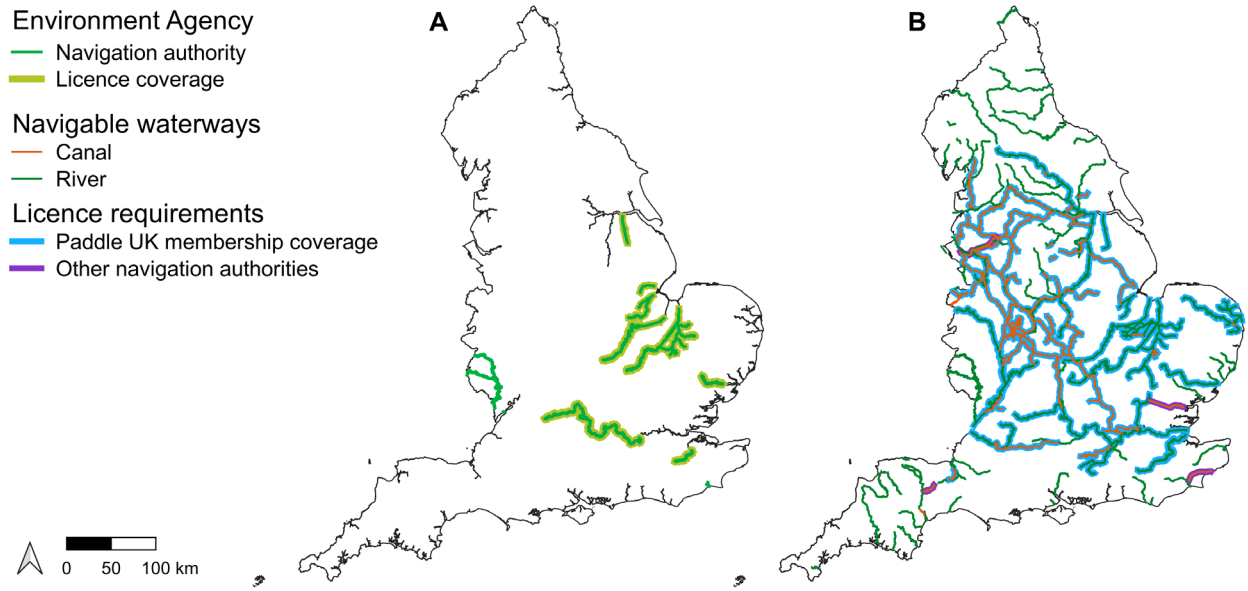

Figure 4: Maps of (A) navigable waterways where the Environment Agency acts as navigation authority (green) with those which require a licence for powered and unpowered watercraft highlighted (yellow), and (B) waterways in England navigable by paddling craft reproduced from Paddle UK 'PaddlePoints' with permission. Thin lines represent waterways coloured by waterbody type (river (dark green) or canal (orange)). Waterways which require a licence have an outline of either blue (included with Paddle UK membership) or purple (another navigation authority).

4.1.3 Recreation locations by waterbody type

In this study, looking across both designated and non-designated waters, data was collated from 17 data sources resulting in 13,500 geolocated reports of water recreation across England. From these reports, 3,347 water recreation locations were identified (rationalised within recreation zones as described in section 3.3.2).

Through this rationalisation approach the 451 designated bathing water monitoring points were merged into 342 recreation locations (as closely spaced monitoring points along the same waterbody/coastal stretch were combined). This example illustrates how the numbers given in this study should be considered an under-estimate. It should be acknowledged that there will be numerous water recreation sites that have either not been included or potentially merged. However, at the national scale the results here represent a

record of the most documented locations contained within the selected datasets captured in 2024.

The recreation locations which were within 500m of coastal and estuarine waterbodies (Figure 1) were assigned as ‘coastal/estuarine’, with the remaining inland points assigned as ‘freshwater’. Overall, 826 coastal/estuarine locations and 2,521 freshwater locations have been identified across England (Figure 5A). Investigating further the types of waterbodies of the 3,347 identified locations, 285 were unambiguously assigned as coastal, 53 as estuarine, 178 as lakes, 1,227 as rivers and 260 as canals. The remaining 1,344 were adjacent to multiple waterbody types (within 500m) or at locations where source attributions from combined reports did not agree and thus were unclassified (Figure 5B).

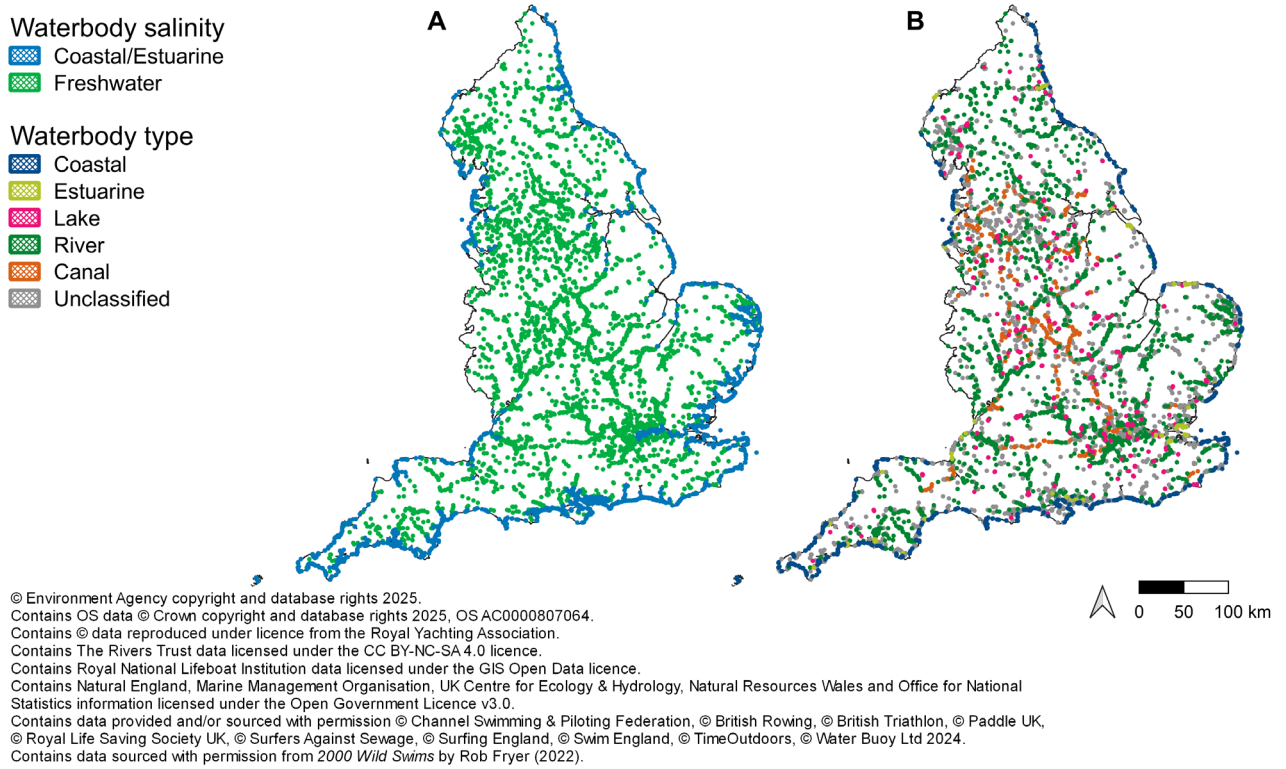

Figure 5: Maps of water recreation zones identified in England by assigned (A) waterbody salinity and (B) waterbody type.

Some highly represented recreation locations could not be programmatically assigned to a waterbody type (i.e. type was set to unclassified) as they were identified at locations of still-water lakes which did not feature in the underlying waterbody GIS datasets. An example of this was at Dorney Lake in Eton, a 2.2km manmade still-water lake used as an open water venue for the 2012 Summer Olympics, which is adjacent but unconnected to the river Thames. These still-water lakes were not present in the WFD waterbody datasets, UKCEH ‘UK Lakes Portal’ dataset nor the OS ‘Mastermap Water Network’. The OS basemap and local surface water products do include still-water lakes but also contain other non-environmental surface waterbodies (e.g. chlorinated lido pools), highlighting the challenge for waterbody attribution (Appendix Figure 1).

4.2 Types of water recreation activities

4.2.1 Overview of locations by recreation activity

It was possible to classify the recreation activities which take place at the indicated sites based upon the origin of the data sources (Appendix section 7.1; for example, Paddle UK data was associated with paddling activity) and in some cases site-by-site attributions within the data itself (Figure 6). Of the 3,347 water recreation locations, 1,727 were used for swimming and of these only 342 (20%) were within 500m of a designated bathing water monitoring point. A subset of these swimming locations (n=259) was also used for multisport events (including triathlons). Furthermore, paddling activities were indicated at 1,706 locations, rowing at 220 locations, sailing at 1,065 locations and surfing at 87 locations across England.

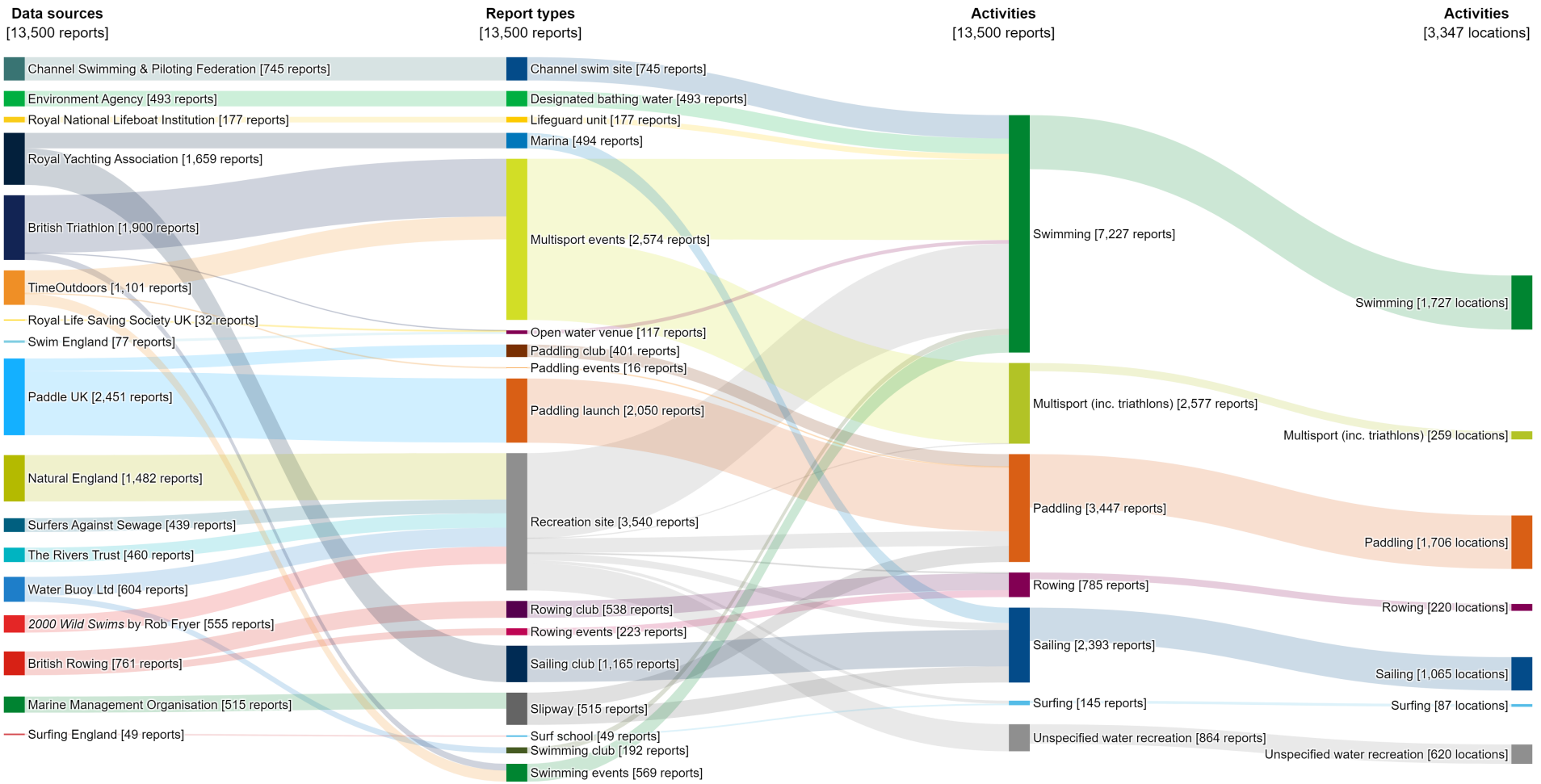

Figure 6: Sankey diagram showing data sources (of point data or derived point data), their respective report types and the number of reports and locations identified for each water recreation activity considered in this study. Note that some reports and locations were used for multiple activities which is especially true for multisport activities that represent a subset of swimming activities.

The locations for various recreation activities were mapped to show the distribution across England (Figure 7). All activities had a national presence with certain areas appearing as ‘hotspots’ for certain activities. Swimming, multisports, paddling and sailing activities took place extensively at both inland and at coastal areas, whereas rowing was largely confined to inland waters and unsurprisingly surfing to coastal waters.

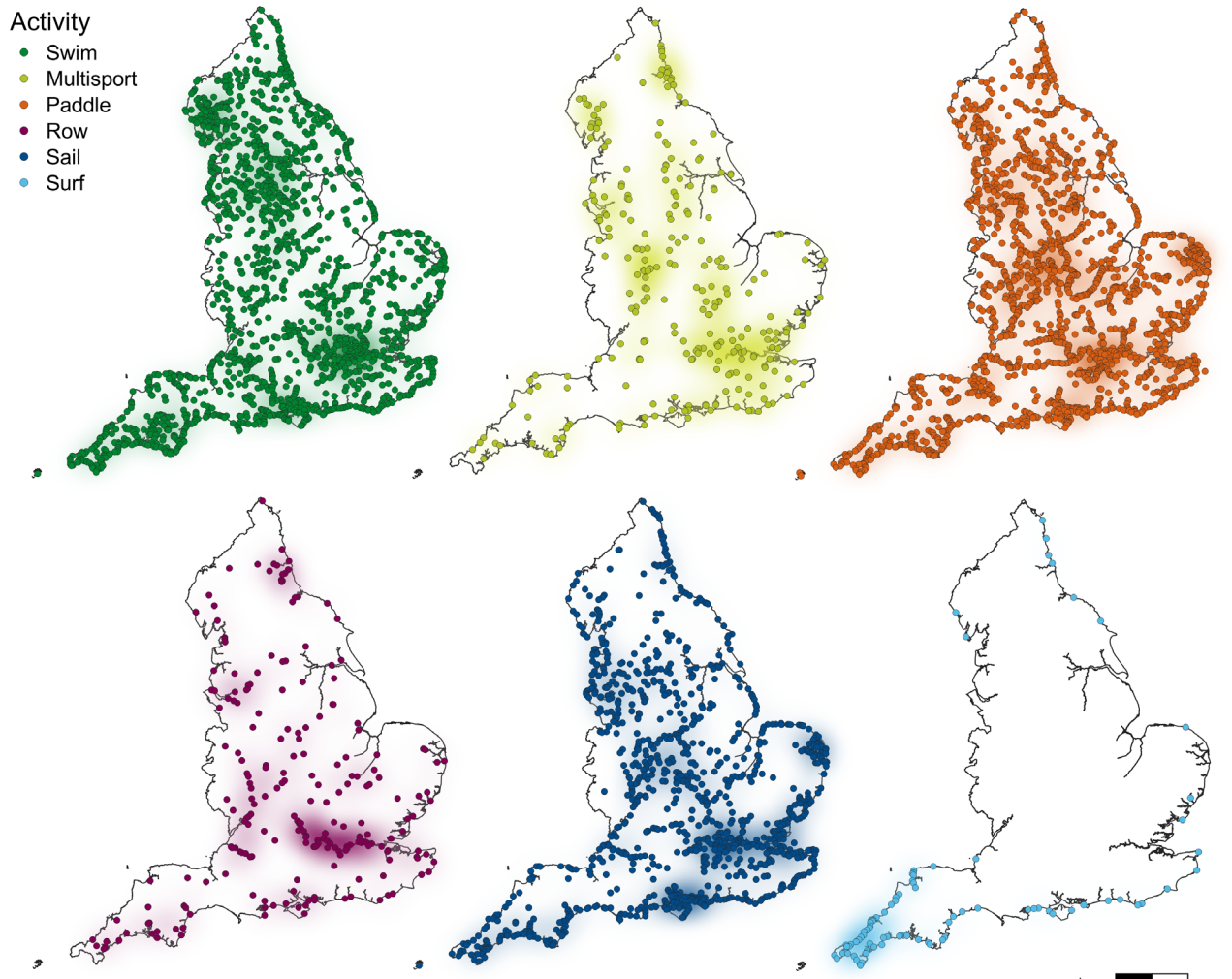

Figure 7: Maps of locations (circles) where water recreation was identified to take place in open waters in England by recreation activity (swimming, multisports, paddling, rowing, sailing and surfing). Heatmaps in the background are based on density of recreation locations for each activity.

Some areas showed a particularly high density of identified water recreation locations. For swimming this included the Lake District National Park followed by areas around London and West Yorkshire (reflecting some of the trends in waterbodies with the highest proportion of accessible waterside; Appendix Figure 2 [50]). Waterbodies around Birmingham and Tyne and Wear were also identified for locations where multisport activities including open water swims took place. Rowing locations were predominantly

found along the river Thames. Paddling and sailing locations were also located along the Thames and densely located within the Broads National Park and the Solent. Surfing was particularly prevalent in the South West, especially along the northern Cornish coastline.

In order to assess the trends numerically, data was also summarised at the river basin district (RBD) level. The most designated bathing waters (n=203) were within the South West RBD and this is also the district where the most locations for swimming (n=342) and surfing (n=64) were identified (Table 4). In terms of recreation locations for any water recreation activity (n=619) the greatest number were within the Humber RBD, in particular those associated with multisport activities (n=48). The most water recreation reports (n=2,574) and locations for rowing (n=49) were found within the Thames RBD. Whereas, paddling and sailing were most prevalent by location in the Anglian RBD (n=310 and 198 respectively). Overall, water recreation locations were more widespread across the country than the current distribution of (mostly coastal) designated bathing waters.

Table 4: Number of designated bathing water (BW) monitoring points, water recreation locations (by recreation activity) and water recreation reports within each river basin district (RBD) in England. Table is ordered by the number of outdoor swimming locations and values are shaded in proportion to the number of locations for each activity in colours to match Figure 7.

River basin district	BWs as of 2024	Recreation locations							Recreation reports
		Swim	Multisport	Paddle	Row	Sail	Surf	Any activity	
South West	203	342	31	271	29	162	64	506	2,309
Humber	24	298	48	295	23	149	1	619	1,741
Thames	18	246	41	240	49	173		507	2,574
Anglian	45	224	42	310	30	198	3	524	1,960
North West	33	196	28	166	20	105	2	382	1,034
South East	83	159	25	160	22	135	11	273	2,155
Severn†	9	122	20	170	29	88	1	305	906
Northumbria	34	95	19	69	15	41	5	160	573
Solway Tweed†	1	39	2	18	2	6		54	141
Dee†	1	5	3	7	1	8		14	104
seaward area*		1						3	3
Total	**451**	**1,727**	**259**	**1,706**	**220**	**1,065**	**87**	**3,347**	**13,500**

† The Solway Tweed RBD sits mostly in Scotland and the Dee RBD sits mostly in Wales. The Severn RBD also extends into Wales. Only water recreation in England was considered in this study.
* Three seaward locations were outside the RBD boundaries but inside the Environment Agency public facing area.

4.2.2 Wild vs open water swimming

A further distinction of the swimming locations was made to categorise locations as ‘wild swimming spots’ or ‘open water swimming venues’ based on the data source (Figure 8), mainly distinguished by the amount of activities organisation and amenity provision at a given site. In total, 1,092 wild swimming spots were sourced from the Rivers Trust ‘River Bathing Sites’ survey, Channel Swimming & Piloting Federation swim records, locations from the WildSwim app (Water Buoy Ltd), the *2000 Wild Swims* book by Rob Fryer, and the non-designated sites from the Surfers Against Sewage ‘Safer Seas and Rivers Service’ (SSRS) app [21], [33], [51], [52], [53]. Whereas, 100 open water swimming venues (predominantly privately managed lakes; section 7.1.13) were sourced from the Swim England ‘Poolfinder’ listing of open water swimming venues, the Royal Life Saving Society’s approved Aqua Parks and Beyond Swim accredited venues (via British Triathlon) [20], [30], [54].

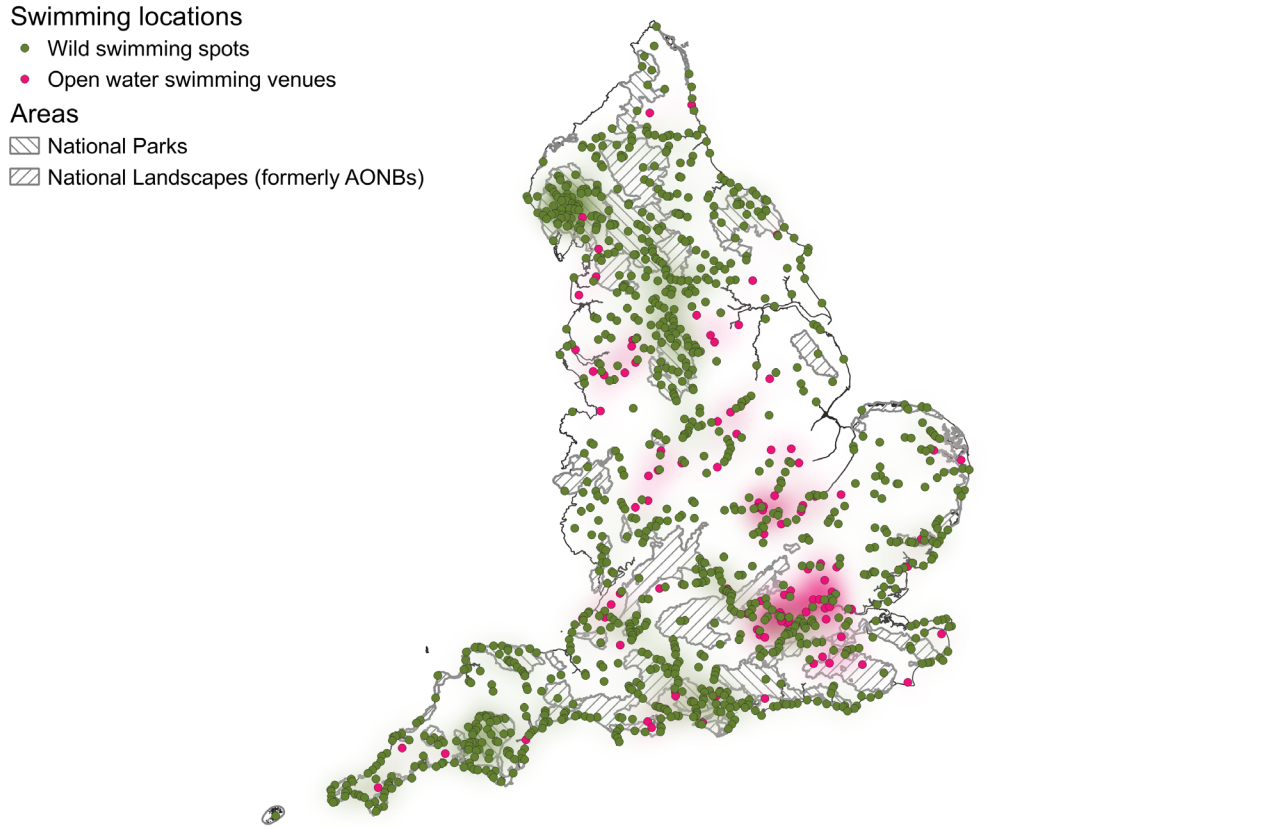

Figure 8: Map of wild swimming spots (green circles) and open water swimming venues (pink circles) in England with heatmaps based on density of sites coloured by categorisation. Hashed areas represent National Parks and National Landscapes (formerly known as Areas of Outstanding Natural Beauty).

One notable finding was that of the 1,092 wild swimming locations identified, 33% of them were concentrated within zones of National Parks (n=199) and National Landscapes (n=166; formerly known as Areas of Outstanding Natural Beauty). Indeed, 5% (n=59) of all

wild swimming spots identified resided in the Lake District National Park. These areas were also where the waterside was most accessible by public rights of way (Appendix Figure 2). Conversely, the 100 identified open water swimming venues were rarely located within these areas (6%; two in National Parks and four in National Landscape areas). In both cases, only a small proportion of locations were within 500m of a designated bathing water monitoring point (only 177 (16%) wild swimming spots and seven (7%) open water swimming venues).

The mean elevation of freshwater swimming sites in general was 63m with mean elevations of open water venues being lower at 51m and wild swimming spots higher at 88m (Figure 9). Additionally, the mean elevation of (the mostly coastal) designated bathing waters was 43m with the highest bathing water at Rutland Water (93m). No open water venues were seen above 242m (Sweethope Loughs, Northumberland), whereas the highest site determined as a 'wild' swimming spot was in the Cheviot Hills, Northumberland National Park (527m). The highest swimming spots in general (identified from any data source) were found in the North Pennines (842m) and Lake District National Park (715m).

This highlights the sheer breadth of water recreation location elevations, including tarns and streams atop England's highest mountains down to valley lakes and beaches along the coastline. Locations become increasingly "wild" at heightened elevations as the number of amenities and degrees of accessibility for recreational use decrease.

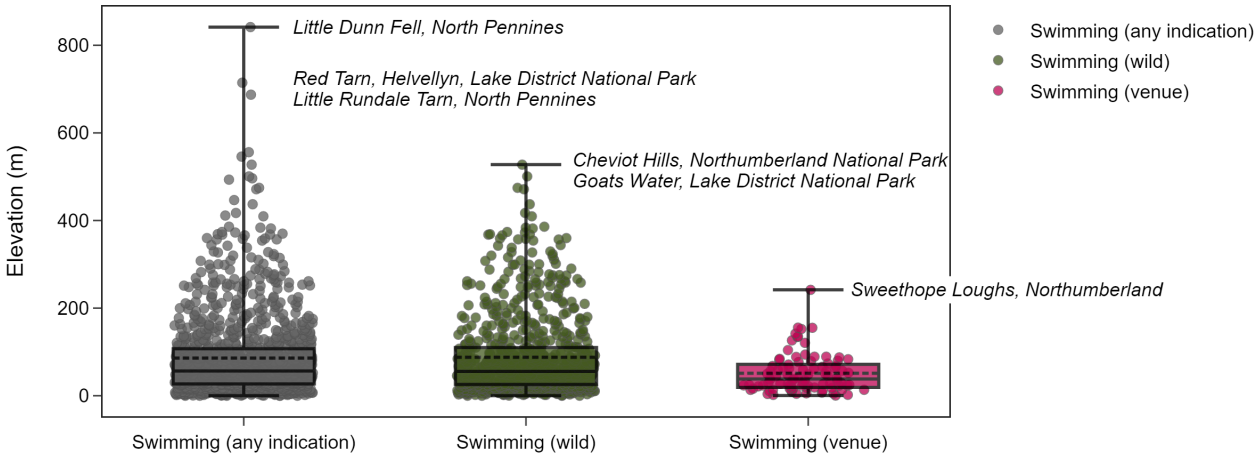

Figure 9: Box and whisker distributions of freshwater swimming recreation locations by elevation (in metres), categorised by swimming activity type (with notable elevated location names highlighted) with median (solid line), mean (dashed line) and interquartile ranges shown.

4.2.3 Water recreation by land cover and waterbody size

In terms of land cover of water recreation zones, the most common type was 'improved grassland' (45% of locations) followed by 'urban and suburban' (30% overall, with up to 61% for rowing activity; Table 5). An increased level of 'coastal' cover (supra- and littoral rock/sediment habitat types) was seen for surfing and sailing. 'Mountain, heath and bog'

land was largely confined to swimming activity (2%), in particular, wild swimming (6%) as no open water venues were seen in this land cover type. Very few (<1%) water recreation reports were identified in 'coniferous woodland' areas.

This data may also be biased by the types of reports utilised as 'wild swimming' data sources provided community-identified recreation sites and Paddle UK data covered paddling launch sites located at the waterbody. Whilst sailing and surfing data was mostly limited to clubs adjacent to the waterbody, except where Surfers Against Sewage and The Rivers Trust data indicated these activities took place at specific recreation sites.

Table 5: Number of water recreation locations (by recreation activity) by majority land cover type within the water recreation zone area (excluding water land cover types).

Land cover	Swim	Multisport	Paddle	Row	Sail	Surf	Any water recreation †
Improved grassland	771 (45%)	110 (42%)	782 (46%)	63 (29%)	401 (38%)	23 (26%)	1,504 (45%)
Urban and suburban	501 (29%)	110 (42%)	565 (33%)	135 (61%)	427 (40%)	34 (39%)	1,010 (30%)
Arable	113 (7%)	20 (8%)	151 (9%)	6 (3%)	76 (7%)	3 (3%)	310 (9%)
Coastal	141 (8%)	9 (3%)	128 (8%)	9 (4%)	124 (12%)	27 (31%)	212 (6%)
Semi-natural grassland	79 (5%)	2 (1%)	36 (2%)	3 (1%)	14 (1%)		118 (4%)
Broadleaf woodland	71 (4%)	5 (2%)	40 (2%)	4 (2%)	13 (1%)		117 (3%)
Mountain, heath & bog	33 (2%)	1 (0%)			5 (0%)		45 (1%)
Coniferous woodland	18 (1%)	2 (1%)	4 (0%)		5 (0%)		31 (1%)
Total	**1,727**	**259**	**1,706**	**220**	**1,065**	**87**	**3,347**

† Rows do not add up to the 'Any water recreation' total as some locations had multiple activities and others the type of recreation activity could not be specified.

The distribution of water recreation location river widths was assessed from 994 sites which were unambiguously assigned as rivers (and not within 500m of an estuary which were much wider). The kernel density estimation curves peaked at 10.8m for swimming activity with paddling at 17.0m, rowing at 33.0m and sailing at 5.7m (Figure 10A). However, rowing and sailing distributions extended into broader rivers as well (Figure 10B).

In terms of lake area, the distribution of recreation locations was wider, in particular due to sites identified at Windermere (14km^2), Rutland Water (12km^2), Kielder Water (11km^2) and

Ullswater (9km^2). Both paddling and sailing distributions extended more broadly towards these larger lake bodies (Figure 10C). However, in general, most lacustrine recreation locations were found at small lakes and ponds with less than 0.125km^2 area (Figure 10D).

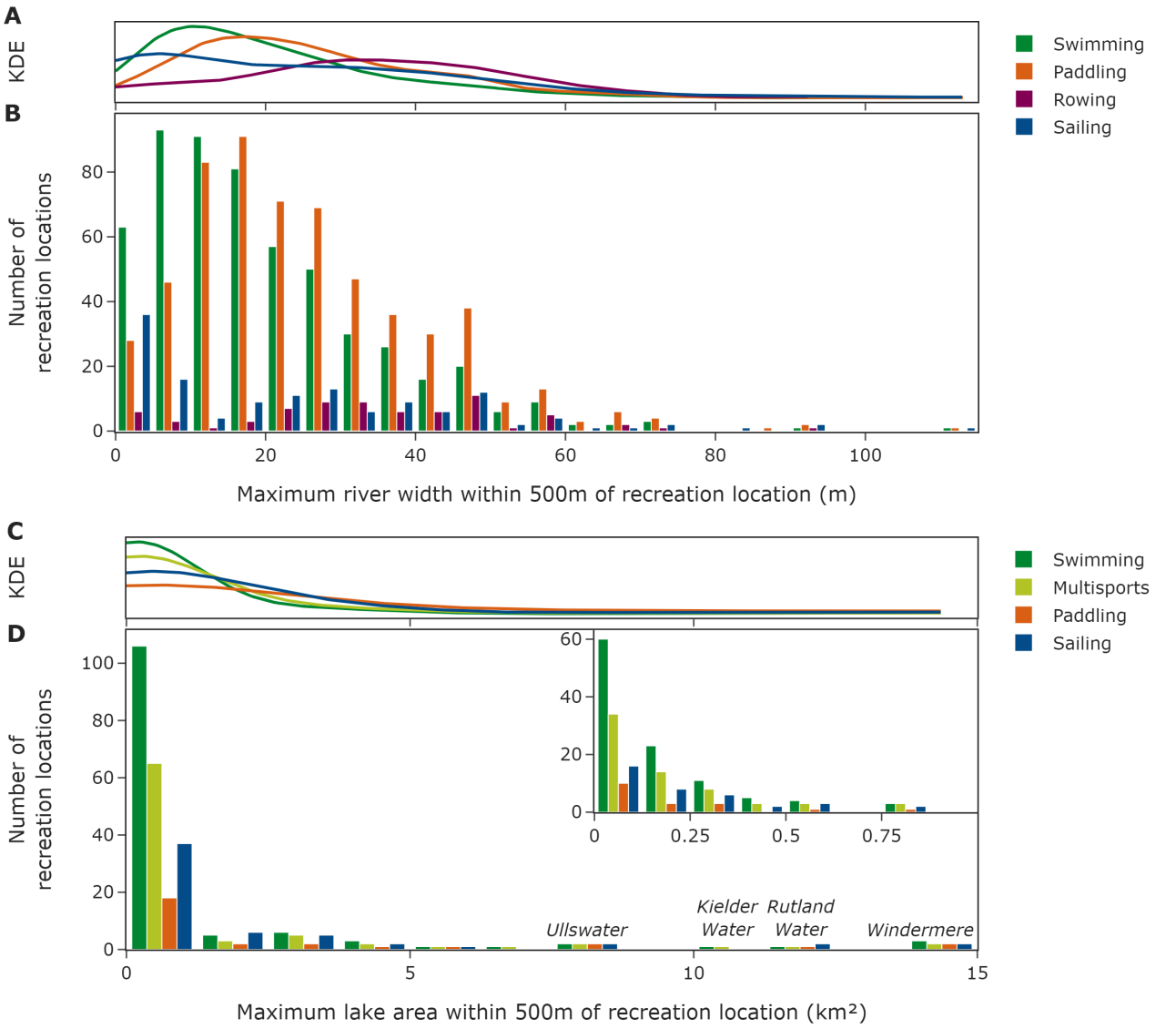

Figure 10: Distribution of water recreation locations by maximum (A)/(B) river width and (C)/(D) lake area (with notable large lakes highlighted), coloured by recreation activity. (A) and (C) are kernel density estimation curves of the distribution shown by the histograms in (B) and (D).

4.3 Time water recreation takes place

4.3.1 Environment Agency bathing water data

Environment Agency samplers record the number of bathers and beach users 50m either side of the monitoring point with every bathing water sample which is taken (up to 20 samples per site within the bathing season and investigations) and report this as the determinand ‘number of bathers per 100m’ and ‘number of beach users’. The Environment Agency data [22] from 2017 to 2024 (104,551 records) were examined to compare both

when samplers go (Appendix Figure 3) and when the highest number of bathers and beach users were observed (Figure 11 and Figure 12).

Between 2017 and 2024, the observed mean number of bathers and beach users showed only a small variation year-to-year with a modest increase after 2020 (Figure 11A and Figure 12A), in support of the anecdotal increases previously described (section 1) which in the most recent data has fallen back to pre-pandemic levels. The greatest mean number of bathers and beach users was recorded in 2020. However, this is likely due to the sampling during the coronavirus (COVID-19) pandemic where samples were only collected in the warmer months of July, August and September (n=1,379 samples), which thus influenced the average calculation.

By month, the most observed bathers and beach users were during August followed by July, with a marked drop in September (Figure 11B and Figure 12B). As only samples which were taken within the designated bathing season from 15th May until 30th September each year were considered in this research project, trends in months outside this period cannot be assessed from this dataset.

Most samples were collected on a weekday (Appendix Figure 3C), whereas the most bathing activity and beach use was recorded on Saturday and Sunday (Figure 11C and Figure 12C). Over the day, it should be noted that samples are predominantly taken earlier in the day. Nonetheless, a normal distribution in bathing activity was observed (Figure 11D), peaking at 2:00PM with a mean of 10 bathers per 100m across all measurements, although this is heavily zero-skewed (Figure 20A). For example, a maximum of 600 bathers per 100m was recorded at 1:00PM (Polzeath Beach, August 2017; Appendix Figure 4D). The same normal distribution was largely seen with beach use, except for after 7:00PM at which a small increase in the mean usage was observed, however it is posited this may be due to non-water-based beach activities (such as dog walking or barbecues).

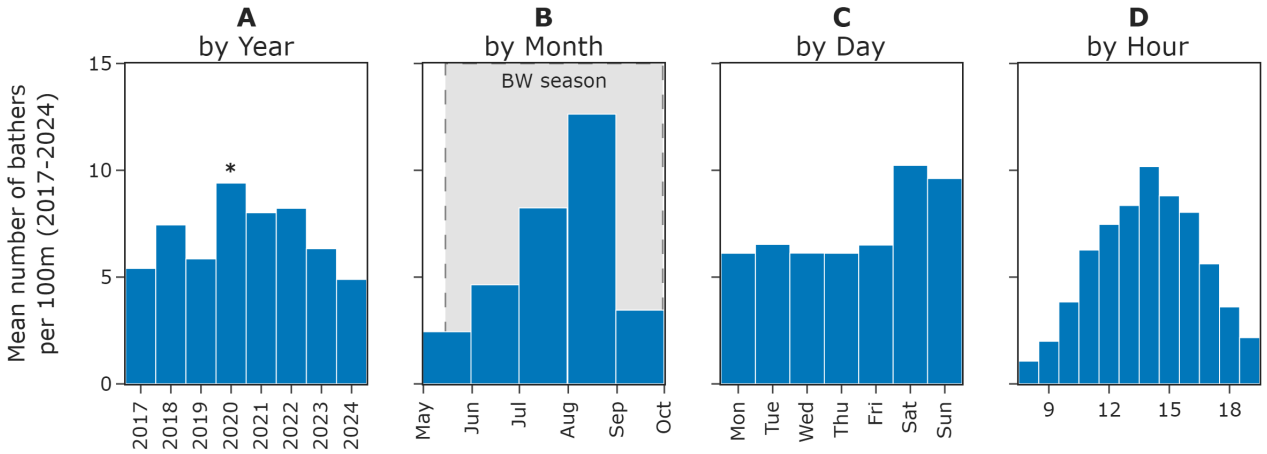

Figure 11: Bar charts showing Environment Agency data recorded between 2017 and 2024 for when bathers were present (*mean* count per 100m per x-axis category) by sampling (A) year, (B) month, (C) day and (D) hour for all designated bathing waters. *In (A) far fewer samples were taken in the year 2020. In (B) samples were restricted to the pre-season and bathing season (15th May – 30th Sep; shaded). Chart showing maxima of this data is Appendix Figure 4.

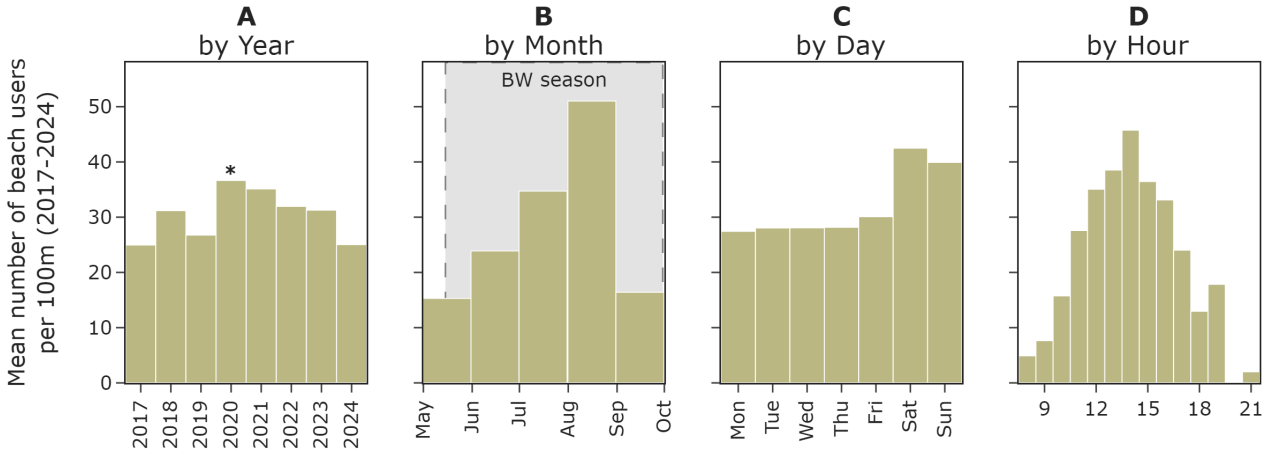

Figure 12: Bar charts showing Environment Agency data recorded between 2017 and 2024 for when beach users were present (*mean* count per 100m per x-axis category) by sampling (A) year, (B) month, (C) day and (D) hour for all designated bathing waters. *In (A) far fewer samples were taken in the year 2020. In (B) samples were restricted to the pre-season and bathing season (15th May – 30th Sep; shaded). Chart showing maxima of this data is Appendix Figure 5.

4.3.2 Water recreation events time of year

Further data were collated for the period 2017-2023 from 1,647 British Triathlon past event listings for events involving open water swims (1,497 multisport events, 48 swimming events and 102 with both) with the aim to explore the times of year that organised events took place. Additionally, wider participation could be determined from scheduled events for

the 2024-25 events season collated from a further 245 events from British Triathlon (181 multisports and 64 with multisports and swimming), 1,101 from TimeOutdoors (730 multisports, 355 swimming and 16 paddling) and 223 from British Rowing event listings. These scheduled events were taken from forward-looking snapshots of the data taken in spring (April/May), summer (July) and autumn (September and November) 2024. It should be noted that this data capture of paddling events is limited and there are likely more comprehensive data sources available.

This recreation report data was grouped by location and event date to prevent duplication of entries from multiple sources and combine multiple listings (e.g. where a triathlon, aquathlon and swim events were organised under different listings at the same location on the same day). In total, 1,580 event dates at 227 locations for 2017-2023 were identified. For 2024-25, using the enhanced datasets (including rowing and some paddling events), 649 event dates were identified.

The highest annual numbers of events were identified as 2018 and 2019 (with 299 and 302 respectively), with 2018 also the year with the most event days (100 out of 365 days). In 2020, during the coronavirus (COVID-19) pandemic, only 48 events over 26 days were recorded. Since then, the number of events has risen in the subsequent years but is yet to reach pre-pandemic levels with only 211 events over 69 days recorded in 2023. The number of events therefore does not evidence a recent increase in water recreation activity (Table 6). As this data is captured from a dataset not necessarily intended for this type of analysis, it must also be considered that these trends could also potentially reflect changes in the organisation's website usage and other factors such as fewer, larger events. Additionally, this data does not cover the number of people or times when participants enter the water as part of practice ahead of these official events.

Table 6: Number of days per year on which water recreation events were identified as being held for the period 2017 to 2023 for data involving outdoor swims sourced from British Triathlon.

	2017	2018	2019	2020	2021	2022	2023
Number of days per year that events were held (/365)	94	100	98	26	69	74	69
Number of events held per year nationally	287	299	302	48	204	229	211

In order to further explore at what time of year open water events took place, the event-day data from years in which there were no COVID-19 restrictions (2017 to 2019 and 2022 to 2023) were collated into 52 weeks of the calendar year (each 7 days (with 8 days in the last week of December); Figure 13A). With this framing, it was noted that the start of the events season at the beginning of May slightly preceded the start of the bathing season (15th May). Similarly, the event season slightly extended beyond the bathing water season (end of September), with events taking place into October and November. Converse to the

bathing water statistics, the events data declined towards the end of July and month of August (coinciding with English school summer holidays). Indeed, the weeks with the most events were the third week of June, and the first weeks of July and September with a total of 89, 88 and 82 events taking place in those weeks within the 2017-19 and 2022-2023 period (an average of 16-17 events per week). The events in these weeks took place at 58, 49 and 51 recreation locations across England, respectively, indicating that it was not always the same locations used each year. The winter months of December, January and February were the only months in which no British Triathlon-associated events were identified between 2017 and 2023.

It was also possible to assess the temporal trends in waterbody usage across the 1,341 events between from 2017 and 2023 (where the waterbody could be classified; Figure 13B). Overall, lakes which were best represented in the data (n=1,009), were the primary waterbodies used outside of the bathing season in March, April and November. The riverine events season started in May and concluded in late September, whilst the coastal and estuarine events tended to fall later between June and later into October. In general, the freshwater events season dominated prior to the designated bathing season and the coastal events season continued after the bathing season ended.

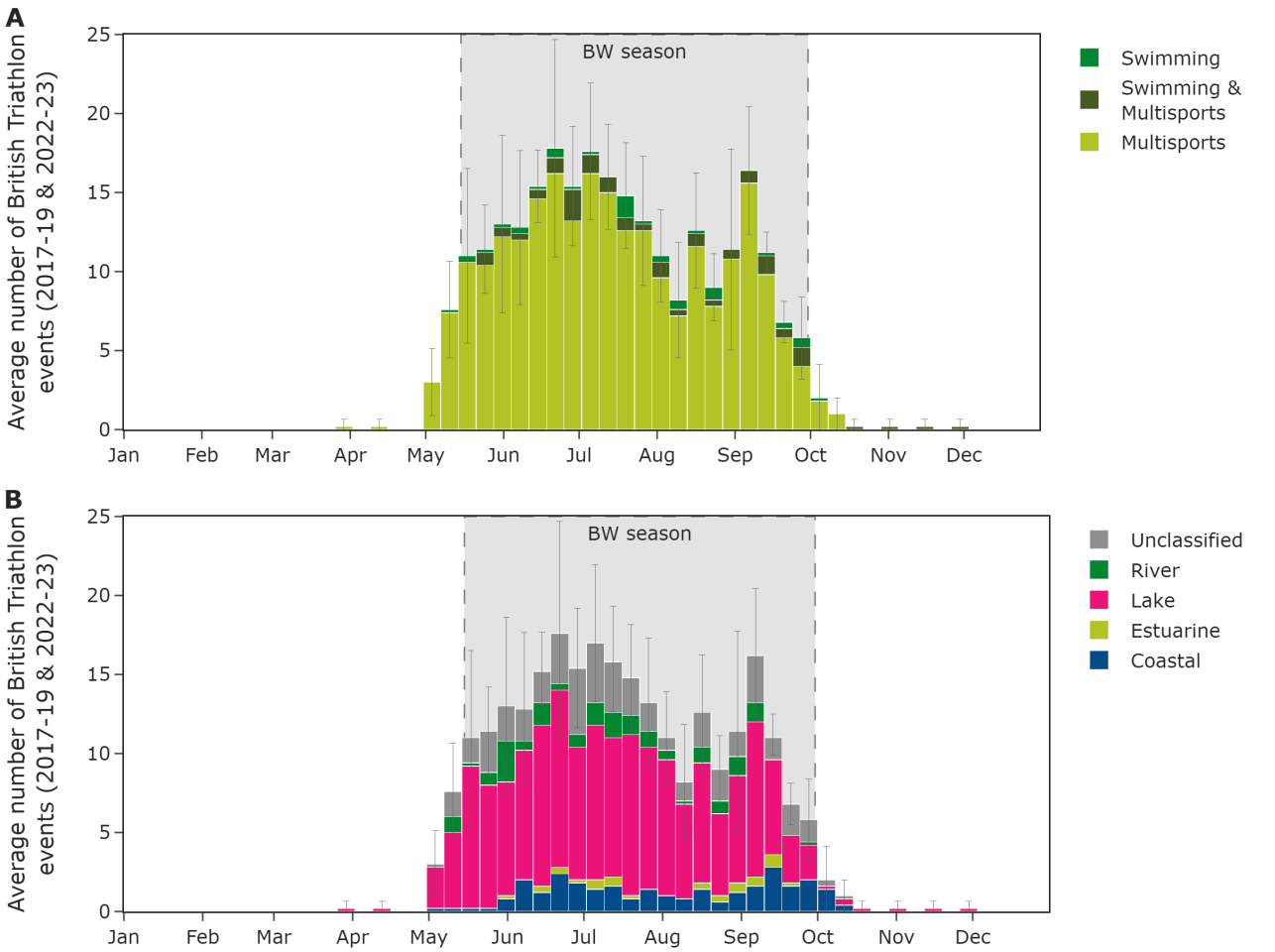

Figure 13: Histogram showing the average number per calendar week of recorded events by (A) activity (swimming, multisports and combined events involving an open water swim) and (B) waterbody type, from British Triathlon events listing data from 2017, 2018, 2019, 2022 and 2023. The designated bathing season is shown by the shaded period from 15th May to 30th September.

Looking at the scheduled events for the 2024-25 season, the second week in July was the calendar week with the highest number of swimming and multisports events identified from British Triathlon data with the first week in September the most for TimeOutdoors published events listings (Figure 14). However, for rowing events listed by British Rowing, the events season was much more evenly spread across the calendar year with the first week in May (the first week data was captured) having the highest weekly number of events. Rowing events were identified in every calendar week from May 2024 until April 2025 except for the last two weeks of December and first two weeks of January. Beyond April 2025 was likely the limit of the pre-scheduling of events as the final data was captured in November 2024.

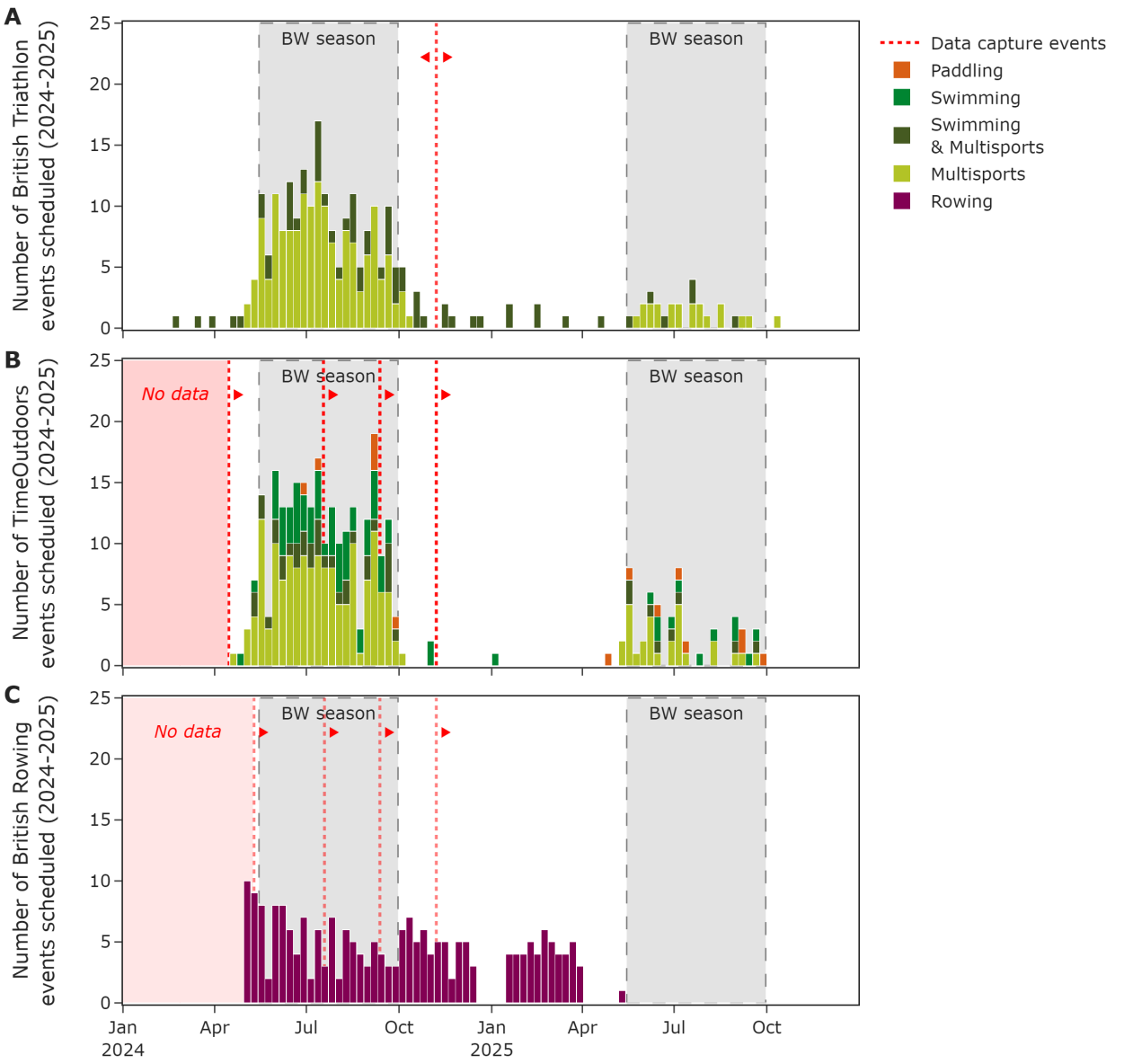

Figure 14: Histograms showing for 2024 and 2025, the total number per calendar week of scheduled swimming, multisports (involving an open water swim), rowing and paddling events from (A) British Triathlon, (B) TimeOutdoors and (C) British Rowing events listing data. The red dashed lines indicate the dates on which scheduled events data was captured, with the arrow indicating whether the data included only scheduled events or past recorded events as well. The shaded pale red area indicates the period before data capture began with no data. The final data capture was in November 2024 meaning that the events season for 2025 is under-estimated. The designated bathing seasons are shown by the grey shaded periods from 15th May to 30th September.

The majority of events took place at the weekend (79%). Of the 1,647 British Triathlon events, 900 events were recorded on a Sunday and 394 on a Saturday for the 2017 to 2023 period (Figure 15A).

Of the events data discussed above, only the TimeOutdoors 2024-25 scheduled event listings data included (readily accessible) start times of events. Of 1,101 events which included start times, the most common starting time was 8:00AM and at least 62% events

took place in the morning between 6:00AM-10:00AM (Figure 15B). Only freshwater events were recorded after 18:00PM, likely due to water safety concerns. 163 events were listed with start times as 00:00 but, upon manual inspection of the descriptions of these events, these did not appear to be ‘night swims’ and therefore were likely a data artifact where the start time was unknown at the time of publication.

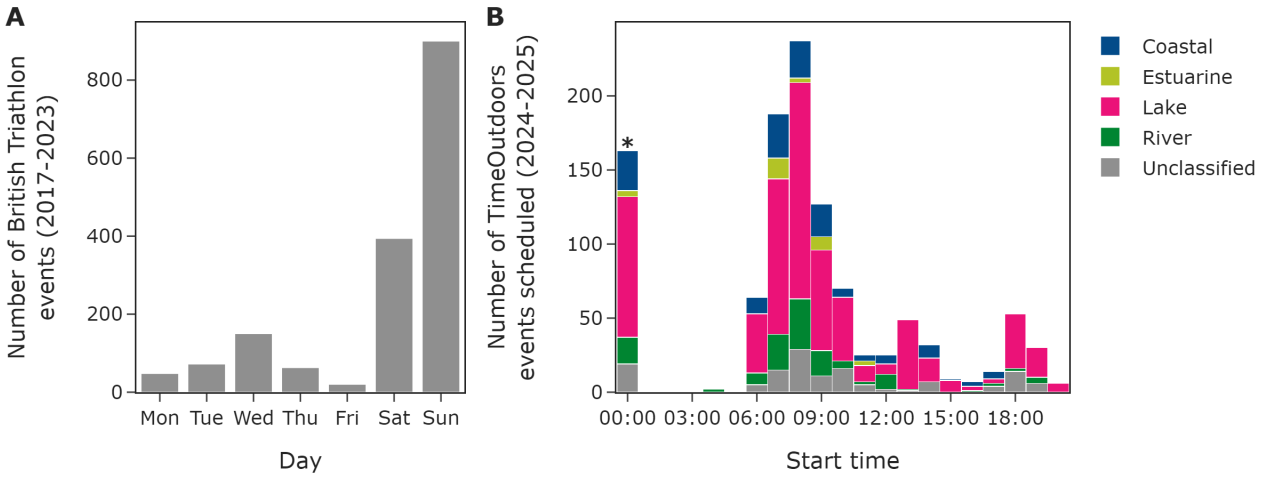

Figure 15: Histograms showing number of (A) recorded events in the period 2017-2023 by event starting day and (B) scheduled events in the period 2024-2025 by event starting hour. * = Data recorded at 00:00 likely had an unknown start time.

4.3.2.1 Festive dips

One notable gap in the above data is perhaps the most well-known type of ‘wild swimming’ activity known as ‘festive dips’, taking place in the last and first week of the calendar year. These cold-water activities typically involve large numbers of people briefly entering the water (usually the sea or large lakes), but most do not have a swim distance component (likely why they do not feature in the open water swimming events listings).

These events are also more locally and loosely organised than other open water events, with no comprehensive national listings known. Many of these events are organised as charity fundraisers by individual RNLI and RLSS UK lifesaving units at the waterbodies they operate at during the bathing season [55].

For the 2024/25 festive period in England, Outdoor Swimmer listed seven Christmas Day, eleven Boxing Day and eight New Years Day events [56]. Whereas, the Outdoor Swimming Society listed 13 Christmas Day, 18 Boxing Day and 14 New Years Day events and three others on different days within the festive period [57]. Whilst these nationally listed numbers are considered an under-estimate, they already match and exceed the number of swimming events identified in many of the weeks of the summer season (Figure 13 and Figure 14).

4.3.3 Water recreation events time of year by participation

The British Triathlon data allowed the number of ‘expected competitors’ at each event to be assessed. In summary, the number of annual expected competitors (Table 7) followed

the same trend as the number of event days (Table 6) with a larger participation rate (average of 132,966 in 2017-2019) prior to the coronavirus (COVID-19) pandemic. In 2020 only 27,638 competitors were expected at events which ran and despite numbers recovering since then a slightly reduced turnout has maintained (e.g. 111,583 competitors in 2023 which was 84% of the prior average).

Table 7: Number of expected competitors per year for the period 2017 to 2023 for data involving outdoor swims sourced from British Triathlon.

Year	Total number of expected competitors at British Triathlon-associated events
2017	107,603
2018	142,786
2019	148,510
2020	27,638
2021	115,581
2022	120,830
2023	111,583

Over the calendar year, for events which the number of expected competitors was provided (likely the most organised and high profile events), the majority occurred within the bathing season and a few weeks at either side in early May and early October (Figure 16). Over the years in which there were no COVID-19 restrictions (2017 to 2019 and 2022 to 2023), the final week of June had the highest number of expected competitors (10,080 on average, 53,623 over 2017-23). At least 4,000 competitors were expected per calendar week in June, July, September and the first two weeks of August.

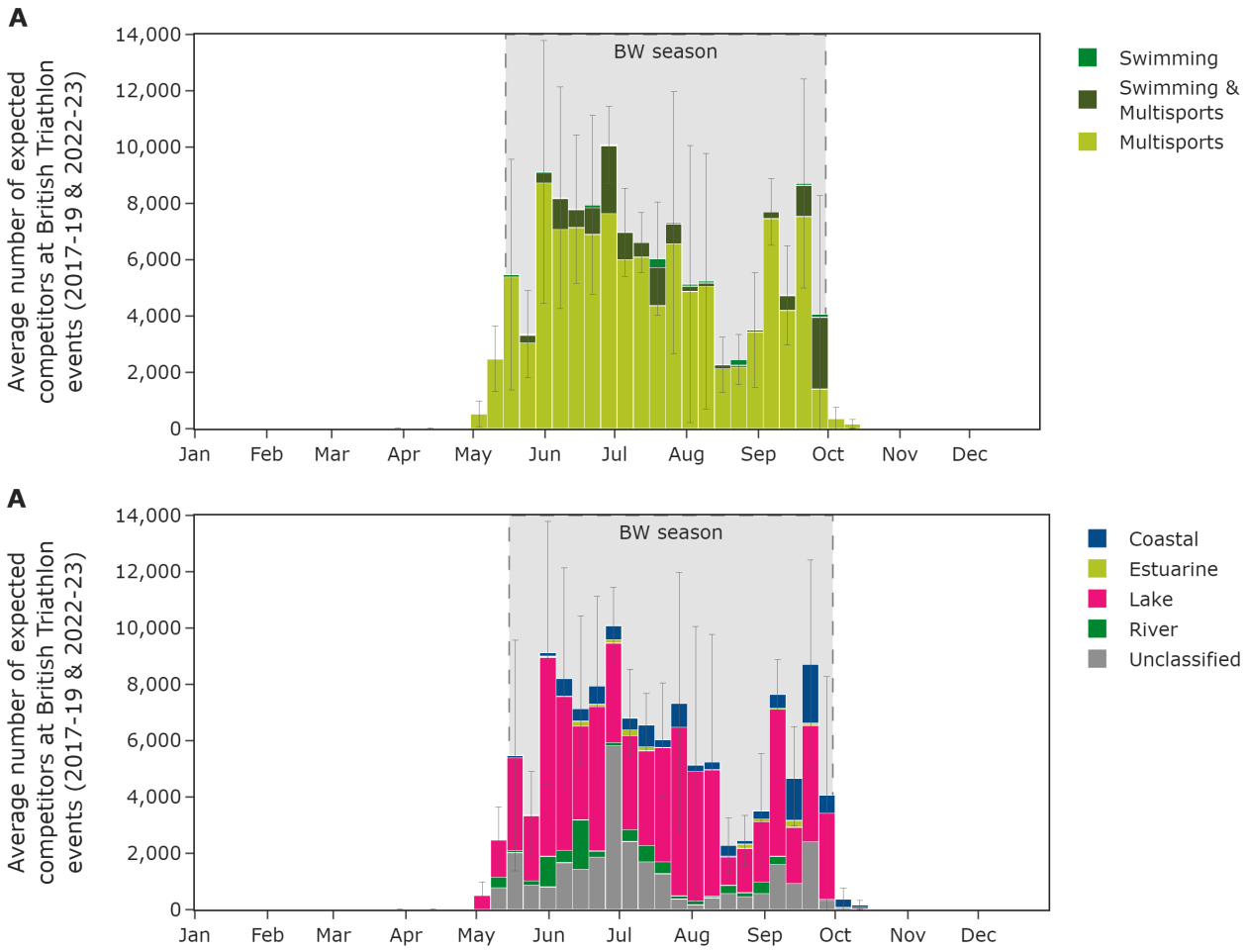

Figure 16: Histogram showing the total number per calendar week of expected competitors at British Triathlon events by (A) activity (for events of swimming only, multisports (involving an open water swim) only or both) and (B) waterbody type, from listing data summed from 2017 to 2023. The designated bathing season is shown by the shaded period from 15th May to 30th September.

4.3.4 English Channel swimming

Much of this research project has focused on access points of water recreation, rather than capturing the full extent (e.g. tracks) of how recreation takes place within a specific waterbody). As an exemplary, data on swims across the English Channel (Strait of Dover) between 2017 and 2023 were sourced from the Channel Swimming & Piloting Federation (CS&PF) with permission (760 records, Figure 17) [21]. It should be noted that this data is not exhaustive and other channel swimming organisations also possess data such as the Channel Swimming Association [58].

Most channel swims started from Abbotts Cliff (between Dover and Folkestone) or Shakespeare's Beach, Dover with three swims out of East Cliff, Ramsgate. The fine-grained route data allows the whole water-based activity (33.5km distance) to be assessed and the spatial scope not just the starting point. This type of data could be important for highlighting where hazards may emerge only in certain areas of a large water body.

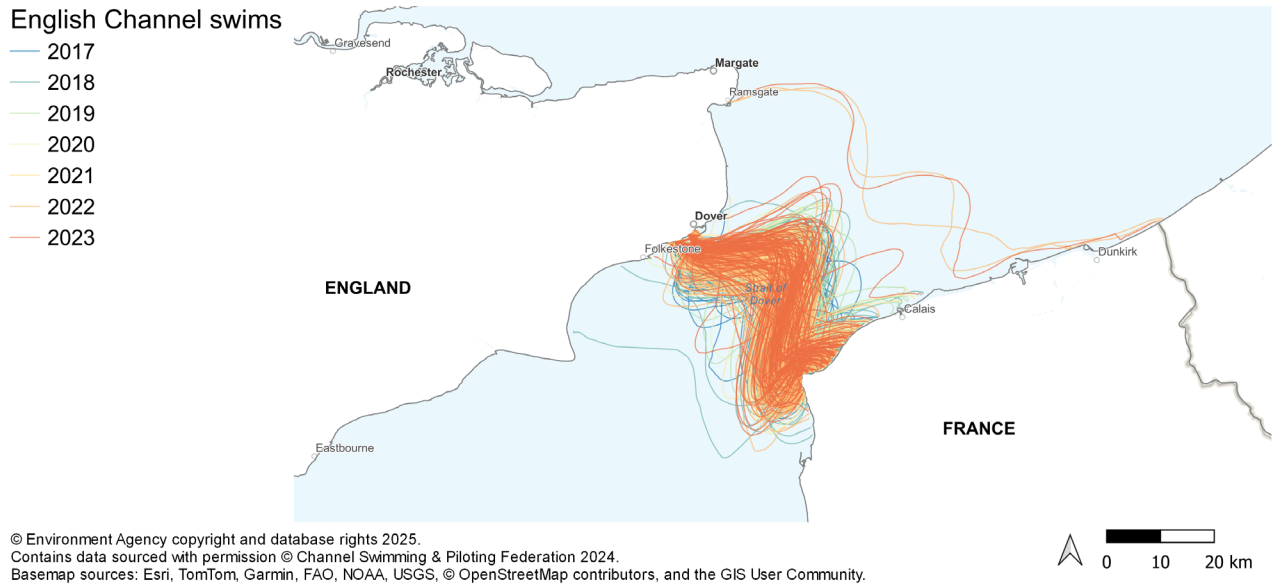

Figure 17: All swims across the English Channel recorded by Channel Swimming & Piloting Federation between 2017 and 2023.

To explore this data further, the annual, monthly, daily and hourly trends in the number of solo and relay swimmers recorded by CS&PF between 2017 and 2023 was collated (Figure 18). On the whole, the number of annual swims has largely been the same (with the exception of 2020, influenced by the COVID-19 lockdowns) with the total number of swims now about 5% higher than pre-pandemic levels (Figure 18A).

In all years within the 2017 to 2023 period swims were conducted between June and October, with the exception of one relay swim in December 2017 (Figure 18B). Notably, in 2024 this trend has already diverged with the first relay swim of 2024 taking place on 13th January. In general, the monthly trends of activity from June to September with some swims taking place into October match those trends observed for coastal triathlon events (Figure 13).

Conversely, the channel swimming daily and hourly trends were opposite to the trends seen with the number of bathers at designated bathing waters and swimming and triathlon event start times. Swims across the English Channel took place every day of the week and tended to begin at night with 77% of swims starting between 10:00PM and 06:00AM (Figure 18D).

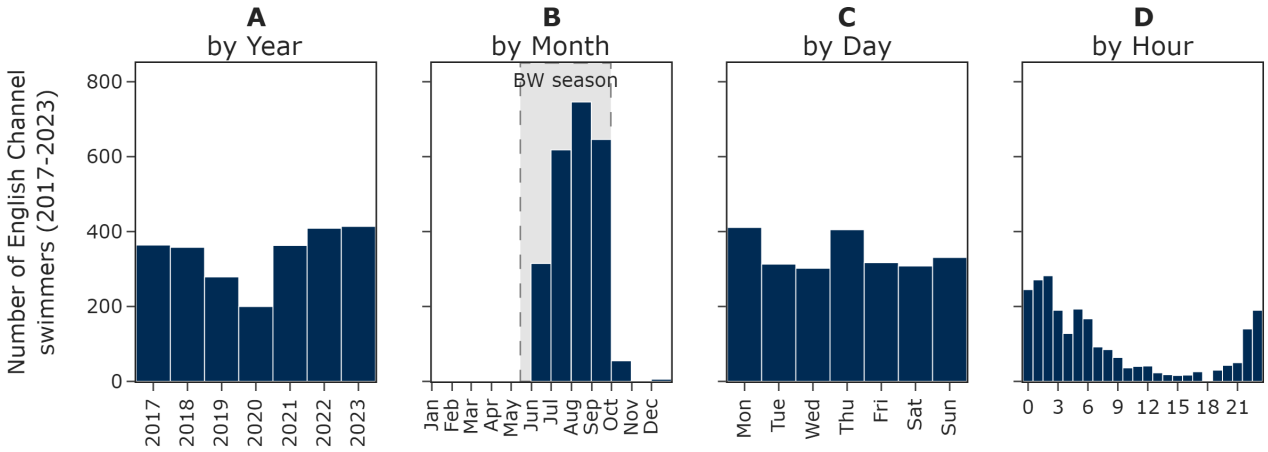

Figure 18: Number of swimmers involved in swims across the English Channel (from solo and relay swims) by sampling (A) year, (B) month, (C) day and (D) hour recorded by Channel Swimming & Piloting Federation between 2017 and 2023.

In 2023, the first England (St Bees, Cumbria) to Isle of Man swim (51km distance) was completed [52]. No tracking data is openly available, but it further shows the expansion of this water-based endurance activity.

4.4 How much water recreation takes place

4.4.1 Usage of designated bathing waters

As discussed in section 4.3.1, Environment Agency samplers record the number of bathers and beach users per 100m with every bathing water sample which is taken. This data enables the spatial scale of participation to be assessed.

The data recorded in the period from 2017 to 2024 bathing seasons was summarised by the mean number recorded at each site for mapping the distribution of both bathers and beach users per 100m (Figure 19). The site with the maximum number of bathers reported in this period was Polzeath beach, Cornwall in August 2017 with 600 bathers per 100m. The highest beach usage was recorded at Perranporth in the same area with 3,000 beach users in August 2023.

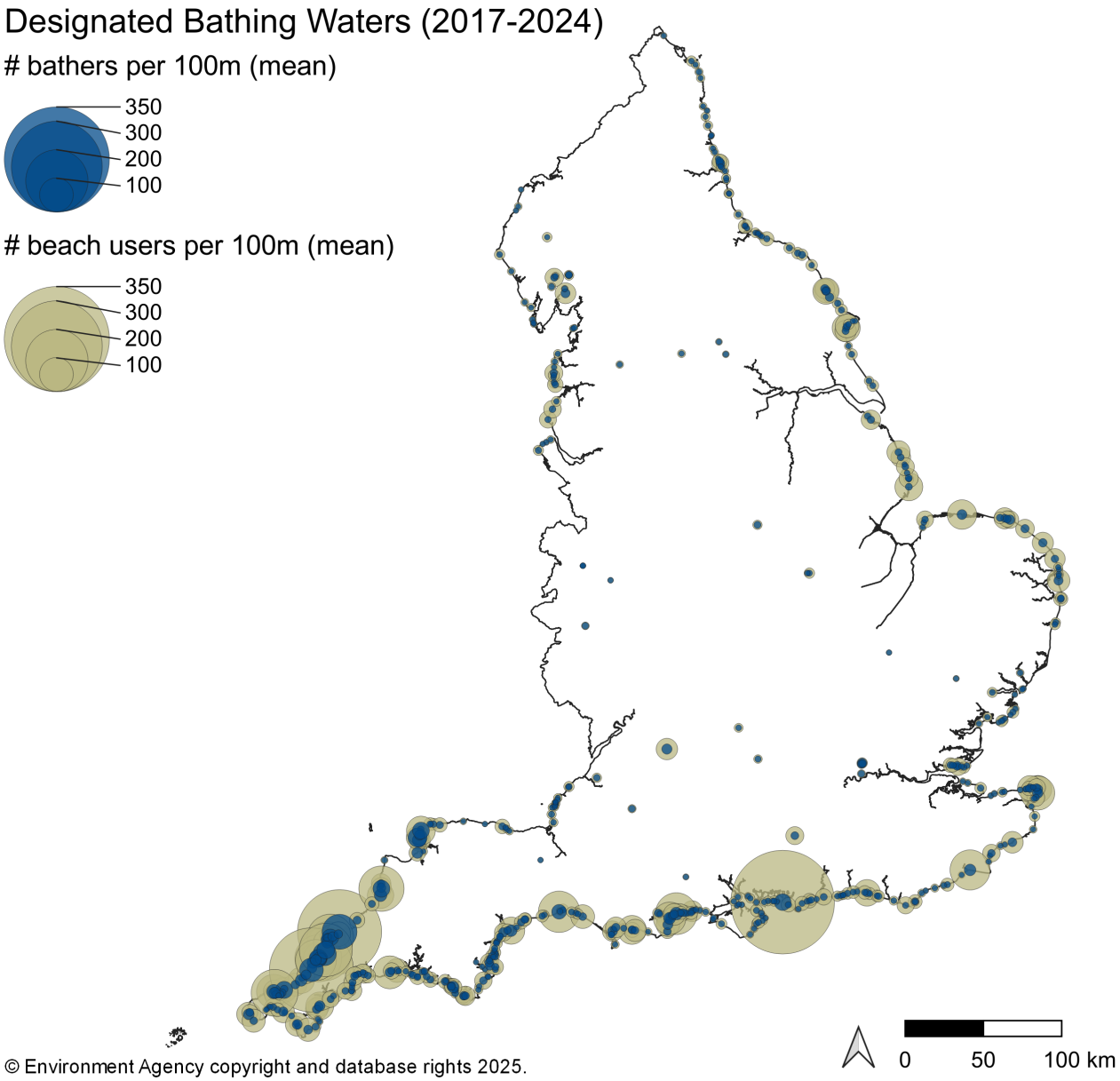

Figure 19: Map of mean numbers of bathers per 100m (blue) and total beach users (beige) recorded with compliance samples in England by the Environment Agency between 2017 and 2024 at designated bathing waters.

Potentially because of the times that bathing waters are sampled (Appendix Figure 3), a large proportion of samples recorded no active bathers (52% of samples) or beach users (16%) in the 2017-2024 period investigated (Figure 20). Only 491 samples (out of 51,064) recorded numbers of bathers above 100 per 100m. This is notable as the Defra requirement for new bathing water applications required data showing two non-event days with at least 100 bathers [4]. However, it is important to note that the unit of 100 bathers per 100m (taken as a snapshot when sampling) is not the same unit as 100 bathers per day (measured up to 4 hours and not incorporating a set distance from a monitoring point).

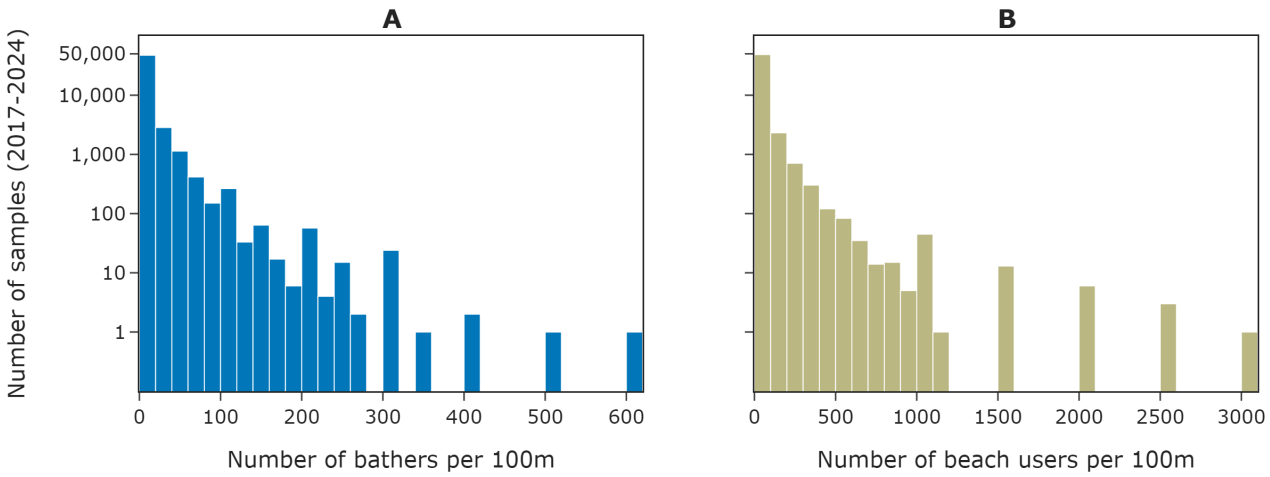

Figure 20: Histogram of numbers of bathers and beach users (per 100m) recorded alongside compliance samples taken by the Environment Agency between 2017 and 2024. The samples (y) axis is scaled logarithmically to enable data with non-zero numbers of bathers (x) to be read.

4.4.2 Usage of navigable waterways

High level statistics regarding the number of (unpowered) boat registration licences were provided by the Environment Agency and its joint registration partners for the period 2017 to 2023. At the national level the overall number of licences issued has increased dramatically since the COVID-19 pandemic, rising from an average of 45,512 annual licences (2017-19) to 103,424 most recently (2021-23; Table 8). The increase has largely been through Paddle UK and British Rowing registrations (which are part of a larger waterways membership and discounted respectively), whilst direct Environment Agency registrations have decreased in this period.

In terms of individual waterways where the Environment Agency acts as the navigation authority, and a licence is required to operate vessels, the river Thames had the highest number of registrations, followed by the Anglian waterways and river Medway navigations (Table 8).

The trend in number of recreation locations identified along these waterways was in line with their waterway lengths (section 4.1.2), whereas the number of reports (a sign of the amount of activity at these locations) follows the order of the number of registrations (Thames > Anglian > Medway).

Regarding other navigable waterways accessible by paddling craft (Figure 4), the highest number of recreation locations was found along the Great Ouse (n=40) and Severn (n=33) rivers as well as the Grand Union Canal (n=52) and Leeds and Liverpool Canal (n=32; Appendix Table 1).

Table 8: Number of annual licences to use unpowered watercraft on Environment Agency waterways (Thames, Anglian and Medway) and national waterways (through Paddle UK membership) sold per year between 2017 and 2023. Data covers licences sold by the Environment Agency and its joint registration partners (British Rowing and Paddle UK). Data is compared against the number of recreation locations and reports which intersected Environment Agency waterways and paddle-navigable waterways (as defined in Figure 4) identified by this study.

Organisation		Environment Agency				British Rowing	Paddle UK	All
Waterways licence coverage:		Thames	Anglian	Medway	Environment Agency waterways		National	
Number of annual, unpowered licences	**2017**	2,835	662	493	3,990	4,571	37,288	**45,849**
	2018	2,817	602	493	3,912	*	39,126	**43,038**
	2019	2,608	645	448	3,701	4,052	39,895	**47,648**
	2020	2,139	493	255	2,887	2,839	64,212	**69,938**
	2021	2,313	706	348	3,367	3,675	96,909	**103,951**
	2022	2,287	570	301	3,158	4,130	98,498	**105,786**
	2023	2,079	578	308	2,965	4,130	93,440	**100,535**
This study	**Number of recreation locations**	61	88	10	187		328	
	Number of recreation reports	910	453	43	1,479		5,759	

* No British Rowing data was received for 2018 due to a system change.

4.4.3 Location importance by report and data source consensus

A large cohort of 17 data sources and (also coincidentally) 17 recreation report types were collated (Figure 6) which enabled feature importance of water recreation locations to be assessed by the consensus of independently sourced data (Figure 21). The hypothesis being that a location indicated by multiple data sources and/or presence of many report types may indicate a more active recreation site.

Of the 3,347 recreation locations found in this study, the majority were identified by only one report type (n=2,131) or one data source (n=2,114), and these were also the locations least likely to be within 500m of a designated bathing water monitoring point (n=7; <1%). As the number of report types and data sources indicating the same recreation location increased, so did the percentage of those locations incorporating a designated bathing water monitoring point (Figure 21). Locations indicated by 11 or more report types (n=7) or

11 or more data sources (n=11) were all within 500m of at least one designated bathing water monitoring point (Table 9).

Table 9: Details of the top 14 water recreation locations in England found in this study (identified by at least 11 recreation report types or 11 data sources), sorted by decreasing number of report types with assigned location ID numbers and recreation zone area. Ordered symbols (as listed in the legend) show presence/absence of the activities and report types found at each location and the originating data sources.

Location ID	Recreation location	River basin district	Waterbody salinity	Recreation zone area (km²)	Number of recreation reports	Number of report types	Number of data sources	Activities	Recreation indicator types	Data sources
03025	Poole Harbour & Bournemouth West	South West	Saline	21.0	111	14	12			
03304	Falmouth Bay & Inner Harbour	South West	Saline	7.1	51	12	12			
01107	Colwick Country Park & River Trent	Humber	Freshwater	9.7	116	12	11			
00181	Derwent Water	North West	Freshwater	7.3	43	11	11			
03190	Paignton & Torquay South	South West	Saline	10.9	75	11	10			
02930	Portsmouth Harbour to Eastney	South East	Saline	15.3	70	11	10			
03144	Teignmouth & Shaldon	South West	Saline	3.5	29	11	9			
03224	Plymouth	South West	Saline	11.8	91	10	11			
00057	Tynemouth & South Shields	Northumbria	Saline	7.0	32	10	11			
03115	Swanage	South West	Saline	2.4	31	9	11			
02871	Summerleaze & Crooklets	South West	Saline	2.8	24	9	11			
03267	Bigbury-on-Sea	South West	Saline	3.9	23	8	12			
03193	Newquay & The Gannel	South West	Saline	9.8	70	8	11			
00310	Coniston Water	North West	Freshwater	6.6	27	8	11			

Activities
- Swimming
- Multisports
- Paddling
- Rowing
- Sailing
- Surfing
- Unspecified water recreation

Recreation indicator types
- Channel swim site
- Designated bathing water
- Lifeguard unit
- Marina
- Multisport events
- Open water venue
- Paddling club
- Paddling events
- Paddling launch
- Recreation site
- Rowing club
- Rowing events
- Sailing club
- Slipway
- Surf school
- Swimming club
- Swimming events

Data sources
- British Rowing
- British Triathlon
- Channel Swimming & Piloting Federation
- Environment Agency
- Marine Management Organisation
- Natural England
- Paddle UK
- Royal Life Saving Society UK
- Royal National Lifeboat Institution
- Royal Yachting Association
- Surfers Against Sewage
- Surfing England
- Swim England
- The Rivers Trust
- TimeOutdoors
- Water Buoy Ltd
- *2000 Wild Swims* by Rob Fryer

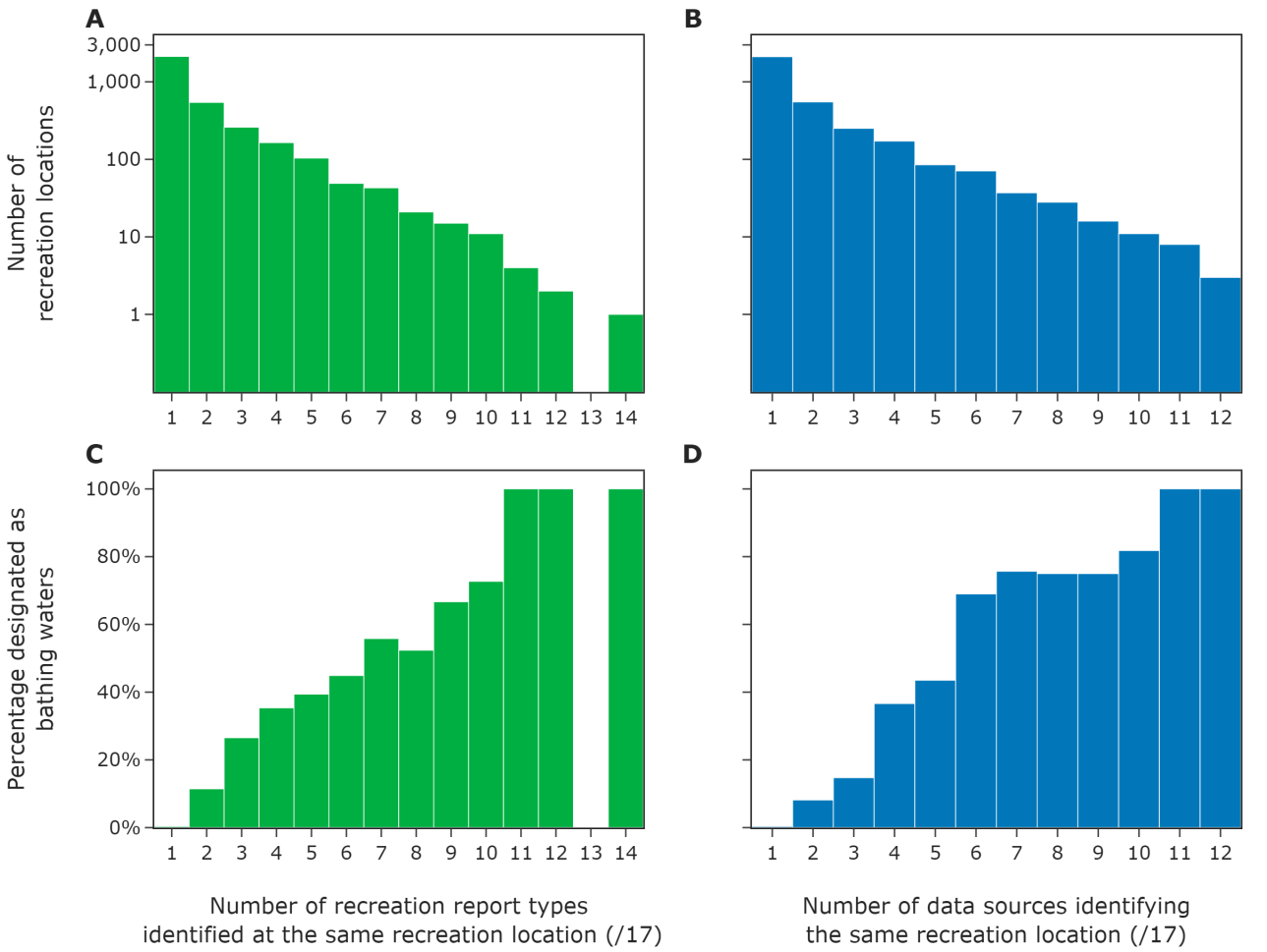

Figure 21: Bar charts of the number of recreation locations by (A) number of recreation report types present and (B) number of data sources identifying them, and the percentage of recreation locations designated as bathing waters by (C) number of recreation report types present and (D) number of data sources identifying them. The locations (y) axis is scaled logarithmically to enable data with more than one report type/data source (x) to be read.

The area around Poole Harbour and the coastline west of Bournemouth was encompassed by a large recreation zone of chained report points (Appendix Figure 6A) covering an area 21km^2 (for reference, a single-point, 500m radius recreation zone covered 0.8km^2). This recreation zone featured 14 unique report types (dominated by recreation sites, multisport events and sailing club/marinas) and was indicated by 12 different data sources. The area around Falmouth Bay and adjacent Inner Harbour (Appendix Figure 6B) was another coastal location with a high consensus from data sources (12) and a large report type diversity (12), however this was within a much smaller recreation zone of 7.1km^2.

In terms of highly ranked freshwater recreation zones, a merged region of the Colwick Country Park and river Trent in Nottingham (Appendix Figure 6C) featured 12 recreation report types and was indicated by 12 data sources (Table 9). This recreation zone covered 9.7km^2 which included the National Water Sports Centre (with regatta lake and white-

water canoe slalom) as well as the adjacent main river. A recreation location at Derwent Water in the Lake District (Appendix Figure 6D) with a recreation zone of 7.3km^2 also recorded high numbers of report types (11) and data sources (11), including the bathing water monitoring point which was recently designated in 2024.

To assess the feature importance at a national level, the data source consensus data was collated to a lower spatial resolution of waterbody catchments (Figure 22). In England, within the Environment Agency's public facing area there are 4,261 river, transitional and coastal waterbody catchments as part of cycle 2 of the Water Framework Directive (WFD). Of these 4,261 catchments only 1,558 (37%) contained water recreation locations identified in this study. This is an important finding as at first glance at the point-data (Figure 22A) the appearance is that recreation locations are everywhere, whilst the catchment-level analysis (Figure 22B) shows that recreation locations are actually limited to approximately only one third of the waterbody catchments.

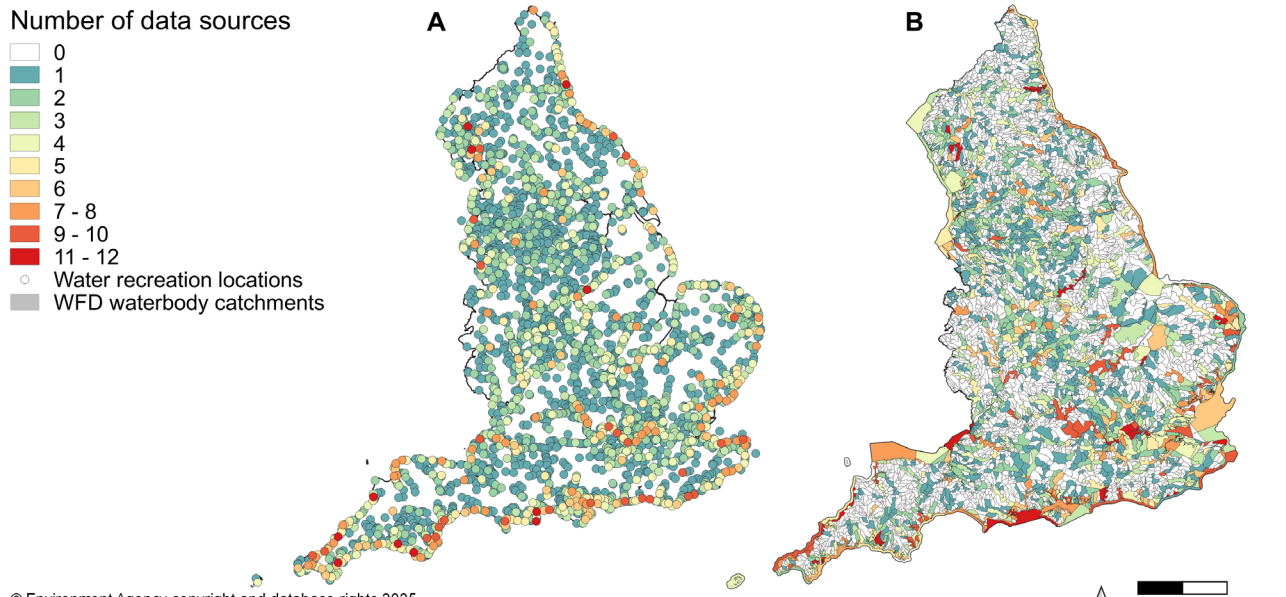

Figure 22: Maps of (A) water recreation location points identified in this study and (B) WFD river, transitional and coastal waterbody catchments in England shaded by the number of data sources identifying recreation locations within each catchment.

4.4.4 Frequency of events and participation at recreation locations

Whilst the previous section (section 4.4.3) discussed feature importance in terms of the consensus of data sources and a high report type diversity, there are other factors which can also make a location recreationally important. For instance, a location might be used solely for a singular activity and thus may be indicated by only a few data sources or report types, however, this location may be used recreationally by large numbers of people.

An example of this described case is the attendance at multisports events. Using the British Triathlon data on the days with events and numbers of expected competitors at events (as discussed in section 4.3.3) the attendance at these events could be assessed. In total 1,580 days of events were hosted at 227 locations between 2017 and 2023, of which only 53 locations (23%) were within 500m of a designated bathing water monitoring point. In all, events were held on 717 event days at 99 lake locations, followed by coastal and estuarine areas (163 days at 36 locations) and rivers (78 days at 21 locations). It was not possible to assign the waterbodies to the remainder 71 locations (which hosted 622 days of events) programmatically. The data which was assigned indicated that events predominantly took place at larger waterbodies (lakes and coastal areas) and these locations were used multiple times per year compared with river locations.

Across the 227 locations, the number of days with events ranged from 1 to 95 days within the 2017 to 2023 period. The location of most frequent (n=95) number of days of events was at Dorney Lake at Eton within the Thames RBD, followed by lakes in the Cotswolds Water Park (n=63) also in the Thames RBD.

The data on the number of expected competitors at each event also allowed the participation at 226 water recreation locations to be assessed. The number of expected competitors at each location was summed from the expected number from each event report within each waterbody catchment and mapped to show the participation rates across England for the period between 2017 and 2023 (Appendix Figure 7).

For the waterbody catchments with the highest number of expected competitors in the 2017-2023 period, the Dorney Lake in Eton (in the Roundmoor Ditch and Boveney Ditch waterbody catchment) was again the location with highest participation (93,240 expected competitors), likely due to the well documented number of days with events (Table 10). The Hever Castle, London Dock and Blenheim Palace locations are notable as while these locations have relatively few annual events (1-3 in 2023), they have a high participation rate with many people entering the water within a single event day. For instance, in 2019 11,000 competitors were expected to participate in the London Triathlon (swimming in the Royal Victoria Dock) at its single event day; the largest attended open water event identified.

4.4.5 Other metrics indicating water recreation intensity at the waterbody catchment scale

As demonstrated in the previous sections there are various data metrics which can be used to assess water recreation usage. Indeed, there were further data identified by this study which provide a measure of water recreation intensity for which a selection is shown in Figure 23.

Table 10: The ten waterbody catchments with the highest number of expected competitors at British Triathlon-associated events recorded between 2017 and 2023. Notable recreation location names are included to provide context, as well as the number of recreation locations, types and data sources identified within each catchment.

WFD waterbody catchment	River basin district	Notable water recreation locations	Number of recreation locations in catchment	Number of recreation report types in catchment	Number of data sources in catchment	Number of expected competitors (2017-23)	Number of days with events (2017-23)
Roundmoor Ditch and Boveney Ditch	Thames	Dorney Lake, Eton	1	9	9	93,240	95
Lower Eden	Thames	Hever Castle Lake	3	4	5	48,300	13
Unnamed coastal catchment (object 18; *part of London management catchment draining to the Tidal Thames*)	Thames	River Thames, London; The Serpentine; Hampstead Heath Ponds; Royal Victoria Dock	19	12	11	47,690	21
Glyme (Dorn confluence to Evenlode)	Thames	Blenheim Palace Lake	1	2	3	41,500	7
Trent from Soar to The Beck	Humber	Spring Lakes, Nottingham; Regatta Lake, National Water Sports Centre	13	12	12	26,280	63
Thames (Kemble to Waterhay Bridge)	Thames/ Severn	Cotswold Water Park	3	8	9	20,810	28
Wyke Beck from Source to River Aire	Humber	Roundhay Park Lake, Leeds	2	4	3	19,800	6

WFD waterbody catchment	River basin district	Notable water recreation locations	Number of recreation locations in catchment	Number of recreation report types in catchment	Number of data sources in catchment	Number of expected competitors (2017-23)	Number of days with events (2017-23)
Unnamed coastal catchment (object 194; *part of Dorset management catchment draining to Weymouth Bay*)	South West	Weymouth Bay	1	9	10	18,200	12
Cram Beck catch (trib of Derwent)	Humber	Great Lake, Castle Howard	1	2	1	18,000	6
Ouse (Newport Pagnell to Roxton)	Anglian	River Ouse, Bedford; Box End Lakes; Grebe Lake	12	10	10	15,032	41

From the collated data in this study, the number of locations per catchment and percentage of a catchment covered by recreation zones (Figure 23B) can be used as metrics as well as the previously discussed number of data sources (Figure 22) and number of report types (Figure 23C). For instance, some smaller coastal catchments were completely covered by the recreation zones whereas for some larger catchments there was a relatively small coverage. Furthermore, mapping the number of reports for each recreation report type (Figure 6) can demonstrate spatial distribution of particular activities and recreational infrastructure (such as for ‘recreation sites’; Figure 23D).

Figure 23E and F show the distribution of the number of bathing waters and mean recorded number of bathers at these sites respectively (as discussed in sections 4.1.1 and 4.4.1). Further detail can be brought to this with data from the Surfers Against Sewage ‘Safer Seas and Rivers Service’ (SSRS) application which listed 439 locations in England, of which 388 were proximate to currently designated bathing waters. For each location the number of app subscribers for pollution alerts was provided (Figure 23G). Three locations had more than 6,000 subscribers indicating a high level of public interest and potentially water usage. These locations included Hove Lawn (n=12,654), Brighton Central (n=10,101) and Gyllyngvase (n=6,037).

Data provided by British Rowing recorded the number of members per rowing club (Figure 23H) which provides further context on the actual usage of waters than is given from the number of club locations or frequency of events (Figure 23I) and supports the importance of the river Thames catchments for this activity.

As well as participation metrics there were also data on the scale of water recreation activity identified, such as the maximum swim distance at swimming and multisports events (Figure 23J). Notable events besides the English Channel swims (33.5km) were ultra swimming events such as the ‘Swim The Channel Up North Challenge’ (36km; Boundary Water Park, Allostock) and ‘The Dozen Dips’ (19.3km; Cotswold Water Park), as well as the large lake length swimming challenges in Windermere (17.7km) and Ullswater (12km).

The length of navigable waterways was calculated per catchment (Figure 23K) and enhanced with Paddle UK data on the number of paddling routes possible from each paddling launch site (Figure 23L).

Finally, a number of coastal-only reports were collated to the waterbody catchment level, including the coverage of the ‘general boating areas’ (areas identified for training and racing from club surveys; Figure 23M) and the automatic identification system (AIS) tracking intensity derived from recreational vessels typically between 10-24 m in length (Figure 23N) from the ‘RYA UK Coastal Atlas of Recreational Boating’ [31]. Further, the number of RNLI water recreation-related lifeboat callouts was included (Figure 23O). From the Marine Management Organisation (MMO) project on ‘Modelling marine recreation potential in England (MMO1064)’ [24] the open data on potential for ‘beach activity’, ‘paddle sports’, ‘sailing’ and ‘surfing’ was collated for the coastal waterbody catchments (Figure 23P).

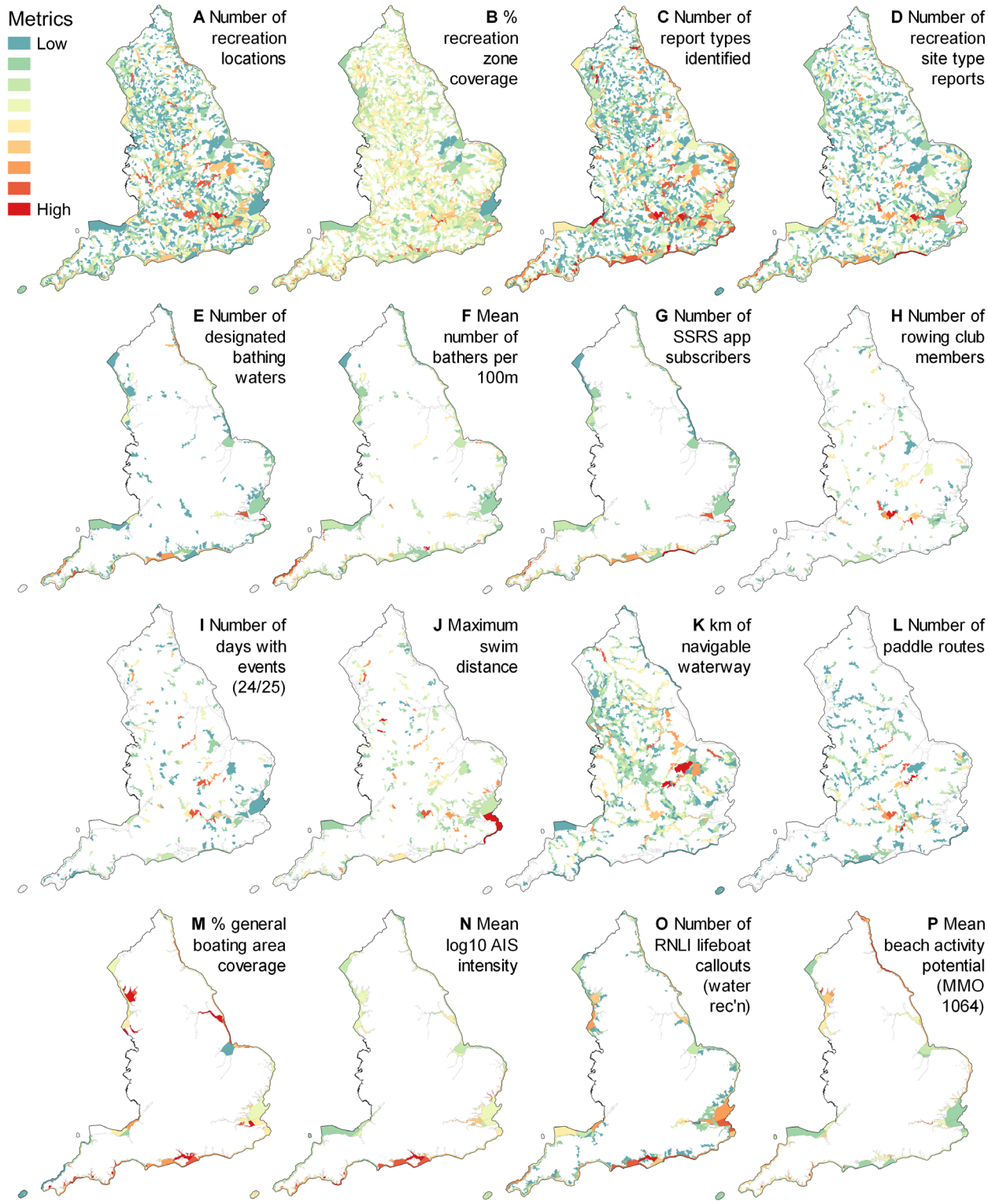

Figure 23: Maps of waterbody catchments in England shaded by a selection of water recreation metrics collated in this study as indicated in the subfigures (A)-(P) and detailed in Table 11.

4.4.6 An approach to rank water recreation intensity at the waterbody catchment scale

Following collation of the above discussed metrics on water recreation intensity to the waterbody catchment scale, an approach was sought to combine these metrics into a single water recreation score for each catchment to provide a national overview.

It is recognised that this approach likely requires further significant effort to optimise and weight a model for water recreation intensity using the data resulting from the project and other data sources. For the purposes of summarising the information collated in this study, a selection of key metrics was selected as inputs for a principal model (Table 11).

Table 11: Details of metrics included in water recreation summary ranking.

Type of metric	Metric
Data consensus	• Number of water recreation locations (Figure 23A) • Number of data sources (Figure 22B) • Number of recreation report types (Figure 23C)
Number of reports per type*	• Marinas (number of reports) • Open water venues (number of reports) • Paddling clubs (number of reports) • Paddling launches (number of reports) • Recreation sites (number of reports) (Figure 23D) • Rowing clubs (number of reports) • Sailing clubs (number of reports) • Slipways (number of reports) • Swimming clubs (number of reports)
Bathing waters	• Number of designated bathing waters as of 2024 (Environment Agency) (Figure 23E) • Mean number of bathers per 100m (Environment Agency) (Figure 23F) • Mean number of beach users per 100m (Environment Agency)
Events	• Days with events 2017-23 (British Triathlon) • Days with events 2024-25 (British Triathlon, TimeOutdoors, British Rowing) (Figure 23I)
Participation	• Number of expected competitors at events 2017-23 (British Triathlon) (Appendix Figure 7)

Type of metric	Metric
	• Number of rowing club members (British Rowing) (Figure 23H) • Number of SSRS app subscribers (Surfers Against Sewage) (Figure 23G)
Recreation scale	• % coverage of recreation zone areas per catchment area (Figure 23B) • Maximum swim distance (British Triathlon, TimeOutdoors, Channel Swimming & Piloting Federation) (Figure 23J) • Number of paddling routes per paddle launch (Paddle UK) (Figure 23L)
Freshwater specific	• % accessible waterside (Natural England) (Appendix Figure 2B) • Navigable waterway length (km) (Paddle UK)
Coastal specific	• Lifeguard units (number of reports) • Surf schools (number of reports) • Number of channel swimmers (CS&PF) • % general boating area (RYA) • Mean log10 AIS intensity (RYA) • Number of water recreation-related lifeboat callouts (RNLI) • MMO1064 mean beach activity potential score (MMO) • MMO1064 mean surfing potential score (MMO) • MMO1064 mean sailing potential score (MMO) • MMO1064 mean paddling potential score (MMO)
* Some report type counts were excluded as these were covered by other metrics and would have otherwise meant double counting the same data.	

For each metric (Table 11) the values for each waterbody catchment were normalised by scaling between 0 and 100% (between the smallest recorded value and largest recorded value). An average percentile score, representing the overall ‘water recreation rank’, was then calculated by taking the average of all normalised metric values for each waterbody catchment (Figure 24). As indicated by Table 11, some metrics were either freshwater or coastal specific in which case they were excluded from the overall rank calculation when not applicable.

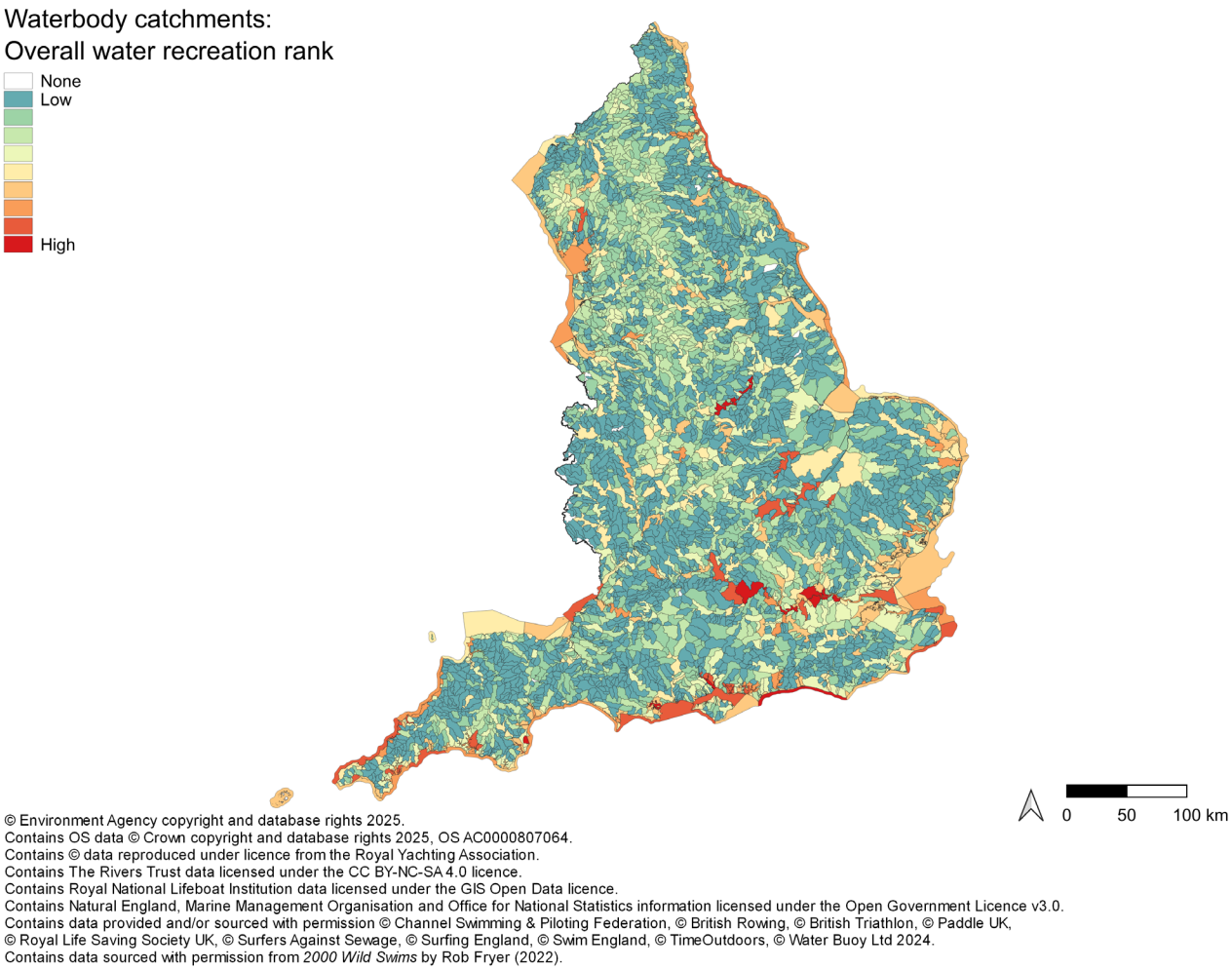

Figure 24: Maps of waterbody catchments in England shaded by overall water recreation rank calculated from the average of a selection of water recreation metrics collated in this study as listed in Table 11.

The ranked catchments indicate a diverse landscape of water recreation across England with the rivers Thames, Trent, Great Ouse, Cam, Nene and Tyne, the lakes of the Lake District and many areas of the coastline particularly standing out with a high ranking for water recreation usage.

The top three river basin districts in terms of highest ranked river catchments were in the Thames, Humber and North West, with the South West, South East and Northumbria highest for coastal/estuarine catchments (Appendix Figure 8).

4.5 Limitations

Reports of water recreation locations have been determined from a desktop study of available existing data (provided ‘as-is’ and not necessarily originally collected for this type of analysis). The dataset is not exhaustive as certain activities (such as bathing) do not require permission nor a licence and have a low barrier to participate so they do not necessarily have a presence in the data. Nonetheless, we specifically sought out information on ‘wild’ swimming from multiple sources to address this data gap. The scope of this study was mainly focused on immersive in-water recreation (swimming) with some limited capture of on-water activities (paddling, rowing, sailing, surfing).

The data is primarily point-based water access locations and has limited coverage of the actual area (i.e. tracks) of where water recreation may take place within a waterbody once entered. Further, data has not been verified on the ground and some data is sourced from non-authoritative sources including community contributions. Inclusion is no guarantee of access (for example sites may require landowner permission, memberships or have time/season limitations).

The time-based data primarily covers the 2017 to 2023 calendar years with limited assessment from the 2024 bathing season and events scheduled in the 2024-25 season. As such, past indications do not necessarily mean locations are still active, permitted or safely accessible at the time of publication (for example, the data also includes now de-designated bathing points) and the inclusion of sites in this study does not imply sites will be monitored going forward.

5 Conclusions

This project has explored a broad selection of data from organisations involved in water recreation across England. The national picture has been evaluated here for the first time as much of the data was available separately and in regional or tabular formats.

It is evident there are a considerable number of distinct locations used for water recreation, totalling at least 3,347 locations. Of these aggregated locations 1,727 were reportedly used for swimming, with wild swimming found to cluster within National Parks and Landscapes where accessible waterside is greatest. Whilst only 342 locations were within 500m of a designated bathing water monitoring point, recreation reports were only identified in 1,558 of the 4,261 waterbody catchments (37%) in England. Almost three times as many inland freshwater recreation sites (2,521) were found in comparison to coastal and estuarine sites (826). In all, 1,233 of the 3,347 locations identified were indicated by more than one data source giving a higher confidence in these locations (of which only 917 were swimming locations).

Where data existed regarding when water recreation takes place, the results provided a mixed picture regarding anecdotal reports of increasing participation in water recreation. The Environment Agency's bather and beach user data shows a modest increase following the coronavirus (COVID-19) pandemic, whereas events listings for open water swimming and multisport triathlons show approximately a 15% drop in occurrence and attendance. Regarding the time of year, there is evidence of organised swimming activities taking place earlier in May and later into October outside of the designated bathing water season. Whereas, rowing events appeared to take place almost year-round.

A principal model was used to distil all the collated data into an overall water recreation rank to gain a better understanding and create a holistic overview of the water recreation landscape across England.

It is important to consider the limitations regarding each data source discussed in this project. Official data tends to only cover designated sites and therefore did not provide a full picture of which water bodies are actually being used nationally for recreation. Whereas community sourced data may not be nationally representative and various participation biases can be associated with this. Furthermore, much of this data has been collected for different purposes and not specifically for this analysis and therefore may contain unintended gaps which distort the national picture.

The collated data only represents a snapshot in time from data sourced in 2024. Less consideration has been paid to sites which have recently been de-designated or sites which may no longer be popular for various social or physical reasons. Additionally, there is no requirement and little driver for recreation users to submit locations, participation and usage data. This means that data may be enthusiast driven and likely missing locations, nonetheless this work does improve upon the prior knowledge in this area.

6 References

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7 Appendix

7.1 Raw data processing

7.1.1 British Rowing data

Data was received from British Rowing concerning the location and member count of each rowing club across England to reflect the level of activity at each location.

All data from this dataset was attributed with ‘rowing’ activity and ‘rowing club’ report type.

To supplement this, data on competitive rowing events was also sourced with permission from the rowing activity finder webpage (https://www.britishrowing.org/rowing-activity-finder/). As event listings only covered future scheduled events, the data capture procedure was carried out on four dates (10th May, 19th July, 12th September and 7th November 2024) to better capture the water recreation season for 2024-25.

Each HTML file was clipped to a JSON string containing locations of clubs, competitions and events. Data regarding clubs (locations) and competitions (start dates and locations) was extracted using the python ‘json’ module.

All data from this dataset was attributed with ‘rowing’ activity and ‘rowing club’/’rowing events’ report types as appropriate.

7.1.2 British Triathlon data

British Triathlon data was sourced with permission from the events listing webpage (https://www.britishtriathlon.org/events/search-on-map?date_from=01-01-2017&date_to=31-12-2023&location=&mode=default). Data for held and scheduled events in the 2024-25 season were also captured in the same way (on 7th November 2024). Data was restricted to open water venues with the url parameter appended ‘&swim_type=X’ (with X corresponding to 1 (lake), 2 (river), 4 (sea) and 5 (dock)). Locations were therefore discarded for either having ‘swim’ stages in ‘Pool’ ‘terrain (assumed to be indoor/non-environmental waters), because the locations only hosted out-of-scope events (e.g. Duathlons; run + bike + run), or due to missing data.

Using the ‘beautifulsoup4’ python module [59], the HTML file was parsed for the ‘input’ element with type=’hidden’ and id=‘data_events’. For each event, information was extracted from the event URL including location, date and the expected number of competitors where published. For each race within an event, data was captured concerning the swim stage terrain and stage (swim) distance.

All data from this dataset was attributed with ‘swimming’ and ‘multisport’ activity types (as per event type distinctions) and ‘swimming events’/’multisport events’ report types.

British Triathlon also provided permission to source venue locations from Beyond Swim (an open water swimming venue accreditation programme by Triathlon England, Swim England and RLSS UK). Beyond Swim data was sourced from the venues archive webpage (https://beyondswim.org/venues/) on 7th August 2024.

Using the python 'json' module the venues.json file was parsed for data concerning the 'title' (venue name) and location (longitude and latitude) of each venue.

All data from this dataset was attributed with 'swimming' and 'multisport' activities, 'venue swimming' subcategory and the 'open water venue' report type.

7.1.3 Channel Swimming & Piloting Federation data

Channel Swimming & Piloting Federation (CS&PF) data was sourced with permission from the successful channel swim records webpages (https://cspf.co.uk/cs-and-pf-swims).

For each year from 2017 to 2023 the swim records HTML file was downloaded. Using the 'beautifulsoup4' python module [59], the file was parsed for tables with the 'id': 'swims', corresponding to two tables with solo and relay swim records. From each table row the first 'td' table data cell was extracted as the date of the swim and the fourth cell as the URL of the swim track webpage where available. From the second cell of the relay table the number of swimmers in parentheses was extracted.

From each swim track page two KML files containing GIS information were captured corresponding to GPS-tracked points and the swim track (line). From the points KML file the swim start time and location (latitude and longitude) were extracted from the earliest point. To remove erroneous GPS data, three tracks with extents beyond 53° latitude were removed from the analysis.

All data from this dataset was attributed with 'swimming' activity, 'wild swimming' subcategory and 'channel swim site' report type.

7.1.4 Environment Agency data

Designated bathing water site information was sourced from the 'Bathing Water monitoring locations' dataset published by the Environment Agency [60]. This geolocated data comprised site IDs, names, water type (coastal, estuarine, lake, river), dates for designation, de-designation and annual classifications.

Environment Agency bathing water data was taken from the Water Quality Archive (WQA) [22] for the period between 01/05/2017 and 01/10/2024 (conclusion of the bathing season) for any samples which included the measurement determinand code '8046' (corresponding to a count of the number of bathers per 100m) or '9161' (corresponding to a count of the number of beach users per 100m). This query captured geolocated data corresponding to designated bathing waters as well as other locations where these measures had been counted (investigations). To remove sample bias from the limited number of out-of-season samples, those relating to investigations (with purpose codes for

local/national planned investigation and unplanned reactive monitoring) were dropped from this study (approx. 2% of all 2017-2024 records).

Sampling data was combined with data from the bathing monitoring location dataset to form a classified dataset used in the data collation steps. For each site the mean and maximum number of bathers per 100m and beach users per 100m was calculated on an annual basis and for the period 2017-2024.

All data from this dataset was attributed with ‘swimming’ activity and ‘designated bathing water’ report type.

The Environment Agency National Navigation team also provided summarised data on the number of boats directly registered with the Environment Agency and, with permission, numbers from joint registration agreements with Paddle UK, British Rowing and the Canal and Rivers Trust. The data was broken down by boat type (powered and unpowered) and registration year for the period 2017 to 2023, with the Environment Agency data additionally broken down by waterway.

All data from this dataset was attributed with ‘paddling’ activity.

7.1.5 Marine Management Organisation data

MMO data concerning slipways (‘Slips’ layer) was sourced from ‘MMO1163 Mapping Sea Angling’ project data [23] under the Open Government Licence v3.0.

The ‘requests’ module in python was used to collect data on the location and length of slipways from the WFS service using the parameters: REQUEST=‘GetFeature’, outputFormat=‘GEOJSON’, SERVICE=‘WFS’, TYPENAME=‘Slips’ and srsName=‘EPSG:27700’.

All data from this dataset was attributed with ‘paddling’ and ‘sailing’ activity types and ‘slipway’ report type.

The marine recreation potential model outputs from project MMO1064 [24] were also sourced under the Open Government Licence v3.0.

7.1.6 Natural England data

Natural England data from national surveys of Monitor of Engagement with the Natural Environment (MENE) covering the period from 2009-2019 and the People and Nature Survey (PANS) for England (2020-2023) was sourced under the Open Government Licence and open data via the UK Data Service respectively [61], [62].

The MENE survey data was combined from the “MENE: Adult Respondent & Visit data by Local Authority (DATA0010)” datasets into a single national dataset. Out of 119,547 records, data was filtered to 1,309 responses which had valid visit locations (with an easting and northing value) and activities of either 'Visit activity - Swimming outdoors' or

'Visit activity - Watersports'. Visits with 'Visit activity - Beach, sunbathing or paddling' were dropped as the paddling aspect could not be distinguished separately. Data from this dataset was attributed with either ‘swimming’ or unspecified ‘water recreation’ activity and ‘recreation site’ report type.

For the PANS data, out of 93,678 records each relating to a survey response the data was filtered to responses with valid visit locations (with a latitude and longitude) and only those which selected ‘Boating, water sports or swimming outdoors’ as the “main activity” done on a specific visit. This resulted in 346 records which were taken forward in this analysis (some visit locations were later excluded for being outside of England). All data from this dataset was attributed with unspecified ‘water recreation’ activity and ‘recreation site’ report type.

For catchment summaries only, Natural England data on accessible waterside (by public rights of way (PRoW) and access land) dataset [25] was sourced under the Open Government Licence v3.0. The total waterside per catchment was also calculated using the Natural England methodology [26] from the OS Open Local [63] water stretches (tidal water polygons, surface water area polygons and surface water line). The percentage accessible waterside per catchment was calculated by dividing the accessible waterside by the total waterside. The calculation was not performed for catchments which partially or wholly intersected one of the 54 (mainly urban) local authority areas which did not respond to the sources data request [64] (Appendix Figure 2).

7.1.7 Paddle UK data

Paddle UK data for points for launching and clubs as well as navigable waterways were sourced with permission from the Paddle Points webpage (https://gopaddling.info/paddlepoints/).

Using the ‘beautifulsoup4’ python module [59] the HTML file was parsed for the ‘div’ elements with id=‘ppSideSectionContent_Rivers’ and ‘ppSideSectionContent_Canals’. From these the name, waterway ID and (where available) URL for each navigable waterway was extracted. From the HTML file of each waterway URL the licence and authority status were extracted from ‘p’ elements with classes of ‘pp_licence_required_yes’ and ‘pp_licence_required_no’, and ‘div’ elements with classes of ‘pp_licence_authority’ respectively.

The line shapes of the waterways and locations of point data were extracted from the ‘admin-ajax.php’ file loaded with the Paddle Points webpage. River and canal line data constructed from location points (latitude and longitude) were converted to a ‘MULTILINESTRING’ geometry type using the ‘shapely’ python module and data was merged with the licence/authority status information based on the waterway name.

The points concerning launches (with ‘MarkerType’ of 1: ‘Launch’, -1: ‘Launch w/ Route’ and -2: ‘Launch w/ BC Route’) and clubs (with ‘MarkerType’ of 28: ‘Club’ and 23: ‘Hire Centre’) were selected including information on the site/club name, route count and

merged with the waterway information based on the waterway ID for waterway name and waterbody type (river or canal).

All data from this dataset was attributed with ‘paddling’ activity and either ‘paddling launch’ or ‘paddling club’ report type as appropriate.

7.1.8 Royal National Lifeboat Institution data

The locations of RNLI lifeguard units were sourced from the RNLI Open Data website under the GIS Open Data Licence [28]. All data from this dataset was attributed with ‘swimming’ activity type and ‘lifeguard unit’ location type.

The locations of RNLI lifeboat callouts (return of service) were also sourced from the RNLI Open Data website under the GIS Open Data Licence [29]. This data was summarised to the catchment level only with the number and number per km^2 of total RNLI total callouts and selected water recreation RNLI callouts (as per data processing in section 7.1.8).

The ‘CasualtyTypeFull’ data field was used to filter the callout records to focus on activities relating to those in this research study including;

- Swimming (and related activities); 'Coasteerer','Inflatable','Inflatables','Multiple persons on the water','Person in distress','Person in water','Swimmer','Tombstoner'
- Paddling; 'Canoe','Kayak','Kayak/canoe'
- Rowing; 'Rowing boat'
- Surfing (and related); 'Bodyboard','Skimboard','Surfboard','Waterskier'
- Sailing (and related); 'Keelboat','Kite board','Kitesurf','Sail Multihull','Sailing dinghy','Sailing training vessel','Windsurf','Yacht (no engine)','Yacht (with engine)'

Notably this excluded some recreational activities including diving, angling and jet skiing which were outside the scope of this work.

7.1.9 Royal Life Saving Society UK data

The locations of RLSS UK approved aqua parks were sourced with permission from the KML download from the Google Map hosted at the ‘Approved Aqua Parks’ website (https://www.rlss.org.uk/listing/category/aqua-parks).

All data from this dataset was attributed with ‘swimming’ activity type, ‘venue swimming’ subcategory and ‘open water venue’ report type.

7.1.10 Royal Yachting Association data

Access to the RYA UK Coastal Atlas of Recreational Boating (2019) was provided under licence for the purposes of this research. From the Atlas the locations of RYA clubs and marinas in England was extracted as point reports of water recreation.

Data from these data types were attributed with ‘sailing’ activity type, and ‘sailing club’ or ‘marina’ report type.

Data from the general boating areas identified by clubs in 2015 as training and racing areas was also provided which indicated where small vessels may be in operation. Further, data from the Automatic Identification System (AIS) intensity (derived from recreational vessels typically > 10m and < 24 m in length) was included.

To aggregate the data the intersection of the RYA general boating area polygons and each catchment was calculated using the python geopandas module [36]. A percentage was calculated by taking this intersected general boating area against each catchment’s total seaward area.

For each seaward catchment the sum of log10 AIS intensity mapped onto 0.25 km square cells was calculated using the QGIS zonal statistics raster analysis algorithm [43]. The count of 0.25 km square cells (including null values with no indicated activity) was also determined to give the total number of cells within each seaward catchment. Using the python geopandas module [36] the sum was divided by the total count to calculate a mean log10 AIS intensity per catchment.

7.1.11 Surfers Against Sewage data

Data was received from Surfers Against Sewage concerning the location of sites listed within the ‘Safer Seas & Rivers Service’ (SSRS) application. Snapshots of the service data were provided on 9th July 2024 and 15th October 2024 capturing the number of subscribers signed up for pollution alerts. Further site data indicated known activities which take place at each site (bathing, kayaking, paddleboarding, sailing, swimming and surfing).

All sites were attributed as ‘recreation site’ report type. For this study all data with kayaking or paddleboarding indication was combined and attributed with ‘paddling’ activity type and all data with swimming or bathing indication was combined into ‘swimming’ activity type. Data from sites which were not designated bathing waters were attributed to the ‘wild swimming’ subcategory.

7.1.12 Surfing England data

Data on the locations of Surfing England surf schools was sourced with permission from the Surf Schools Archive website (https://www.surfingengland.org/surf-schools/).

Using the ‘beautifulsoup4’ python module the HTML file was parsed for ‘div’ elements with the ‘class: ‘card listing’, corresponding to each swim school. From each ‘div’ element the name and location of each school was extracted.

All data from this dataset was attributed with ‘surfing’ activity and ‘surf school’ report type.

7.1.13 Swim England data

Data on the locations of open water swimming pools was sourced with permission from the Pool Finder website [54].

Using the ‘beautifulsoup4’ python module the HTML file was parsed for ‘li’ list item elements with the ‘class: ‘results-item’, corresponding to each swimming pool. From each item the name, URL and location of each pool was extracted.

Via the specific URL of each pool the associated pool terrain types were captured (from list items with ‘class’ of ‘facility-pool’, of which pools of the following types were kept for this study: Man Made Lake (42), Natural Lake (24), Quays/Wharf (8), Quarry (7), River (1) and Beach (1).

All data from this dataset was attributed with ‘swimming’ activity, ‘venue swimming’ subcategory and ‘open water venue’ report type.

7.1.14 The Rivers Trust data

Data on recreation sites indicated by the Rivers Trust ‘Bathing and Amenity Sites Survey’ was sourced under a CC BY-NC-SA 4.0 licence [33] and included in open datasets with permission.

All data from this dataset was attributed with ‘swimming’ activity, ‘wild swimming’ subcategory and ‘recreation site’ report type. Further, the free-text descriptions were searched for keywords associated with ‘multisport’, ‘paddling’, ‘rowing’, ‘sailing, ‘surfing’ activity reports.

7.1.15 TimeOutdoors data

TimeOutdoors data was sourced with permission from the website event listings webpages [34].

As event listings only covered future scheduled events, the following data capture procedure was carried out on four dates (15th April, 18th July, 12th September and 7th November 2024) to better capture the water recreation season for 2024-25.

For each of the English regions (‘london’, ‘south-east’, ‘south-west’, ‘east-of-england’, ‘east-midlands’, ‘west-midlands’, ‘yorkshire’, ‘north-east’, ‘north-west’) the HTML file for the following activity pages pertaining to water recreation were downloaded:

- ‘swims’
- ‘swims/sea’
- ‘swims/lake’
- ‘swims/river’
- ‘triathlons’
- ‘triathlons/novice’
- ‘triathlons/super-sprint’
- ‘triathlons/sprint’
- ‘triathlons/olympic’
- ‘triathlons/half-ironman’
- ‘triathlons/ironman’
- ‘triathlons/relay’
- ‘triathlons/kids’
- ‘swim-runs’
- ‘swim-runs/sprint’

- ‘swim-runs/ regular’
- ‘swim-runs/ultra’
- ‘aquathlons’
- ‘aquathlons/sprint-distance’
- ‘aquathlons/ standard-distance’
- ‘aquathlons/long-distance’
- ‘aquathlons/kids’
- ‘aquabikes’
- ‘aquabikes/super-sprint’
- ‘aquabikes/sprint’
- ‘aquabikes/ standard-distance’
- ‘aquabikes/ middle-distance’
- ‘aquabikes/long-distance’
- ‘aquabikes/kids’
- adventure-races’

Each HTML file was clipped to a JSON string containing locations of swimming, paddling and multisport events. Data regarding event names, locations, start dates and times, waterbody type, swim/paddle distance and sport activity was extracted using the python ‘json’ package.

Events were attributed as either ‘swimming’, ‘multisport’ or ‘paddling’ activity type, and ‘swimming events’, ‘multisports events’ or ‘paddling events’ report types as appropriate.

7.1.16 Water Buoy Ltd data

Data was received from Water Buoy Ltd concerning the location of sites listed within the ‘WildSwim’ application. A snapshot of the service data was provided from 25th July 2024 capturing the location of sites and information on any known swimming club association. From this the presence/absence of a known swimming club was derived for each site.

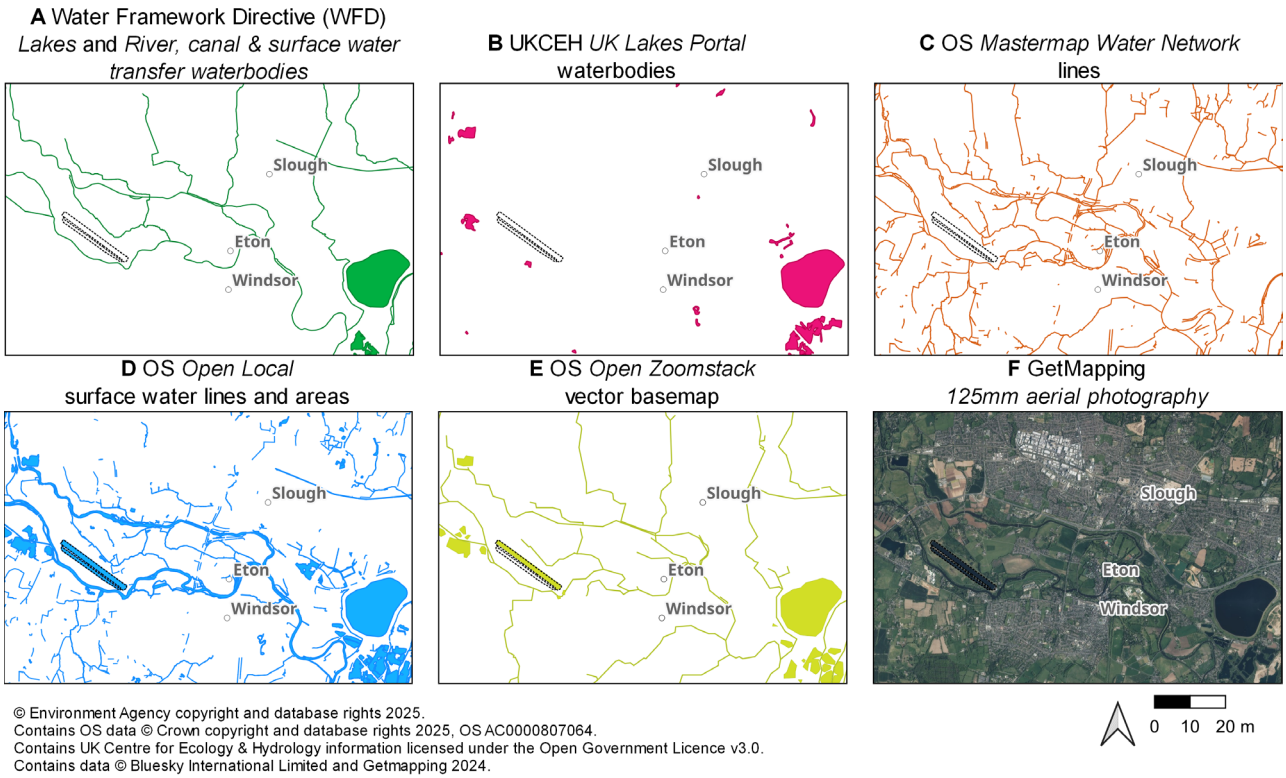
All sites were attributed as ‘swimming’ activity type, ‘wild swimming’ subcategory and ‘recreation site’ report type.

7.1.17 2000 Wild Swims data

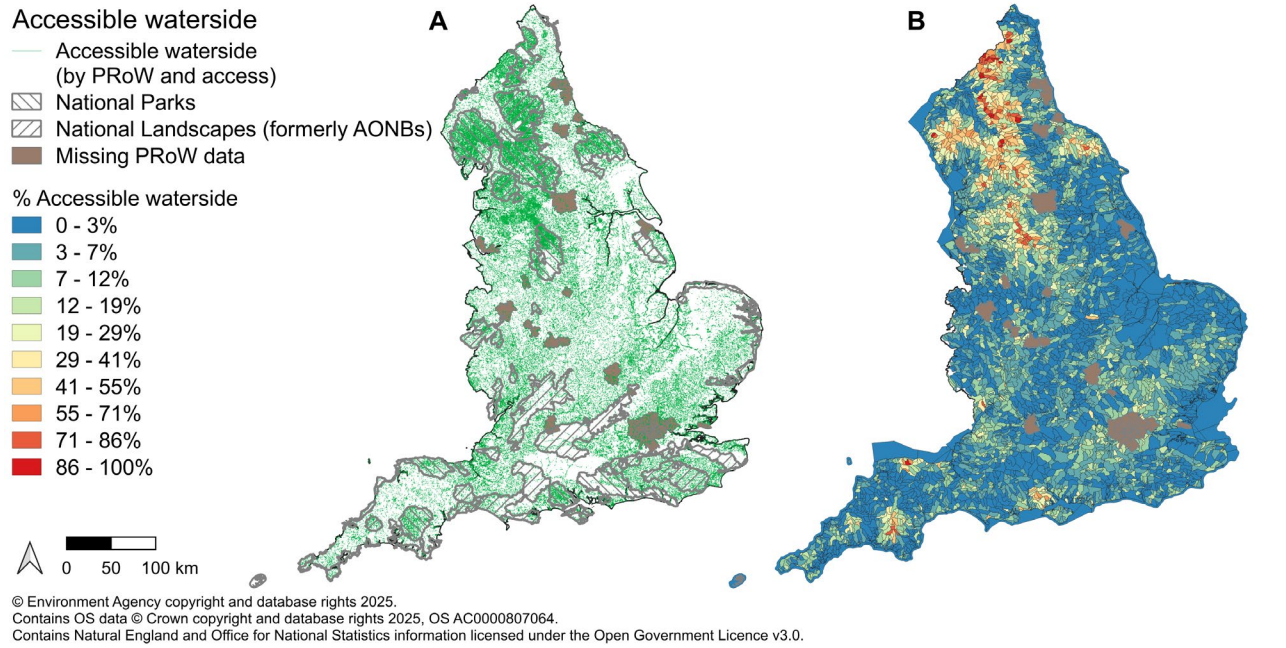
The ‘Wild Swimming Database’ index from the *2000 Wild Swims* book published in 2022 by Rob Fryer was provided for use within this research. From each row of the index the grid reference corresponding to each wild swim site was extracted.

All sites were attributed as ‘swimming’ activity type, ‘wild swimming’ subcategory and ‘recreation site’ report type.

7.2 Supplementary information

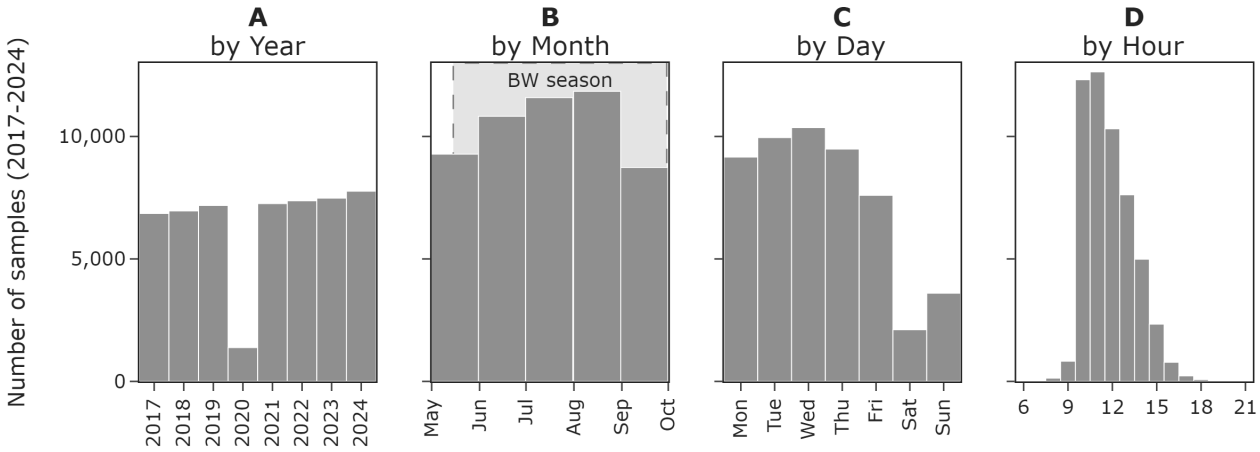


Appendix Figure 1: Maps of the still-water Dorney Lake in Eton (highlighted with a black dashed outline) as shown as missing with GIS datasets of (A) WFD waterbodies, (B) UKCEH 'UK Lakes Portal' and (C) OS Mastermap Water Network, and shown as present with (D) OS Open Local surface water, (E) OS Open Zoomstack and (F) GetMapping aerial photography.

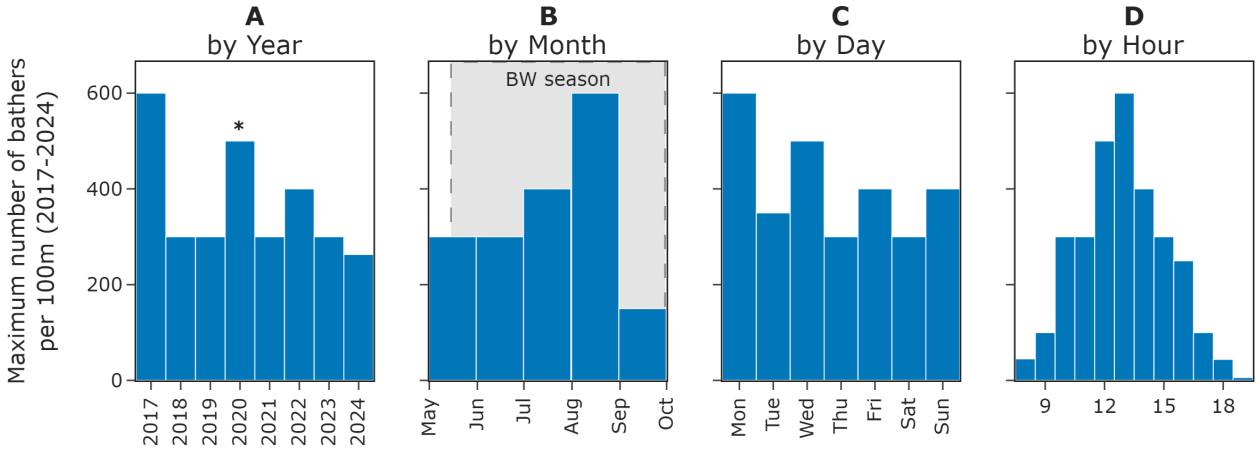


Appendix Figure 2: (A) Map of waterside in England accessible by Public Rights of Way (PRoW) and access land (with PRoW missing data highlighted), overlayed with National Parks and National Landscapes (formerly Areas of Outstanding Natural Beauty),

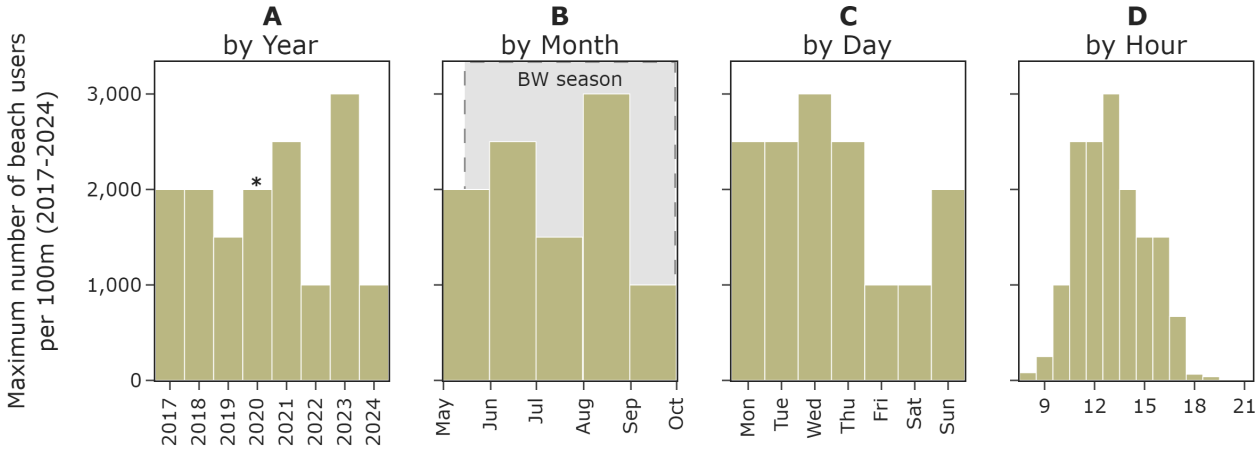
reproduced from Natural England data in [50]. (B) Map of WFD river waterbody catchments in England shaded by the percentage of accessible waterside as a fraction of the total waterside within each catchment.



Appendix Figure 3: Bar charts showing Environment Agency data for all designated bathing waters recorded between 2017 and 2024 for how many samples were taken (total number per x-axis category) by sampling (A) year, (B) month, (C) day and (D) hour. In (B) samples were restricted to the pre-season and bathing season (15th May – 30th Sep; shaded).



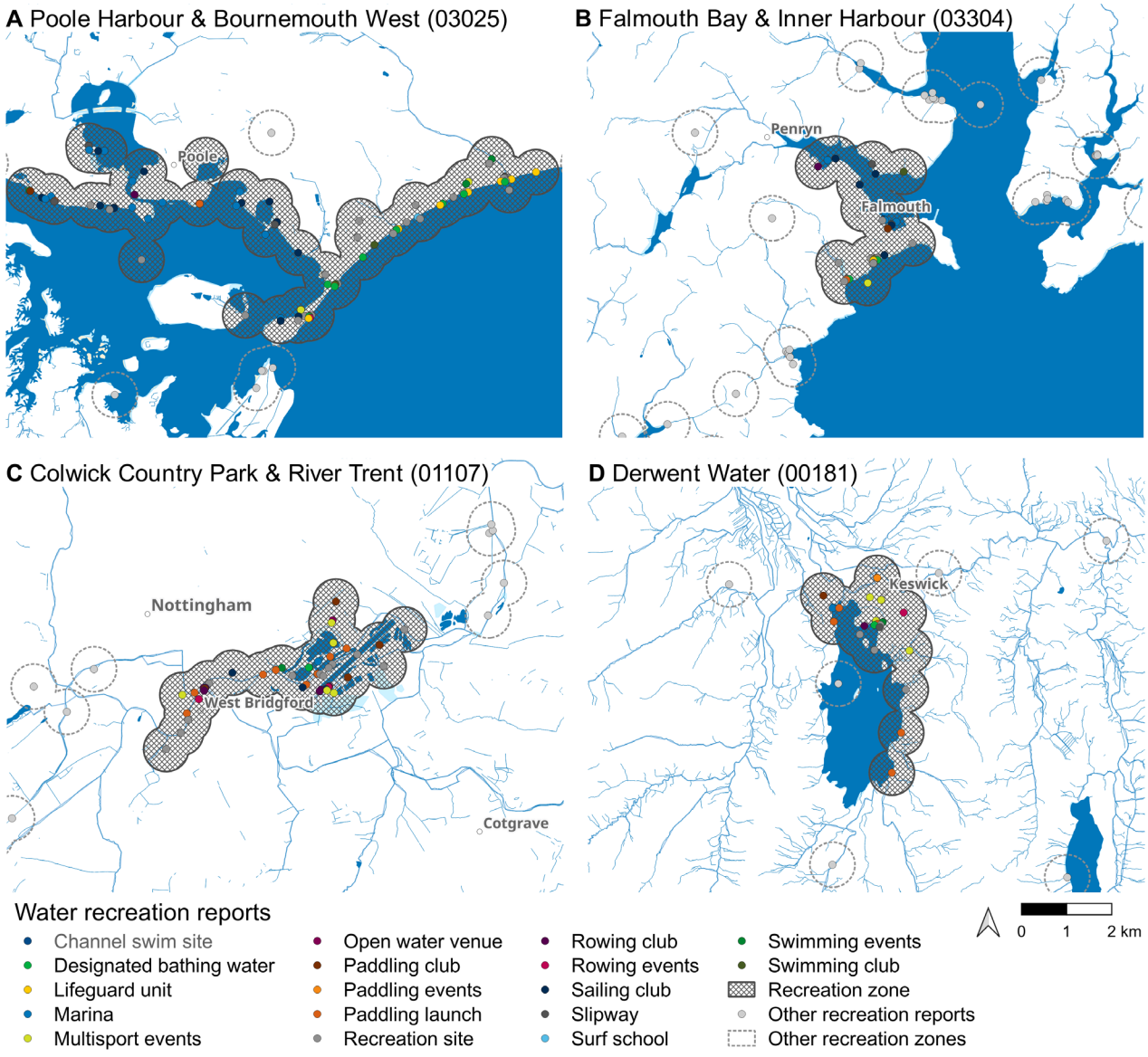
Appendix Figure 4: Bar charts showing Environment Agency data recorded between 2017 and 2024 for when bathers were present (*maximum* count per 100m per x-axis category) by sampling (A) year, (B) month, (C) day and (D) hour for all designated bathing waters. *In (A) far fewer samples were taken in the year 2020. In (B) samples were restricted to the pre-season and bathing season (15th May – 30th Sep; shaded).



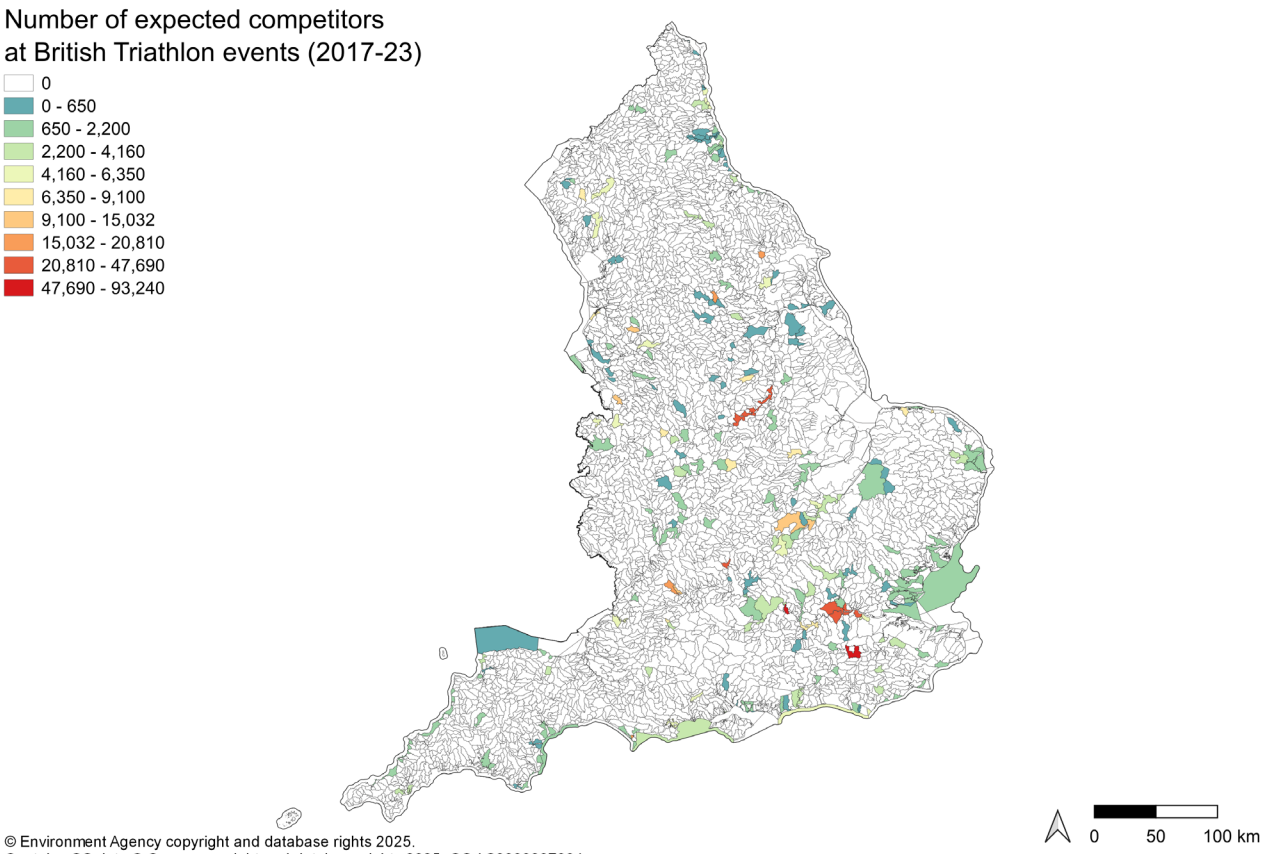
Appendix Figure 5: Bar charts showing Environment Agency data recorded between 2017 and 2024 for when beach users were present (*maximum* count per 100m per x-axis category) by sampling (A) year, (B) month, (C) dy and (D) hour for all designated bathing waters. *In (A) far fewer samples were taken in the year 2020. In (B) samples were restricted to the pre-season and bathing season (15th May – 30th Sep; shaded).

Appendix Table 1: Number of recreation locations identified for all navigable rivers and all navigable canals (in bold). The number of locations identified for named waterbodies with at least 12 recreation locations are also shown. In some cases recreation location zones intersected both a navigable river and canal in which case the combined result is shown as the waterbody was unclassified.

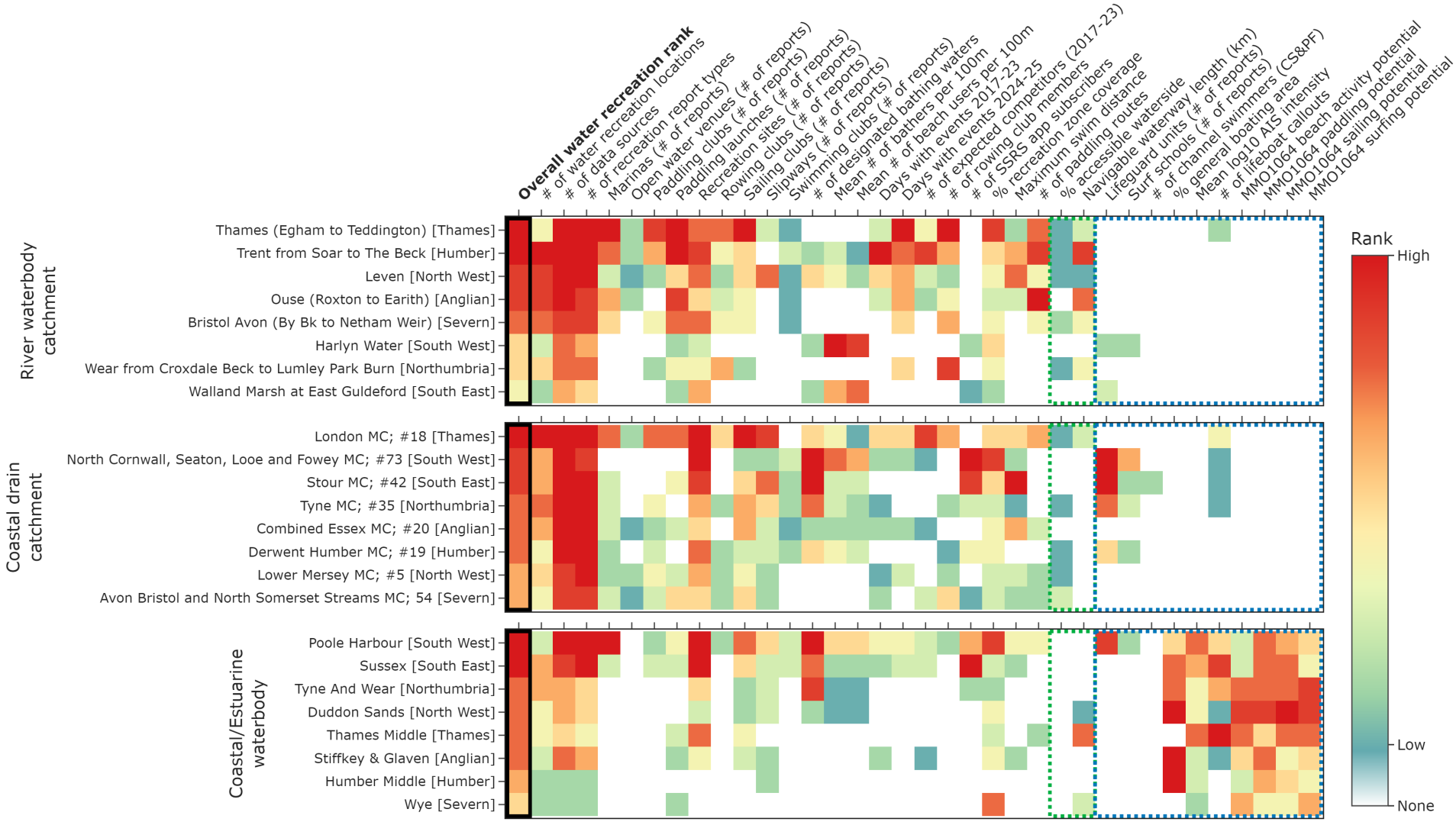
Waterbody	Number of recreation locations	Waterbody	Number of recreation locations
Navigable rivers:	**799**	**Navigable canals:**	**391**
River Thames	68	Grand Union Canal	52
River Great Ouse	40	Leeds and Liverpool Canal	32
River Severn	33	Grand Union Canal - Leicester Arm	20
River Nene	29	Basingstoke Canal	16
River Trent	25	Chesterfield Canal	15
River Wharfe	20	Lancaster Canal	14
River Medway	20	Oxford Canal	13
River Tees	19	Staffordshire and Worcestershire Canal	13
River Tyne	18	Kennet and Avon Canal	12
River Wye	17	Ashby Canal	12
River Avon (Warwickshire)	16		
River Wey	16	**Intersecting river & canals:**	**73**
River Lee Navigation	14	Leeds and Liverpool Canal; River Aire	12
River Derwent (Derbyshire)	14		
River Avon (Bristol)	14		
River Kennet	13		
River Stour, Kent	13		
River Wear	12		



Appendix Figure 6: Maps of recreation locations with high feature importance (number of report types and data source indications); the two highest coastal locations (A) Poole Harbour & Bournemouth West (assigned location ID 03025) and (B) Falmouth Bay & Inner Harbour (03304), and the two highest freshwater locations (C) Colwick Country Park & River Trent (01107) and (D) Derwent Water (00181). Recreation reports are displayed by coloured circles enclosed in the aggregated recreation zone (dark grey hashed) created from intersecting buffer zones. Other report points outside of the recreation zone are displayed with pale grey circles and dashed line recreation zones.



Appendix Figure 7: Map of waterbody catchments in England shaded by the total number of expected competitors at British Triathlon events between 2017-23 within each catchment.



Appendix Figure 8: Heatmap of the highest ranked riverine, coastal drain (land to sea) and coastal/estuarine waterbody catchments in each main river basin district in England shaded by a selection of water recreation metrics collated in this study and detailed in Table 11. The overall rank is enclosed in a black outline with inland-focused metrics in a green dashed outline and coastal-focused metrics in a blue dashed outline.

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