



## **Fisheries mapping project: Mapping inshore fishing activity in The Wash using vessel-based sightings information**

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**Eastern IFCA Research Report**

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**Elise Quinn**



## 1. Introduction

Developing a good understanding of fishing effort, intensity and methods is critical to informing effective management of fisheries and other human activities within Marine Protected Areas (MPAs) (Jennings and Lee, 2012; Szostek et al., 2017). At present, Vessel Monitoring Systems (VMS) are required in the UK only on vessels  $\geq 12$  m long (EC No. 1224/2009). Consequently, current representation of the inshore fleet, which supports a high number of smaller vessels, in fishing intensity data is poor. The lack of VMS data for The Wash fleet, which is primarily composed of boats  $<12$  m, at present means there are significant gaps in data describing the spatial distribution and intensity of fisheries in the area (Figure 1).



**Figure 1.** The Wash embayment in relation to the British coastline.

In 2010, the Eastern Sea Fisheries Joint Committee compiled charts of the distribution of important fishing grounds for bass, brill/turbot, cockles, cod, crustacea, dab/flounder, dogfish, herring/sprat, mackerel, mussels, plaice, rays, sandeels, shrimp, soles, whelks and whiting in the district (Eastern Sea Fisheries Joint Committee, 2010). To inform these charts, informal sightings and face-to-face interviews with fishers were used.

To follow on from this project, the vessel sightings database was set up to record sightings of fishing vessels on an opportunistic basis, when Eastern IFCA officers are at sea for other research and marine protection work. Data recorded in 2017 has been used here to make a first attempt at mapping fishing effort in The Wash and to investigate the usefulness and possible applications of this spatial data.

While the poor representation of the inshore fleet in fishing intensity data is due to change in 2018 upon the arrival of inshore VMS to UK waters, which will be required on all fishing vessels, there is merit in continuing to collect vessel-based sightings information to support this data. Although vessel speed can be used as a proxy for whether a vessel is fishing or not, sightings information can be used to report and confirm whether a vessel is actively fishing and what methods it is using.

## 2. Methods

The data presented and analysed here is sightings of fishing vessels that have been recorded by Eastern IFCA officers onboard *RV Three Counties* in 2017. Data recorded by Eastern IFCA includes date, time, own vessel position, fishing vessel position, whether the vessel is fishing and what method of fishing they are using if so.

### 2.1. Vessel-based sightings data

When *RV Three Counties* was at sea in 2017 and the crew were in a position to do so, the positions of sighted fishing vessels were recorded using an on-board radar linked to a GPS. These have been plotted here using the open-source software QGIS.

#### 2.1.1. Calculating relative fishing effort using sightings-per-unit-effort

A method developed by Cefas originally for use by the Sea Fisheries Committees was used to describe the distribution and intensity of fishing activity in The Wash (a similar published method is described by Breen et al., 2015). Using the GIS software MapInfo Professional 8.5, a surveillance effort grid and a number of sightings grids were plotted and overlaid. Sightings per unit effort (SPUE) was then calculated (Eq. 1) to plot fishing effort maps for hand gathering and beam trawling.

$$\text{Sightings per unit effort (SPUE)} = \frac{\text{Number of sightings}}{\text{Surveillance effort}} \quad (\text{Eq. 1})$$

### 2.2. Caveats associated with vessel-based sightings information

There are significant caveats associated with the use of vessel-based sightings data to look at fishing intensity and methods in The Wash. These are as follows:

#### 2.2.1. Spatial variation

The Wash has a significantly higher density of sightings data than other parts of Eastern IFCA's district, with no sightings data available for elsewhere in the district in 2017. This is because survey effort is higher, with Eastern IFCA's research vessel based in Sutton Bridge and the majority of Eastern IFCA's vessel-based research work being undertaken in The Wash. This is the reason that The Wash is the focus of this report. Furthermore, there is bias within The Wash caused by the nature of patrol and survey effort (often concentrated over specific sand banks). There has been no effort to normalise the data regarding bias introduced from patrol or survey location or effort.

In the shallow waters of The Wash, a great deal of fisheries patrol and survey effort is undertaken through "drying out" (i.e. remaining on the crest of an intertidal mud/sandflat over the length of a tidal cycle) to regulate the intertidal shellfish fisheries regulated by The Wash Fishery Order 1992. Furthermore, patrols are generally targeted at specific fisheries, generally focussed on specific cockle and mussel beds. This means that in The Wash patrol/survey vessels may remain in a single area for most of a day rather than covering a broader area of The Wash, thus introducing further bias into the collection of sightings information.

### **2.2.2. Temporal variation**

The frequency and location of patrols and surveys are not uniform throughout the year, so the data will not show temporal trends. Timing of high-intensity annual surveys (e.g. annual cockle and mussel surveys that occur in spring and autumn, respectively) may increase the number of sightings recorded, while vessel refit – which usually occurs throughout the month of February – will result in a very low number of sightings being recorded from other vessels, if any are recorded at all.

There is, therefore, risk associated with producing fishing intensity charts utilising this vessel-based sightings data, as whole areas may have received very low or no survey coverage at certain times of the year.

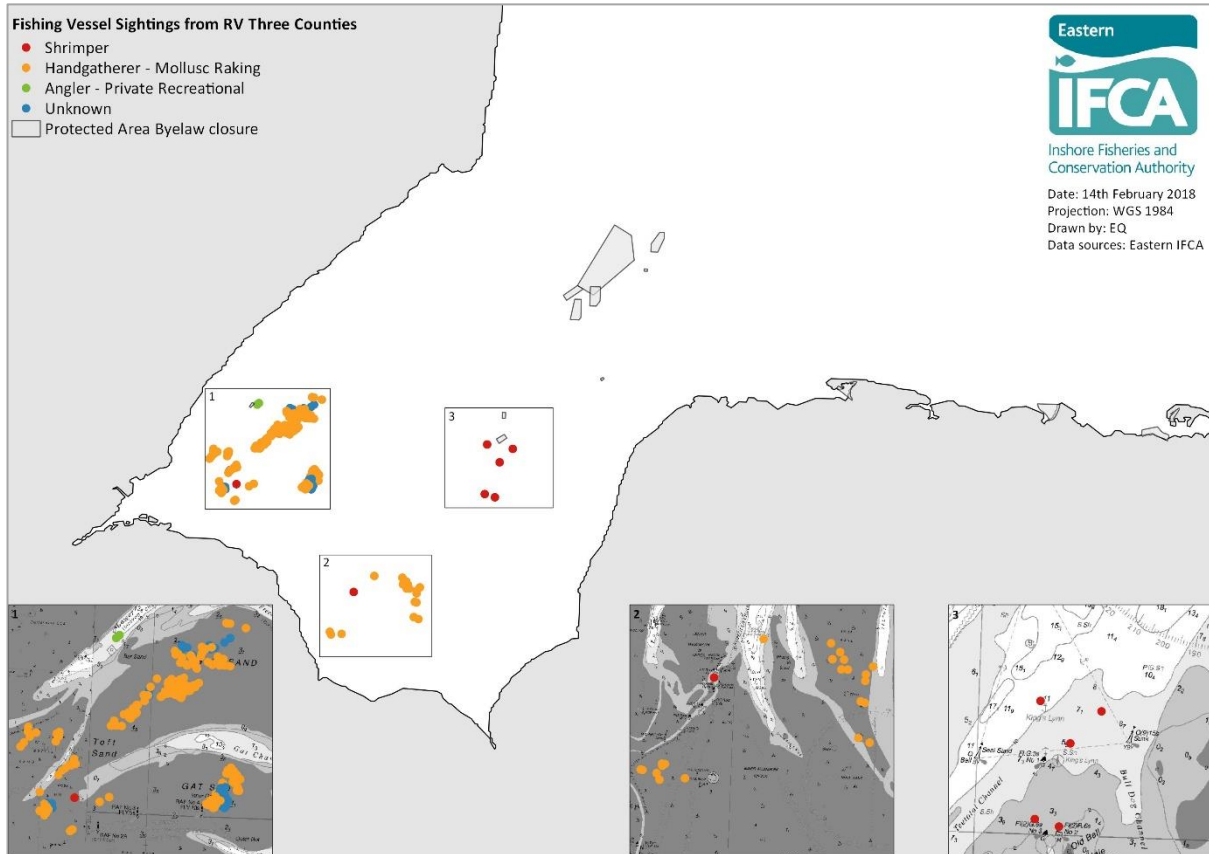
### **2.2.3. Variation in data collection/quality**

Throughout the course of 2017, several different officers were responsible for collecting and recording sightings information. Although there have been efforts to use a standard protocol there may be a certain amount of bias induced by the different officers collecting sightings data. Human error may affect the dataset. Furthermore, while officers aim to record data at every opportunity, depending on the priority workload when a vessel is seen, it is not always possible to record all the required data.

### 3. Results

#### 3.1. Vessel sightings

In 2017, fishing vessels were generally recorded in three distinct areas of The Wash, these have been labelled and reported on as boxes 1 – 3 (Figure 2).

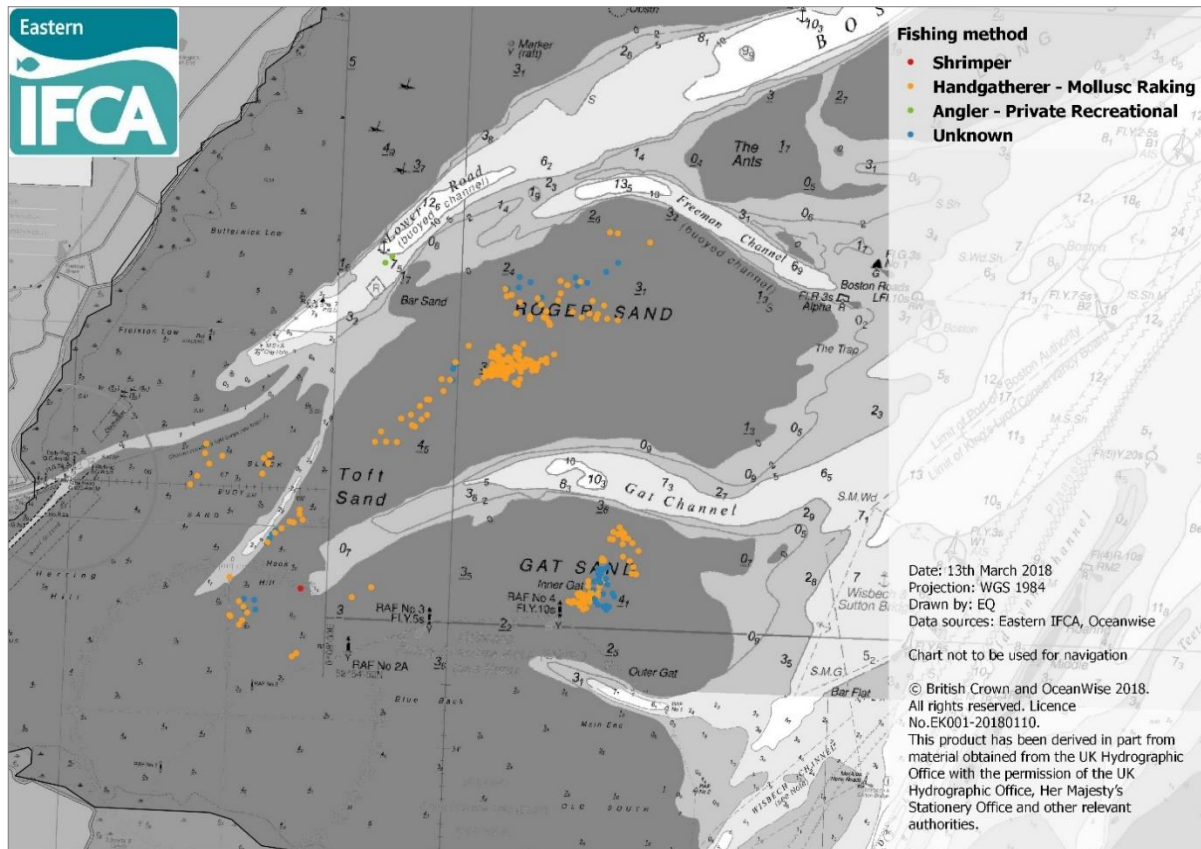


**Figure 2.** All fishing vessel sightings recorded in 2017 in The Wash.

Box 1 incorporates the Roger Sand, Lower Road Channel, the Toft Sand and the Gat Sand, the Gat channel. In 2017, the area was dominated by hand gatherers raking for molluscs. There were two sightings recorded of recreational private anglers in the Lower Road buoyed channel between the Roger-Tofts and Butterwick Low.

There were just seven sightings of vessels beam trawling for shrimp in 2017, with five of these in the north east of The Wash in Teetotal channel, to the north of King's Lynn (Box 3).

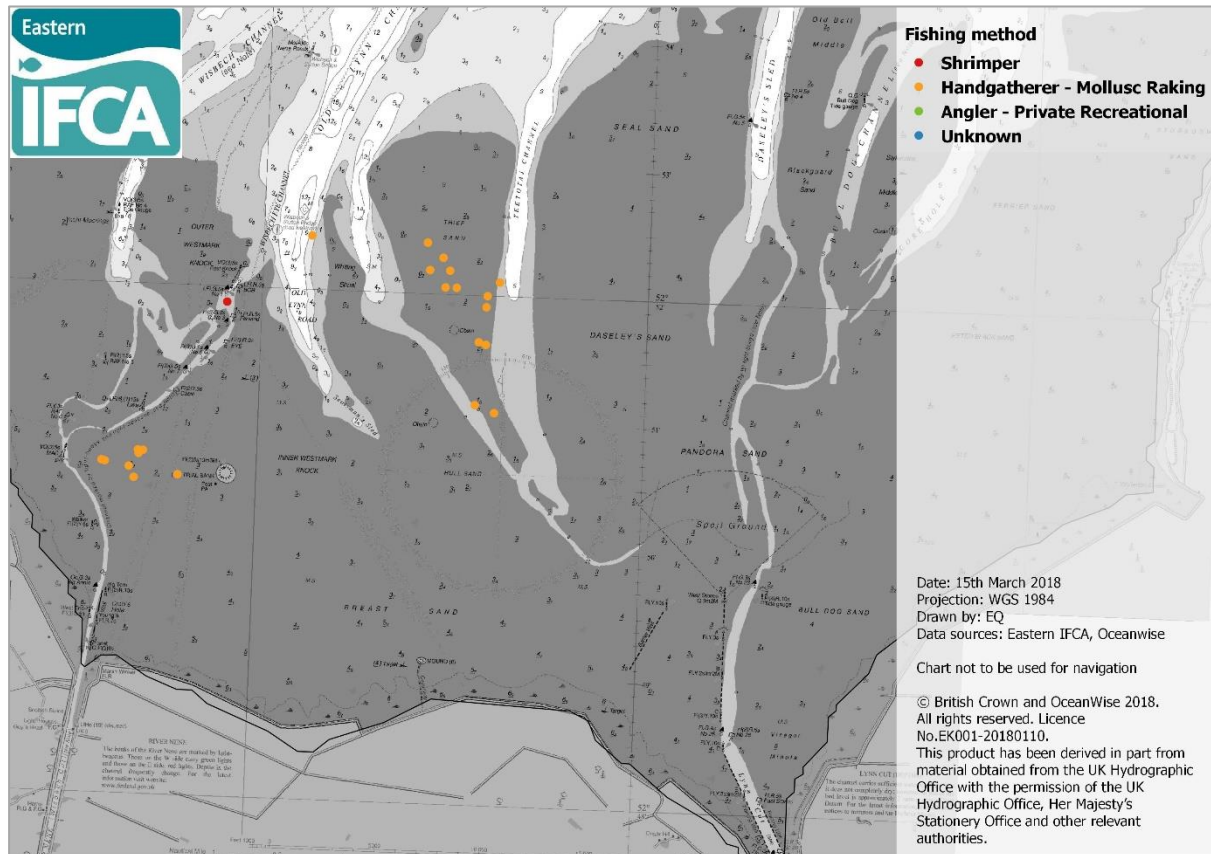
Box 1, located to the west of The Wash, supported a range of fishing activity in 2017 (Figure 3). Fishing in the area was dominated by hand gathering for cockles around Black Buoy, on the Roger and Toft Sand and on The Gat Sand. A single vessel was sighted beam-trawling for shrimp at the western end of The Gat Channel. There were two sightings of recreational angling vessels in the Lower Road channel in July, although these were not fishing at the times the vessels were recorded.



**Figure 3.** Fishing vessels sighted on the western side of The Wash (Box 1) in 2017.

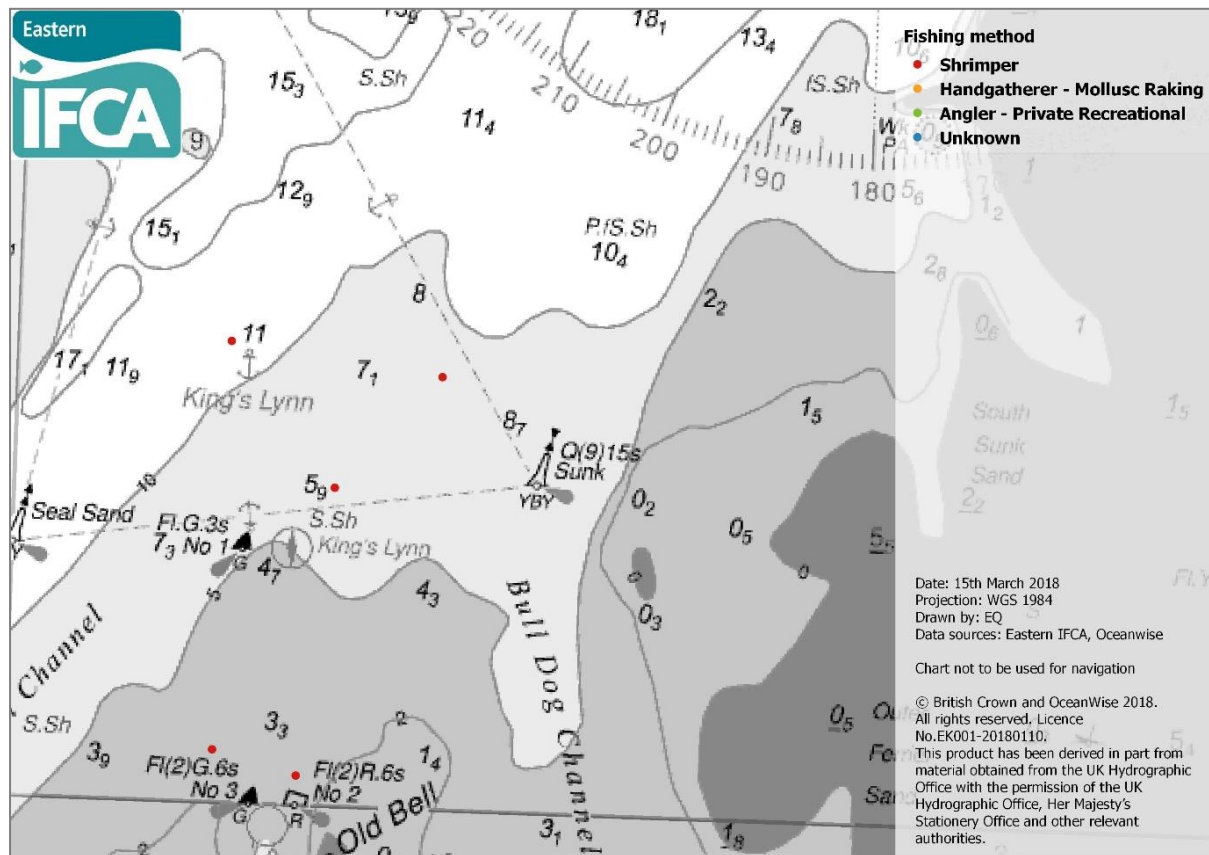


Box 2 (Figure 4), located in the area between the Great Ouse and Nene river channels in the southern-central Wash was also dominated by hand gatherers fishing for molluscs, although the total number of sightings in the area was much lower with 17 sightings of hand gathering vessels recorded in 2017, as well as a single vessel beam trawling for shrimp in the south of the Wisbech Eye Channel.



**Figure 4.** Fishing vessel sightings recorded in the southern-central Wash (Box 2) in 2017.

Within Box 3 (Figure 5), to the north-east of The Wash, five vessels were recorded beam trawling for shrimp in 2017. This area incorporates two areas restricted to bottom-towed gear under the Marine Protected Areas Byelaw 2016 (Figure 2)<sup>1</sup>. There were no records of non-compliance with these restrictions, with no vessels sighted within these restricted areas.



**Figure 5.** Fishing vessel sightings recorded to the north east of The Wash (Box 3) in 2017.

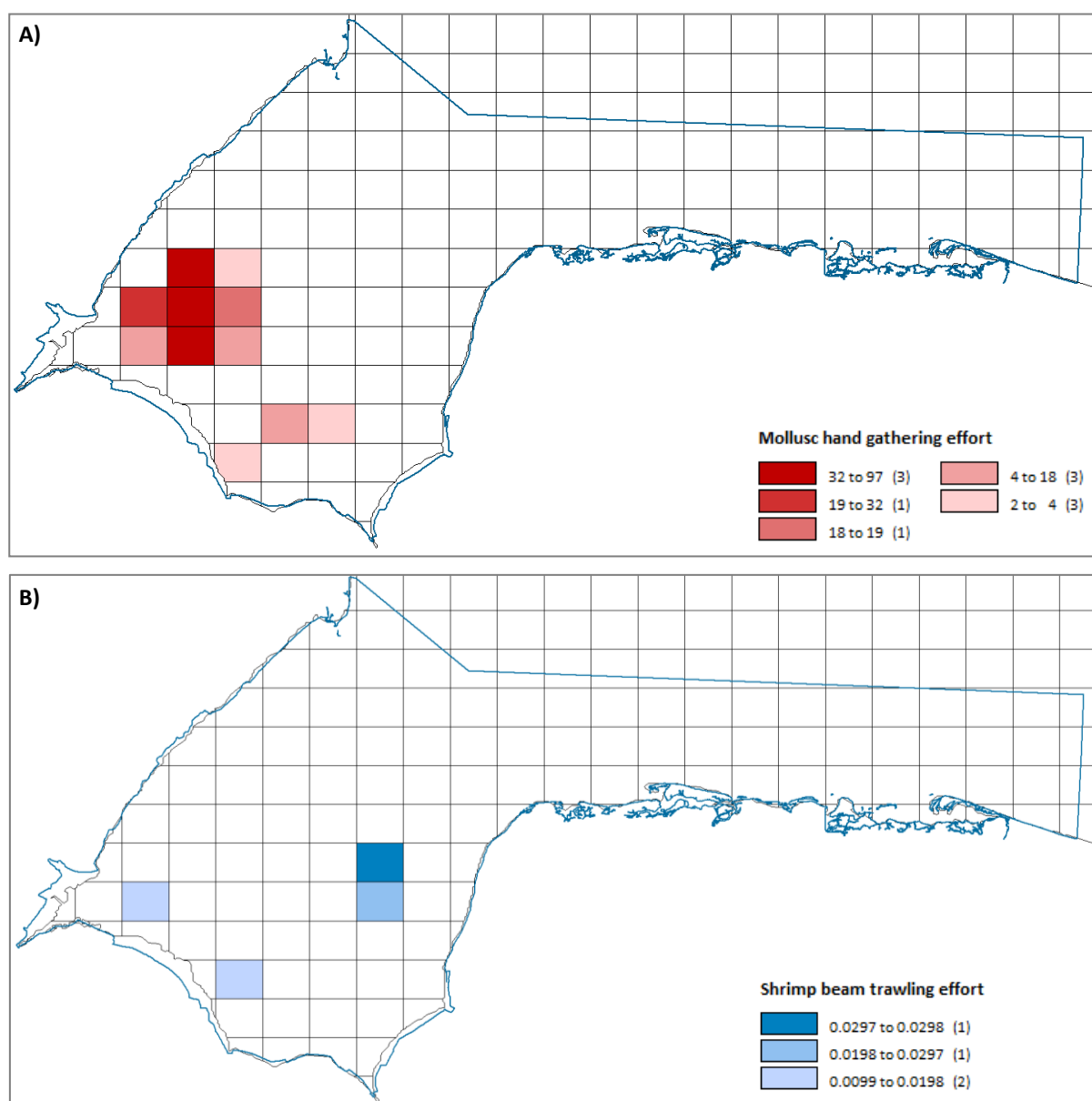
<sup>1</sup>Restrictions originally introduced under the Protected Areas Byelaw



### 3.2. Sightings per unit effort

Handgathering and beam trawling effort in The Wash was calculated and plotted for 2017 using MapInfo Professional 8.5 (Figure 6). Effort was calculated using a SPUE buffer approach, which investigated the number of fishing vessels in a location compared to the number of times Eastern IFCA's research vessel was in the area.

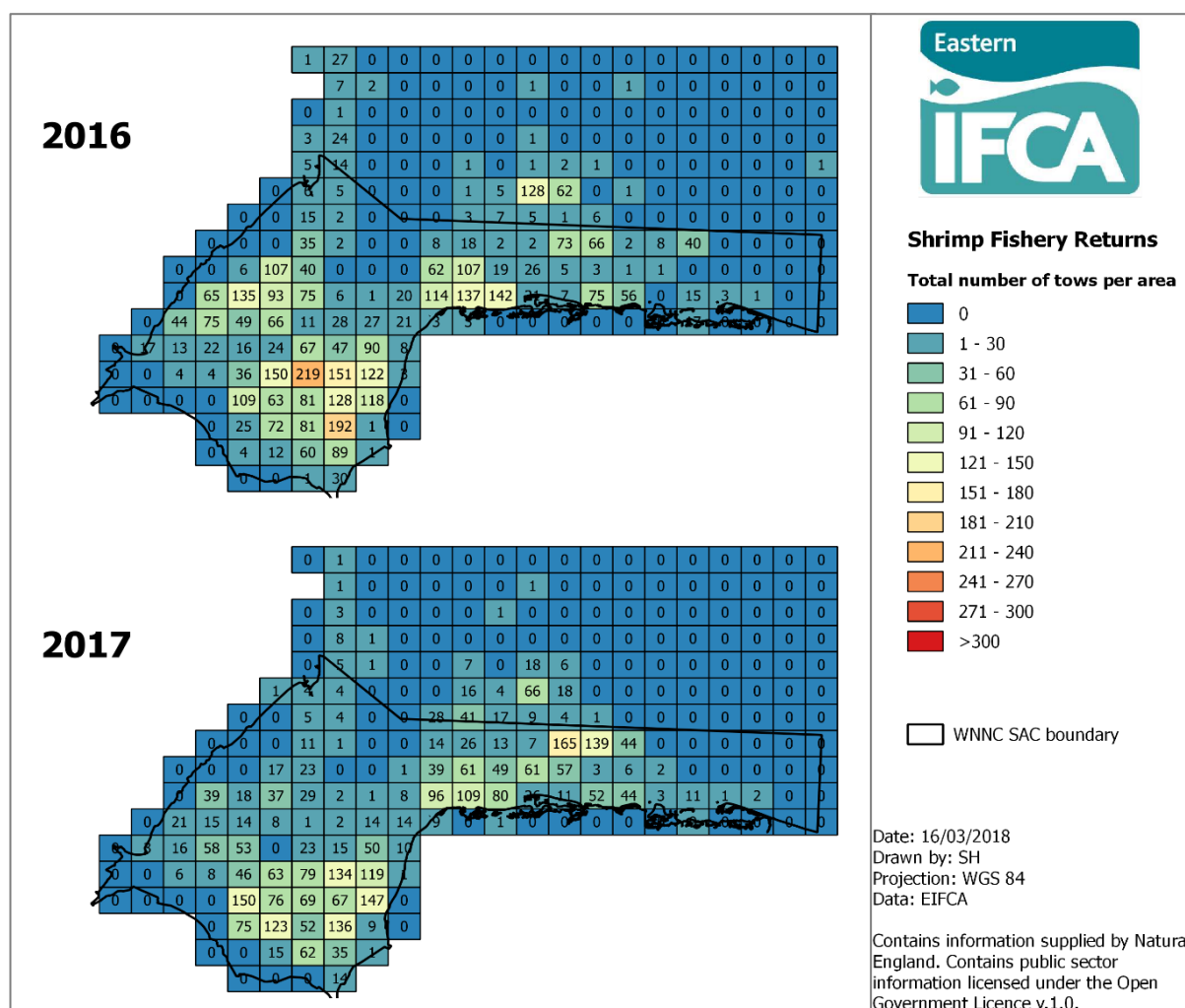
The inshore fleets handgathering effort was greatest to the west of The Wash, around Black Buoy, on the Roger and Toft sands and on the Gat sand. Aside from this area, very low effort or no effort was reported throughout the rest of The Wash, aside from low intensity effort to the north and north east of the River Nene (Figure 6A). Shrimp beam trawling effort showed very different spatial patterns to hand gathering effort, with intensity at its highest towards the north east of The Wash (Figure 6B).



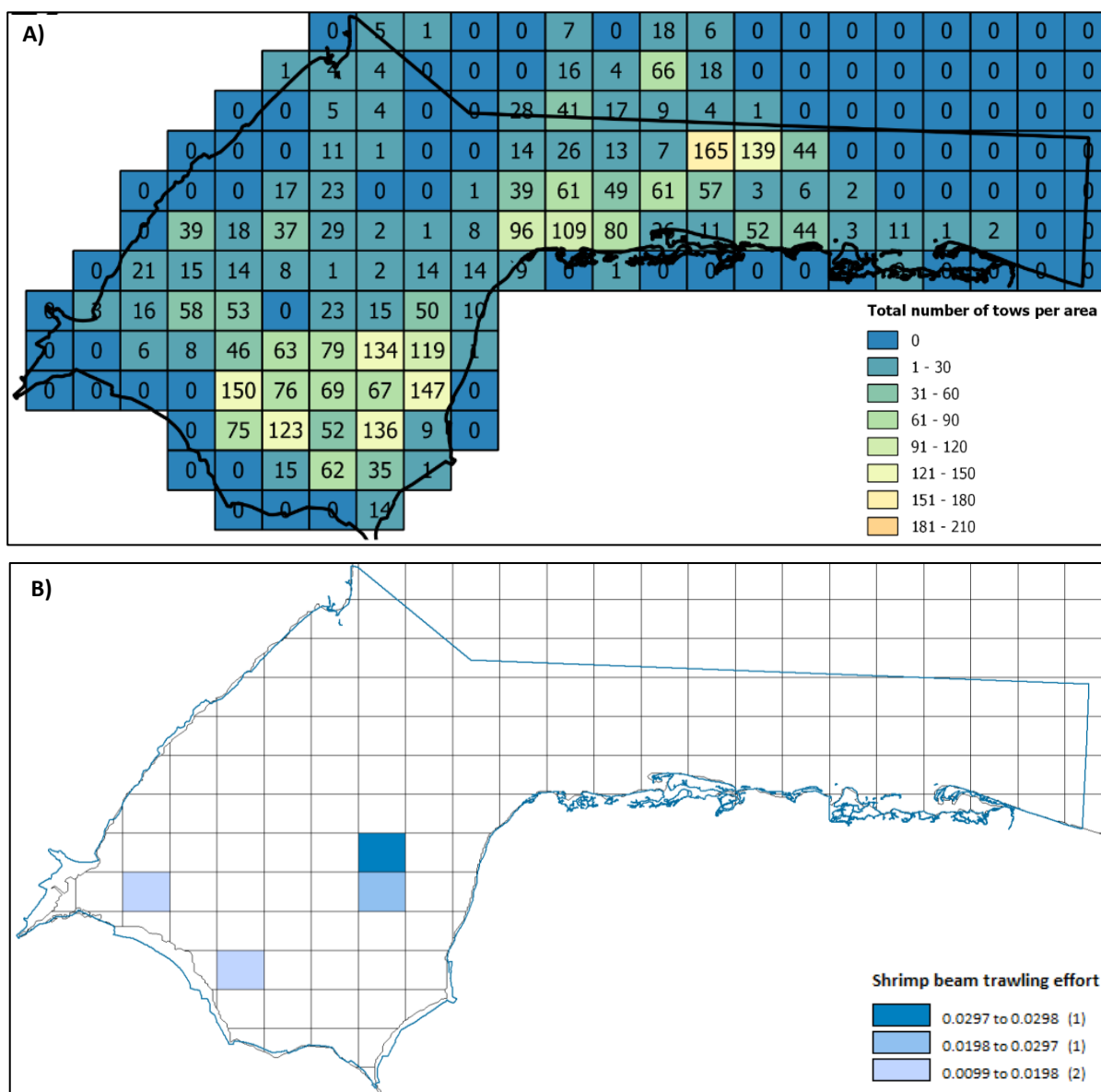
**Figure 6.** Mollusc hand gathering (A) and shrimp beam trawling (B) effort in The Wash and North Norfolk Coast SAC (blue outline), as calculated using sightings per unit effort (SPUE) from Eastern IFCA's research vessel Three Counties.

### 3.2.1. Comparison of shrimp beam trawling sightings and returns data

Since late 2015, fishers participating in the shrimp beam trawl fishery have been required to report their shrimp fishing activity to Eastern IFCA on a weekly basis. The required information includes the location of trawling activity within a rectangular grid (each grid rectangle measuring 3.34 km x 2.78 km). This is required of all shrimp fishing vessels in the district and provides a mechanism to monitor intensity of trawling effort over any part of The Wash and North Norfolk Coast SAC (Figure 7).



**Figure 7.** Total number of tows per area of the shrimp beam-trawl fishery, as per returns data supplied to Eastern IFCA by fishers in 2016 and 2017.



**Figure 8.** (A) Shrimp returns data on total number of tows per area provided by fishers to Eastern IFCA in 2017 and (B) sightings-per-unit-effort (SPUE) data in The Wash and North Norfolk Coast SAC in 2017.

Despite evident gaps in the sightings data recorded by Eastern IFCA officers for large areas of The Wash and North Norfolk Coast SAC (Figure 6; Figure 8), the limited data available from the SPUE chart (Figure 8B) show similar spatial patterns to the 2017 shrimp returns data provided by fishers (Figure 8A). According to both data sources, shrimp beam trawling effort was highest towards the north east of The Wash, with lower levels north of Sutton Bridge and in the Gat and Herring Hill area. These similar trends provide a limited level of validation to both datasets.

#### **4. Conclusions**

Knowledge of human activities in Marine Protected Areas is key to good management of these sites. Quantitative information on fishing activity in The Wash remains patchy, although the vessel-based sightings information provides useful data that can be used to support information from other sources (e.g. returns data and inshore VMS upon its introduction onto smaller vessels). By placing a greater emphasis on the importance of accurately recording sightings whenever time and circumstances permit in 2018, Eastern IFCA could increase the availability of spatial data on The Wash fisheries for use alongside other data sources. This would help to develop a better understanding of fishing effort, intensity and methods used in the area. It should be noted however that regardless of any increased efforts to record sightings, there will remain large areas where information from vessel-based sightings will be unavailable as Eastern IFCA's research vessel, on which most of the sightings are recorded, only visits certain areas as required for other research work.

## 5. References

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