

Hydro acoustic fish population survey

The Relief Channel

27th-28th July 2022

This report provides a summary of results from our recent fish population survey of the Relief Channel between Denver and Saddlebow. The survey was carried out to assess the health of the river and enable successful management of our principal fisheries.



Image 1: The acoustic survey boat Kingfisher moored at Denver - July 2022.

Summary

- The Relief Channel was surveyed in late July 2022 using hydro acoustic sampling methodology.
- The survey was conducted a month later than initially planned due to a member of the acoustic team testing positive for covid. The survey was rescheduled to coincide with the next available new-moon period and take advantage of the additional darkness during these conditions.
- The river was sampled over two concurrent nights:
 - Night 1:** Stow Bridge to Saddlebow and back - 27th July
 - Night 2:** Denver to Stow Bridge and back - 28th July
- When the results of this sampling were collated the average fish density estimates from the upstream and downstream passes were closely comparable and equated to 19 and 21 Ind./1000m³ respectively with an overall population estimate of 20 Ind./1000m³.
- The 2022 density estimate is >50% higher than observed during the preceding survey conducted in 2021.

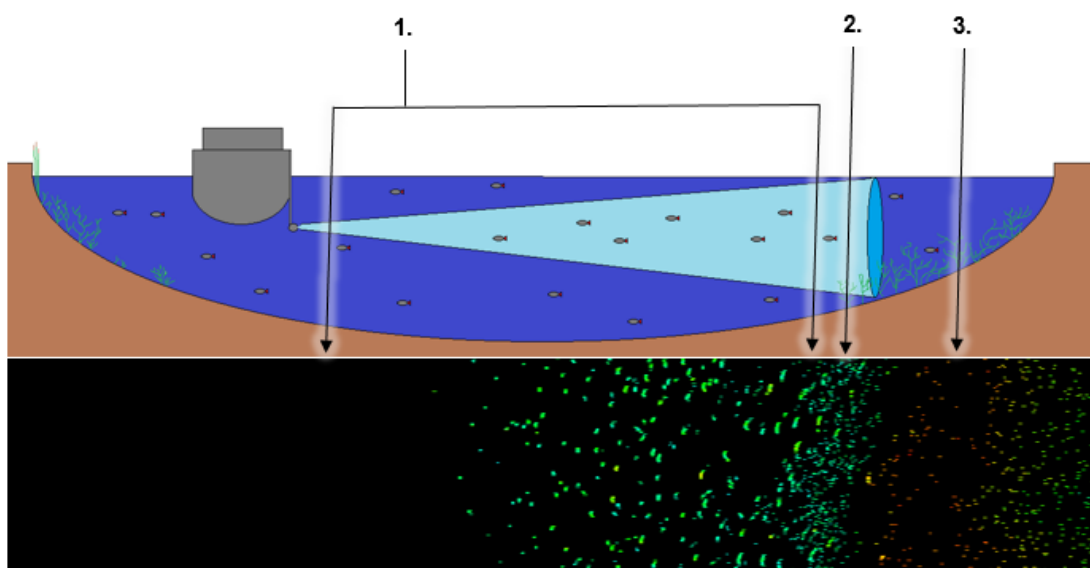
Survey technique:

Previous surveys had identified considerable disparity between stock density on opposing sides of the channel. To assess whether localised and rapid changes in stock distribution (i.e., fish moving from bank to bank between passes) had influenced our results it was decided that this survey would trial sampling the channel in two reaches allowing the upstream and downstream pass through each to be completed on the same night. This would reduce the opportunity for movement of stock between passes.

- Hydro acoustic surveys utilise sound waves (pings) which are fired across the river channel and are reflected off objects within the water column. Depending on the strength of the returning echo the nature of the reflective object can be determined. Solid items such as the far bank, bridge supports and riverbed give extremely strong returns; echoes from fish, or more accurately from their swim bladders, give a moderate return while surface scatter gives much weaker echoes.
- Pre-survey tests showed that the sounder was well calibrated, producing an average return of -40.3dB from a calibration sphere with a known target strength (TS) of -39.5dB. The average return from the calibration sphere must fall within 3dB of the known TS value.
- The pulses of sound are transmitted at 10 pings per second to produce an elliptical sonar beam across the channel width. The transducer is bow-mounted, well forward on the craft, to prevent any background electronic 'noise' from interfering with the acoustic signal. The survey vessel is piloted at approximately 6km/h, working the marginal shelf and any reflected echoes are recorded and analysed by an on-board computer.
- Surveys are conducted at night, since fish are more evenly distributed throughout the water column during hours of darkness, which allows them to be easily distinguished from the substrate, macrophyte growth and bank-side clutter. It is important to avoid periods of boat traffic as the propeller wash can greatly reduce the range of the survey apparatus by filling the water column with air bubbles, which reflect echoes and obscure the images received.
- The resultant data is subsequently post-processed and interpreted later. Output is primarily in the form of fish density given as fish per 1000 meters cubed (Ind./1000m³) and as density groupings in map format.

Image 2: Simplified image of the hydro acoustic survey technique.

1. Open water and clearly visible fish echoes.
2. Limit of the 'usable' data surface scatter (light blue) and echoes from rooted plants (light green).
3. Heavy (red and brown) echoes from marginal slope and riverbank.



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Results:

Results from the 2022 survey are provided as **Table 1**. Long-term density values are given as **Figure 1**.

Year	Average fish density from upstream pass	Average fish density from downstream pass	Overall average fish density
2022	19	21	20

The Relief Channel was surveyed in late July using our routine hydro acoustic sampling technique. The survey was conducted during the hours of darkness under a new moon and two complete passes along the channel length were completed. In 2022, the channel was split into two reaches, allowing an upstream and downstream pass of the reach to be completed on the same night.

The 2022 survey found density and stock distribution to be closely comparable between banks/runs, whether this was coincidence, or due to the change in methodology, is currently uncertain however the river will continue to be sampled in this manner in future years and it is hoped that the data will remain as consistent as observed in this recent survey. The average fish density derived from upstream and downstream passes of the two sample reaches equated to 19 and 21 Ind./1000m³ respectively with a combined population estimate of 20 Ind./1000m³, a value over 50% higher than that found during the preceding survey in 2021.

Figure 1: Density estimate 2010 - 2022

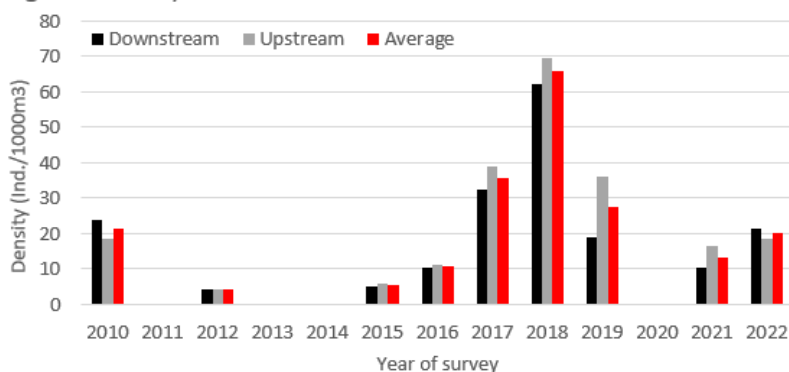
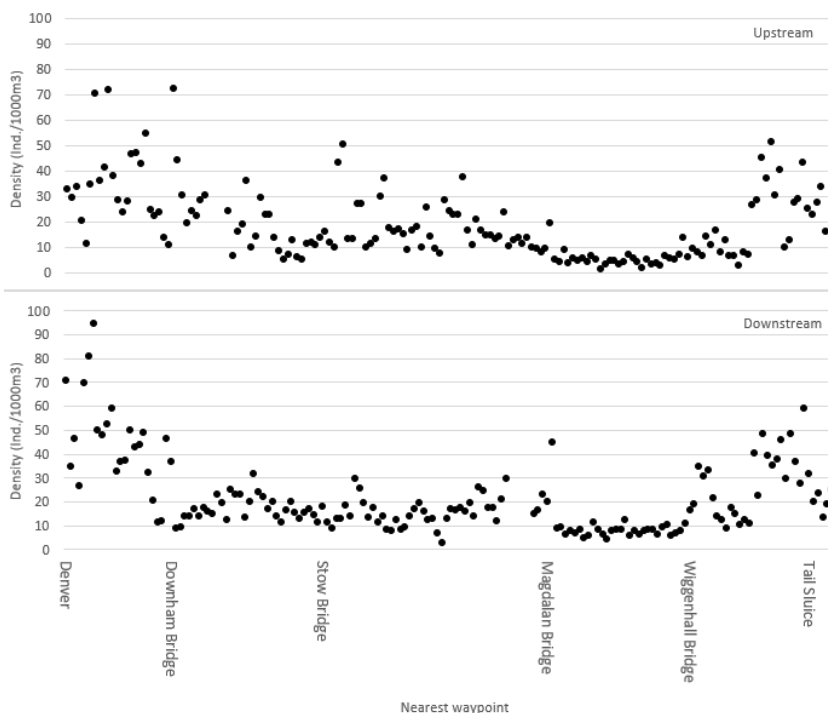


Figure 2 (and **Maps 1** and **2** at the rear of this report) display stock distribution expressed via fish density.

The highest fish densities were found close to Denver Sluice; indeed, whilst preparing the survey boat one member of the team was able to identify eight species in proximity of the mooring pontoon. These included roach, rudd, perch, common bream as well as a shoal of juvenile chub, which was observed within the fast water directly below the fish pass outfall.

Both upstream and downstream survey passes noted a reduction in stock between Denver and Stow Bridge with density then slowly climbing towards a second peak observed upstream of Magdalen Bridge within the perennially consistent fish holding area known as the 'Golden Mile'.

Figure 2: Fish density recorded on upstream and downstream survey passes



A reduced density was apparent on both runs downstream of Magdalen Bridge and fish stocks remained consistently low until Wigenhall Bridge where density increased once more and continued to build to create a third population peak near to Saddlebow.

The Relief Channel contains a well-known shoal of large bream, that includes fish to double figures, and which was last encountered by the E.A. during the 2017 seine netting survey at Stow Bridge (**Image 3**). These fish were not observed on the side scan unit, but a large group of suspiciously loud echoes were observed approximately 4km upstream of the Tail Sluice, which could well have been part of this illusive shoal?

A side-scan fish finder is run alongside our survey apparatus and its live view is invaluable for interpreting and validating incoming survey data. During 2022, the side scan unit showed large beds of rooted macrophytes were present which appeared more extensive than encountered during previous surveys on this channel. The increased plant cover may have been due to the latter timing of the 2022 survey, or perhaps growth had been invigorated by the recent warm conditions. Whatever the cause, the prevalence of macrophytes growth became problematic within the upper reaches of the channel by reducing survey range and requiring the acoustic beam to be angled slightly upwards to avoid spoiling the acoustic image received. An example of the macrophyte growth is shown below as **Image 4** and an image from the side scan is displayed as **Image 5**.

The survey also suffered from a lack of flow, which can be useful in orientating the fish side-on against the acoustic beam; however, the extremely low level of rainfall meant that there was no flow available to aid the survey process. Despite this drawback, the survey produced some excellent results and it is hoped that the 2023 survey will show continued population growth, which may be bolstered by improved juvenile growth and survival during the warm low-flow conditions experienced during 2022.

The Relief Channel will be sampled again by seine netting and hydro acoustic sampling in 2023

Justin Mould

**Analysis and Reporting
5th August 2022**



Image 3: Part of the common bream shoal located at Stow Bridge 2017

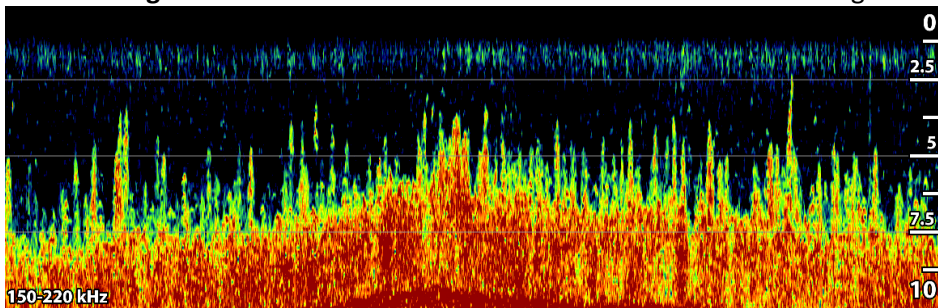


Image 4: Extensive macrophyte growth in the upper channel, note how far this extends up into the water column

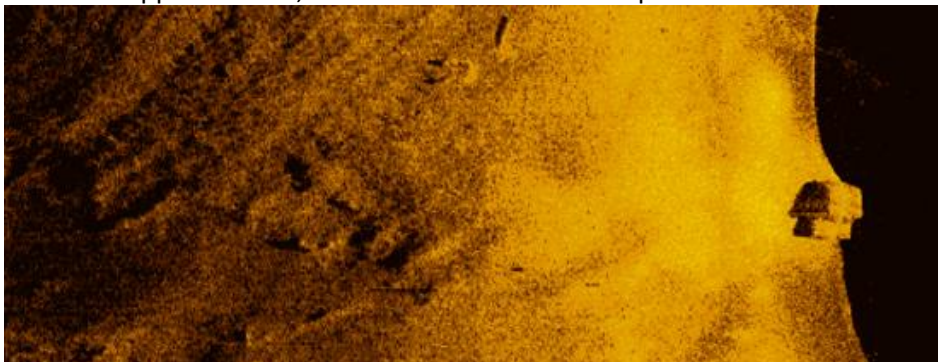
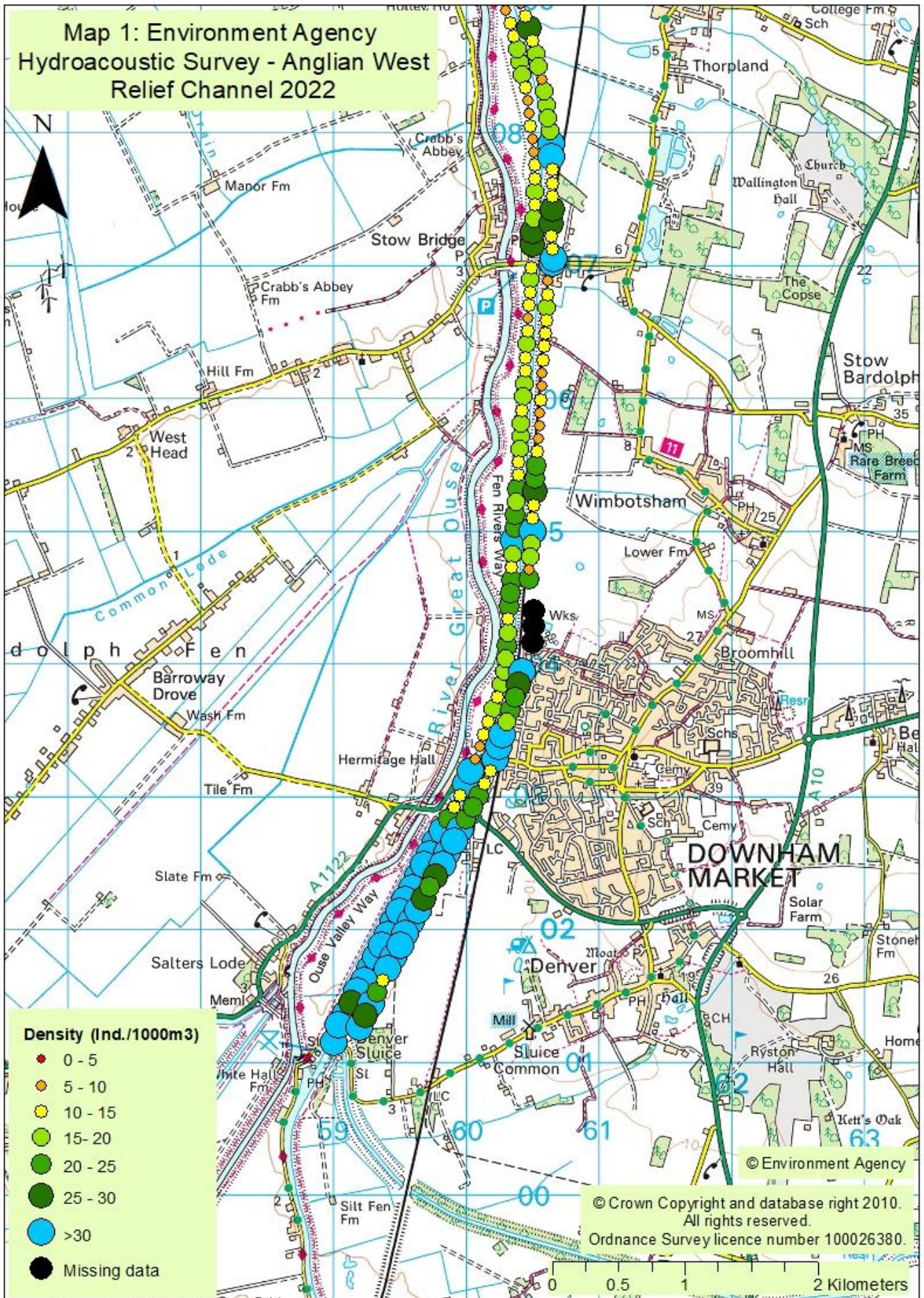


Image 5: Weed-beds and unusual and regular shaped object laying on the bottom of the channel which appears to be a small angular vehicle somewhat akin to a vintage Mini (or Postman Pats van?)

**Map 1: Environment Agency
Hydroacoustic Survey - Anglian West
Relief Channel 2022**

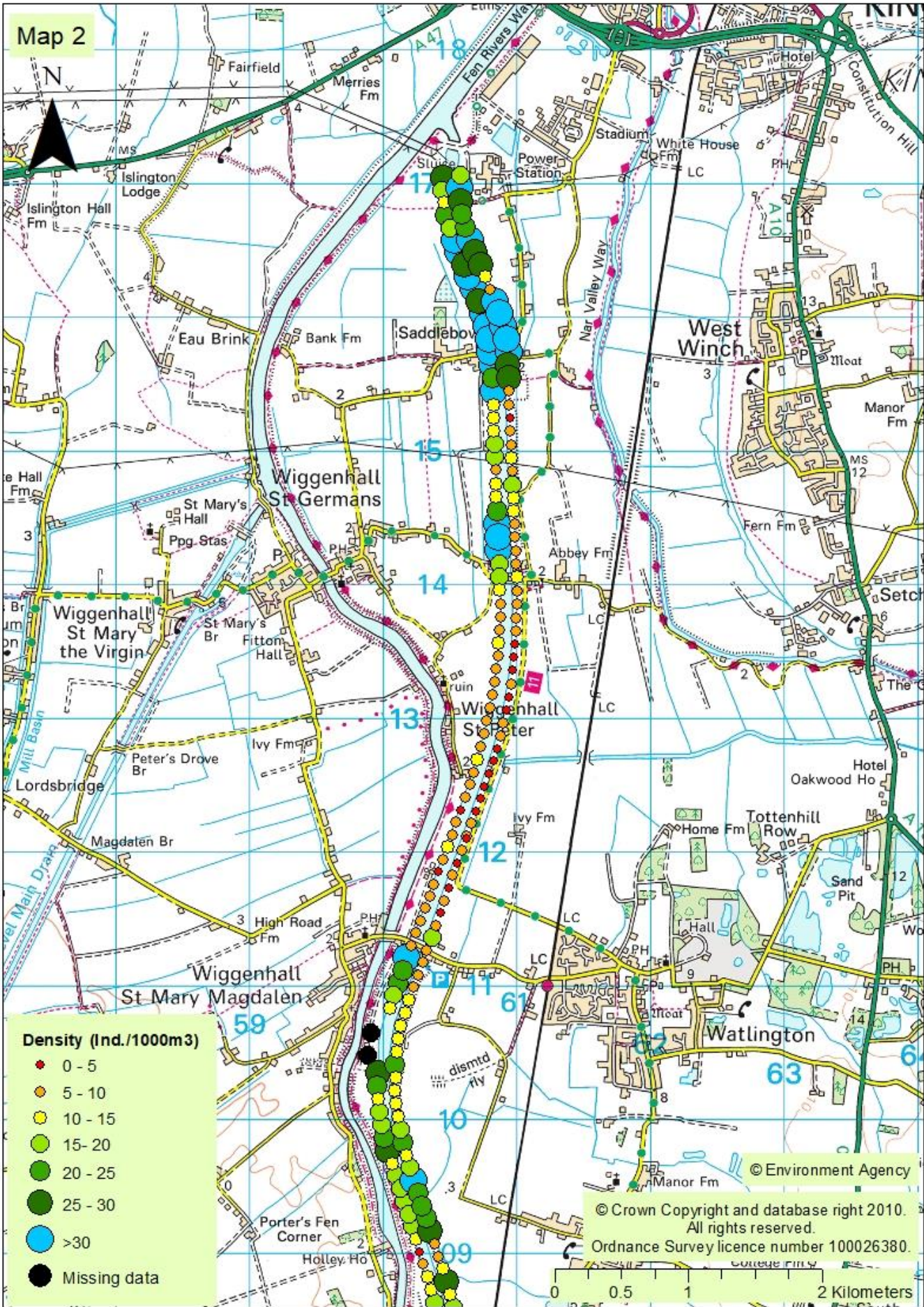


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