# Rivers investigation

## KEY TERMS

| Key term | Definition | Advantages | Disadvantages |
|---|---|---|---|
| Primary data | Data that you collect first hand, by us. | Careful consideration is known to have been given to control a range of variables, and data is known to have been collected in a reliable and trustworthy manner | There are limits to places that are accessible to get the primary data, as well as money, equipment and resources available to get the data. |
| Secondary data | Data that has been collected and published by someone else. | Allows data to be gathered from areas that were inaccessible for us. It allowed a wider range of data to be collected that we didn't have the time or ability to collect. This saved us money and time from having to collect it ourselves. | There is no knowledge of how the data was collected, which means the reliability of the data may be questionable The secondary data will have been collected on a different day, at a different time of the year, affecting the accuracy of the results. |
| Qualitative data | Descriptive data and results collected without numbers, based on people's opinions or ideas e.g. a field sketch | This allows data that is not numerical to be recorded. It allows for subjectivity in the collection and analysis of the results. Opinions can be expressed. | As the data is more descriptive it is difficult to make comparisons between results. It can also be difficult to condense and present the data. |
| Quantitative data | Data and results which contains numbers e.g. measuring velocity. | As the data is numerical it is easy to make comparisons between data sets. The quantitative data is often very objective and accurate, showing clear trends. | It prevents any descriptive or explanatory comments on data. Some topics do not lend themselves to numerical quantities (e.g. opinions). |
| Systematic sampling | when a sample is selected in a regular and consistent manner. E.g. collecting a river sample every 50cm | This reduces bias, as the results are collected at set intervals. | It can lead to a poor representation of the overall sample if large areas/groups are not hit by the structured order. |
| Stratified sampling | when the larger sample size is divided into smaller sub-categories. This helps to ensure that certain groups are included within our sample size | Results are more accurate as you ensure that all subgroups needed in the sample size are included. | The proportions of the sub-sets must be known and accurate if it is to work properly (prior knowledge of the area is required). |
| Random sampling | This is when a sample of a study area/group is selected at complete random, with no prior knowledge of the area needed | This reduces bias, as the results are collected randomly, so everyone/everything has an equal chance of being selected | It can lead to a poor representation of the overall sample if large areas/groups are not hit by the random numbers generated. |

## AREA OF STUDY

We visited the River Clywedog in North Wales. The source is in Snowdonia. It then flows eastwards, south of Wrexham, towards the River Dee, which it enters at the English/Welsh border.

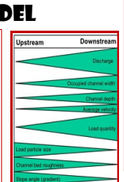
| Why did we choose this site | Risk assessment |
|---|---|
| 1) Close to our school. The river is easily accessible by coach.<br>2) It is a small tributary of the River Dee, meaning that it is not very deep or fast flowing.<br>3) The river is surrounded by forests, which intercepts heavy rainfall, so reducing the chance of flooding. | 1) Drowning — To minimise this risk we used the flood risk map (GIS) to identify areas of low risk and used this to locate areas to complete our fieldwork.<br>2) Getting lost — To minimise this risk we all had access to a map, staying in small groups, and had a contact number of the teacher.<br>3) Slipping/falling — To minimise this risk we ensured that we had the appropriate clothing and footwear with us. |

## ENQUIRY QUESTIONS

| | |
|---|---|
| 1 | How does river discharge change with distance from the source? |
| 2 | How does river width and depth change with distance from the source? |
| 3 | How do river features change with distance from the source? |

## BRADSHAW MODEL

A theory of how a river changes downstream. We will investigate if our conclusions agree with this.




## DATA COLLECTION METHODS

| Measuring changing river landforms along a river course — Fieldsketch | |
|---|---|
| Description | qualitative data. At the six different sites (2 from each river course — stratified sampling) a sketch (drawing) of the area took place. Annotated a diagram fully to show the different features. |
| Benefits | + allows additional information to be annotated around the sketch.<br>+ focusing on the key features. |
| Limitations | - subjective<br>- field sketch is not an accurate representation |

| Measuring velocity of the river | |
|---|---|
| Description | quantitative data. The flow meter was placed into the water, with the propeller facing up river towards the source. The velocity reading was then taken. This was repeated 3x. |
| Benefits | + with an average measurement recorded to help accuracy.<br>+ the same person took the measurement each time. |
| Limitations | - the flow meter was temperamental<br>- a tennis ball method was used to measure the velocity, Human error. |

| Measuring the width of the river | |
|---|---|
| Description | quantitative data. The tape measure placed from bank to bank, ensuring that it was just above the river water. The width of the river was then taken 3 more times. |
| Benefits | + the test was repeated three times, to ensure accuracy.<br>+ the same person took the measurement to ensure consistency, |
| Limitations | - human error—the tape measure not being held tight.<br>- vegetation at river bank made access to certain areas more difficult. |

| Measuring the depth of the river | |
|---|---|
| Description | quantitative data. The tape measure was used and stretched across the top of the river, from bank to bank. At every 50cm across the river the depth was taken using a meter ruler (systematic sampling). |
| Benefits | + the test was repeated three times.<br>+ the same person took the measurement |
| Limitations | - small amounts of splashing meant inaccurate readings.<br>- areas where large rocks were present affected results |

| **Secondary data** for sites 1,2, 5 and 6 (inaccessible for us to complete) | |
|---|---|
| Description | For sites 1 and 2 (near the source of the river), and sites 5 and 6 (near to the mouth of the river), secondary data was used. This was because these locations were not accessible for us on the day This provided us with a range of qualitative and quantitative data in the form of field sketches, velocity, width and depth data. |
| Benefits | + allows data to be gathered from areas that were inaccessible<br>+ collection of data from other sources saved us money and time |
| Limitations | - There is no knowledge of how the data was collected<br>- The secondary data was collected on a different day |

## EVALUATION

| Success | Limitations |
|---|---|
| Data collection methods were repeated 3 times to ensure that accurate results<br>Data collection methods were repeated by the same person each time to ensure the methodology was consistent.<br>A combination of stratified sampling and random sampling was used to determine where on the river the measurements were taken<br>Some of the data was collected by primary data collection methods.<br>Data was collected from 6 separate sites along the river course. | Some of the data had to be collected from secondary data sources.<br>Some of the equipment was faulty and unreliable.<br>The secondary data was collected at a different time of the year and under different weather conditions<br>More than 6 sites for data collection methods would have ensured that the results were more accurate.<br>Some of the measurements may have involved some elements of human error |

## PRESENTATION TECHNIQUES

| Field sketch to show changing river features | |
|---|---|
| Description | An annotated picture of the area showing the main features for each site. |
| Benefits | + allows additional information to be annotated around the fieldsketch.<br>+ allows for unimportant importation to be omitted from the sketch. |
| Limitations | - subjective as students may choose to omit certain features (human error)<br>- difficult to make comparisons with other areas as data is not quantitative. |

| Proportionate arrows to show changing velocity | |
|---|---|
| Description | Arrows of different sizes drawn onto a map of the river. The size (width) of the arrow is proportionate to the speed of the river. The larger the arrow, the faster the river flow. |
| Benefits | + shows multiple data (location of site and speed of river in that location).<br>+ clear to see trends/correlations and anomalies. |
| Limitations | - a large range for the data means that presentation of the arrows may be too large or too small to be presented on the map.<br>- size may obscure location or mean less accurate positioning on maps. |

| Line graph to show changing river mean depth and width | |
|---|---|
| Description | The plots showing mean depth or width are plotted for each site. They are then joined with a straight line to show the changes in mean depth or width between each site. |
| Benefits | + exact figures can be read from the graph, making comparisons easy.<br>+ clear to see trends/correlations and anomalies. |
| Limitations | - needs continuous, quantitative data to be able to produce this.<br>- can only display two forms of data (x axis and y-axis). |

| Scatter graph To show changing river discharge | |
|---|---|
| Description | The plots showing river discharge for each site are plotted onto the graph. A line of best fit is then drawn onto the graph to show a correlation. |
| Benefits | + clear to see trends/correlations and anomalies.<br>+ exact figures can be read from the graph, making comparisons easy. |
| Limitations | - needs continuous data to be able to produce this.<br>- trend difficult to read with small data set. |

## CONCLUSIONS

| Conclusion | Evidence | Explanation |
|---|---|---|
| **The discharge increases with distance from the source**<br><br>Discharge = (width x average depth) x velocity | Velocity at site 1 (source)= 1.40 m/s<br>Velocity at site 6 (near mouth) = 2.87 m/s<br>Discharge at site 1 = 0.02 $m^3/s$<br>Discharge at site 6 = 85.1 $m^3/s$ | The velocity increases as more water is carried in the river. This means that less of the water is in contact with the bed of the river, so there is less energy used to overcome friction.<br>Therefore, **as river discharge is the volume of water flowing through a river channel at one point; the discharge will increase as width, depth and velocity increases.** |
| **The width and depth of the river increases with distance from the source** | Width at site 1 = 0.2 m<br>Width at site 6 = 14 m<br>Depth at site 1 = 0.05 m<br>Depth at site 6 = 2.12 m | The width and depth of the river increases as more water is added to the river (from tributaries), giving the river for power to erode the sides and bed of the river. |
| **The river features seen along the river change with distance from the source** | River features (upper course) = V-shaped valleys, interlocking spurs, waterfalls and gorges<br>River features (lower course) = meanders, ox bow lakes, levees and floodplains | In the upper course features like V-shaped valleys, interlocking spurs, waterfalls and gorges are formed, as this is where vertical (↓) erosion is much greater than lateral erosion (↔). In the lower course features like meanders, ox bow lakes, levees and floodplains are formed due to lateral erosion (↔) being greater than vertical (↓) erosion. The increased lateral erosion will also lead to a loss of land at the sides of the river. |