

EV5006 Material for Assessment

The main assessment for EV5005 is a Report generated from an analysis of a dataset provided. There are two datasets available for the assessment, and you are free to choose whichever you prefer. The document below includes a brief introduction to each of the datasets.

INTRODUCTION TO DATASETS

Harbour Baseline Survey for Environmental Status

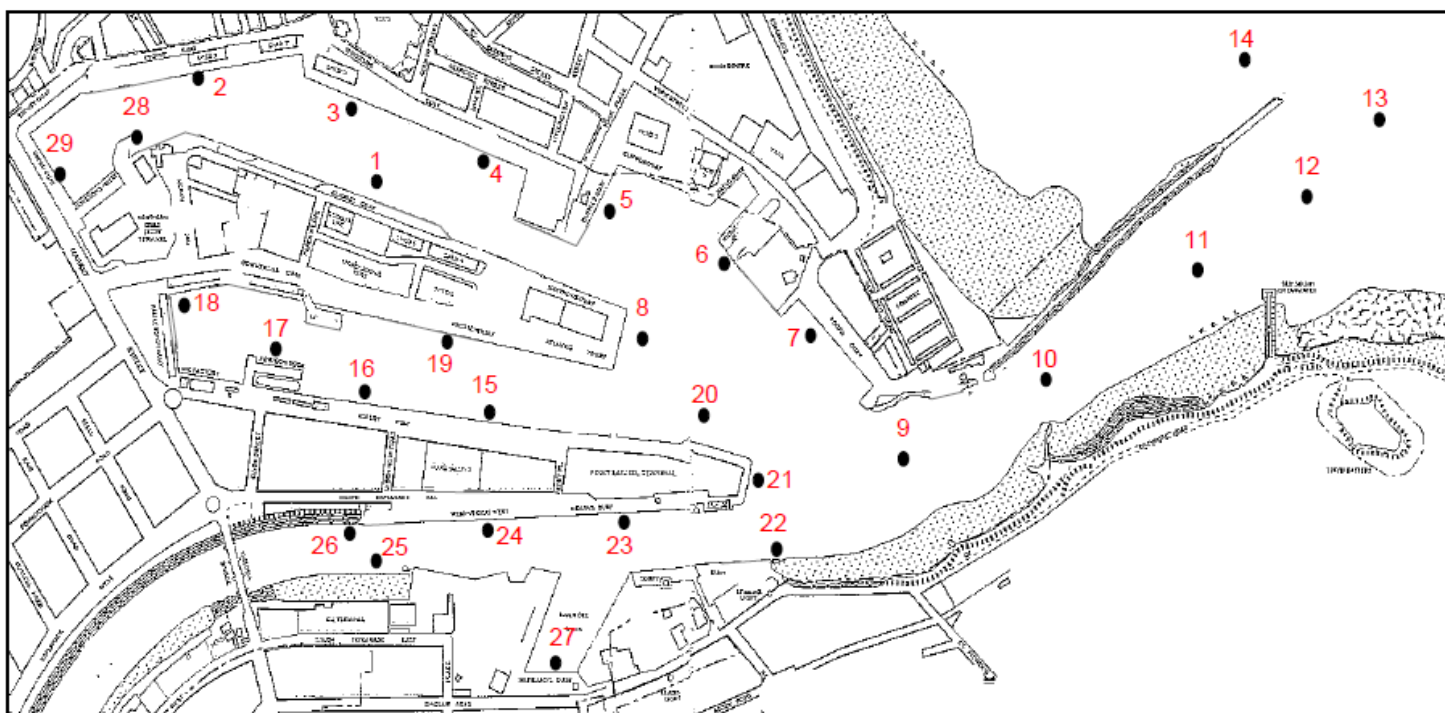
Overview and Justification

Baseline studies are fundamental in evaluating the health of an environment. A healthy environment is one with low pollutant doses present and a successful and actively functioning ecosystem. Although a coastal environment may be actively used for commercial and recreational objectives it is still possible to sustain a healthy system. This baseline study was carried out in July 2009 and the results must be seen in the context of a single temporal interpretation. The sampling design and objectives were discussed with stakeholders and the results have been disseminated through the same route.

Sampling Strategy

Twenty-nine sites were collected along a transect extending from the inner bay towards its mouth, using a Van Veen grab (See Map 1). Three samples were taken at each site. Water samples were also taken to measure a range of parameters relating to the nutrient status of the water and the presence of enteric bacteria.

Map 1-sampling locations



Methods of Analysis

A wide range of chemicals was measured in the sediment. These included the elements arsenic, chromium, cobalt, copper, iron, lead, manganese, nickel and zinc. Oil was also measured by evaluating the concentrations of the petroleum-type fraction and also the weathered “difficult to degrade” fractions.

In the excel spreadsheet you will find the following variables: Site No (an identity code for the sample location), pH (refers to that of the sediment), SS (suspended solids in the water), % organic C (percentage organic carbon), Ps %<63 (particle size below 63), Cd, Cr, Cu, Mn, Ni, Pb, Sn, Zn (elemental analysis carried out with acid digest and analysis by ICP-OES; values as mg/kg dry weight of sample; three independent replicates were taken per site), PAH ng/g (poly nucleated aromatic hydrocarbons as ng/g (ug/kg) by solvent extraction and LC-MS), alkanes (aliphatic fraction of hydrocarbons less than C30 by solvent extraction and GC-FID as ng/g or ug/kg dry weight of sample), TBT ng/g (tributyltin by GC-MS after derivitizations as ng/g or ug/kg), DBT ng/g (dibutyltin by GC-MS after derivitization as ng/g or ug/kg), MBT (monobutyltin by GC-MS after derivitisation as ng/g or ug/kg), fecal coliform (levels measured in samples), total bacterial load.

Soil Analysis Exercise

Craibstone pH plots

The soil in the area is a Dystric Cambisol with a sandy loam texture, from the Countesswells Association, Dess Series (Imperfect drained).

The beds were originally established to demonstrate the influence of soil pH on different agriculturally important crops in Scotland. In 1961, an 8-course rotation was established with the following:

1. Winter wheat
2. Potatoes
3. Barley
4. Swede
5. Oats
6. Hay
7. Pasture
8. Pasture

The native soil pH is approximately 5.0. Therefore, to lower or raise the pH to desired levels, aluminium sulphate or ground limestone was applied, respectively, to achieve seven theoretical pH values of 4.5, 5.0, 5.5, 6.0, 6.5, 7.0 and 7.5. The soil pH is tested once a year, normally in February, and adjusted as described above (although ferrous sulphate has been used instead of aluminium sulphate since 2009).

An example of the contrasting effect of pH on different crops is the following data on crop yields over one eight-year crop rotation (1975-1982).

Intended pH Oats (tonnes/ha) Barley (tonnes/ha) Potatoes (tonnes/ha)

4.5	4.1	Nil	39.6
5.0	4.3	2.3	42.7
5.5	4.2	4.9	43.3
6.0	3.8	4.8	42.3
6.5	2.2	3.5	38.9
7.0	0.7	1.9	31.9
7.5	Nil	1.1	28.8

The Craibstone pH plots are a unique resource in Scotland, and one of only a handful of long-term, controlled soil pH experiments in the world. Generally, total carbon, nitrogen and organic matter do not vary significantly across the gradient. In addition, and perhaps a unique feature of the Craibstone pH plots is the fact that the crop rotation ensures that there is no long-term effect of one individual plant type on the soil, therefore making it an extremely useful for looking at the effect of controlling pH on different aspects of soil.

This study was carried out by an MSc student last academic year (2020-21) as part of their final MSc thesis project. The main objective of this work was to assess whether soil pH management affects soil physical behaviours due to the direct impact of particle bonding and soil organic characteristics, thus, mineral interaction.

Three (3) random replicate core samples and bulk samples were collected from each of the 7 pH sub-plots. This resulted in a total of 21 treatments (7-pH sub-plots X 3 random replicates) to give a grand total of 63 cores and bulk samples. Samples were collected from the topsoil at 2 – 7 cm depth. From the water retention data, macroporosity was measured by subtracting the total porosity from the volumetric water content at -5 kPa.

Soil aggregate stability

The wet sieving method was used in determining aggregate stability of the soil samples, using an Eijkelkamp wet sieving apparatus (250 µm) and the standard procedure for evaluating slaking resistance (rapid wetting). To each sieve cup 4 g of air-dried soils was placed and then immersed into 65 ml deionised water and mechanically lowered and raised for three minutes with oscillation speed of 36 cycles per minute. The water and unstable soil that passed through the sieve was then oven dried at 105 °C. The stable aggregates that remained on top of the sieve were then dispersed using a solution of sodium hexametaphosphate (2 g/ L) to

determine the 'stone' content to be subtracted from the aggregate stability measurements. Solutions were then left in the oven overnight to evaporate the liquids and the water stable aggregates (WSA) of the soil was then expressed as:

$$WSA = \frac{((Initial\ Soil\ Mass - Stone\ Content) - Unstable\ Soil\ Mass)}{Initial\ Soil\ Mass - Stone\ Content}$$

with 0.2 g deducted from the dispersed soil aggregate value to cater for the presence of the dispersing agent.

The assignment

The aim of the main assessment is to demonstrate your ability to manipulate data, apply appropriate statistical analyses, interpret the output from the analyses, produce relevant graphs and tables and to write a report that explains the findings in a way that is appropriate as a scientific report.

Using one of the datasets provided, you can focus your work on addressing research you will develop based on the dataset of your choice. You can ask any question relevant to your dataset. You should aim to address at least two questions in your report. In order to address the questions, you will need to restate them more precisely. There are many ways to approach the questions, you should justify and explain your approach.

Your report should follow the format provided at the end of this guidance sheet, with a title page, a graphical abstract, Short Introduction with research questions and hypotheses, methodology (only on statistics used), findings, brief discussion, literature cited, appendices. The findings should be supported by appropriate figures and tables and the presentation should be of a professional standard throughout. Your report should be approx 2000 words (+/- 15%, excl references, appendix).

Keep in mind the steps that we have been following in class in relation to refining and restating the question into testable hypotheses and exploring the data before attempting any statistical tests.

Title page: Title (with subtitle if needed), Prepared by: _____, Prepared for: _____, Month and year

Abstract + Graphical abstract: less than 350 words, single-spaced. The abstract should address the report purpose, scope, methods, and major findings, including the report results, conclusions, and recommendations. Abstracting services publish abstracts to help readers determine whether a report is targeted to their area of interest; therefore, it should be understandable as a stand-alone document. The abstract should not contain undefined symbols, abbreviations, or acronyms, and should not refer to specific elements of the main report. Furthermore, the graphical abstract should summarize the contents of the article in a concise, pictorial form designed to capture the attention of a wide readership. The graphical abstract should have a clear start and end, preferably "reading" from top to bottom or left to right. Try to reduce distracting and cluttering elements as much as possible. Do not, however, include citations within the abstract.

The Journal: Environmental Pollution (<http://www.sciencedirect.com/science/journal/02697491>) requires authors to submit graphical abstracts, so you can find some great examples there.

Key words: minimum of six, maximum of eight

Introduction & Research question(s): summarizes the purpose of the report and should give relevant background. At the end state research questions and Hypotheses. You should aim to test at least 2 hypotheses. The introduction should be very concise (500-600 words max).

Methodology: a brief description of the site and justification of the methodology in relation to the data analysis only. Support your choice of statistical tests with references.

Findings: presentation of the results of the analyses, supported by appropriate evidence in figures and tables. All figures and tables should have a complete legend and they should be cited in the prose of the findings. Relevant statistical results should be presented but supporting evidence (e.g., detailed output from SPSS) if important to the report, should be organized into an appendix.

Discussion: this should be an explanation of the implications of the findings for a scientific report. It should also include a critical reflection of strengths and weaknesses in the methodology and findings.

References: Separate reference section at the end. Follow any format you prefer, but be consistent within the report. Avoid referencing formats (such as the one used by "Nature") which use a numbering system for in-text references.

Appendix: Show all analysis workings in the appendix (not to be included included in the word count).