

The Value of a Longer-Term View

Using Variations over Time to Understand Catchments

Headlines

Why this Might be Important for You

Examining changes over time in catchments has multiple benefits:

- It connects with stakeholders who have known the catchment over many years;
- It can show how things once were, how bad they became, how things have improved and what there is left to do;
- It gives us context for year to year variability;
- We can use it to provide evidence that an activity caused problems from the time of its introduction or see how measures have improved things.

Types of Long-Term Datasets

Information held by the Environment Agency:

- Fisheries records back to the early 20th century and digital fish survey data back to the 1970s.
- Digital water quality data back to the 1970s and digital invertebrate data to the late 1980s.
- Discharge consents records back to the 1950s.
- There is a 1990s pollution incidents database which NIRS¹ superseded in 2001.

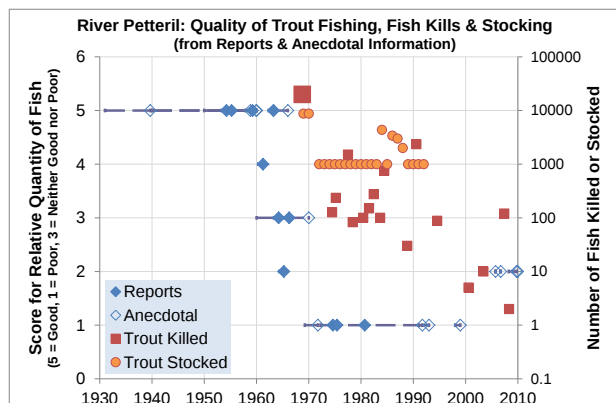
There is also a wealth of information in archives (see Ref 1), on historical maps, on land use and in old reports held by your stakeholders or on the web.

Examples

Fisheries Records, Fish Kills & Stocking

This example from our River Petteril work (Ref 1) shows the trout fishery deteriorating in the 1960s.

The Decline of a Trout Fishery

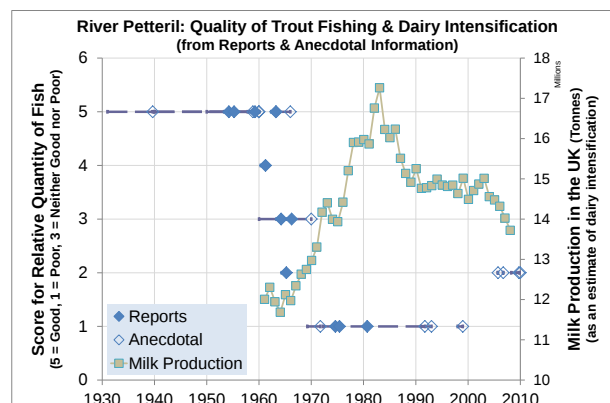


Note: Blue points show trout numbers (reported & anecdotal) declining sharply in the 1960s. In 1969 a phenol tanker spill killed most of the trout. Thereafter, despite trout stocking, there were repeated fish kills (related mainly to farm effluents – see p2). In 2009 the river was still at Poor or Moderate WFD status.

Land Use Change

See Ref 2 for information on land use change (June agri-census) data from the **EDINA dataset**. We have also used **FAOSTAT data** for e.g. milk production to understand when dairy intensification occurred (shown here with the decline of trout on the Petteril).

The Decline of a Trout Fishery and Intensification of Milk Production (Evidence for Possible Cause?)



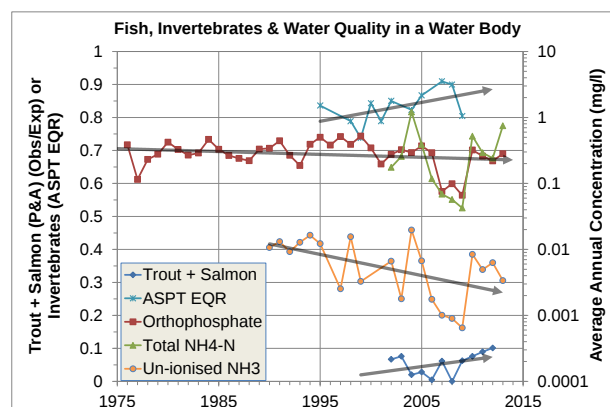
Note: See notes on previous chart. UK milk production data from FAOSTAT website – a Petteril dairy farming surrogate.

DEFRA (2008) Report FD2120 Appendix 1 has some really useful background information on changes to land management in rural catchments.

Water Quality, Fish & Invertebrates Data

The next chart shows how average annual water quality, fish and invertebrates have changed in one of the water bodies in the Petteril catchment.

Recent Improvements: Petteril downstream of the M6

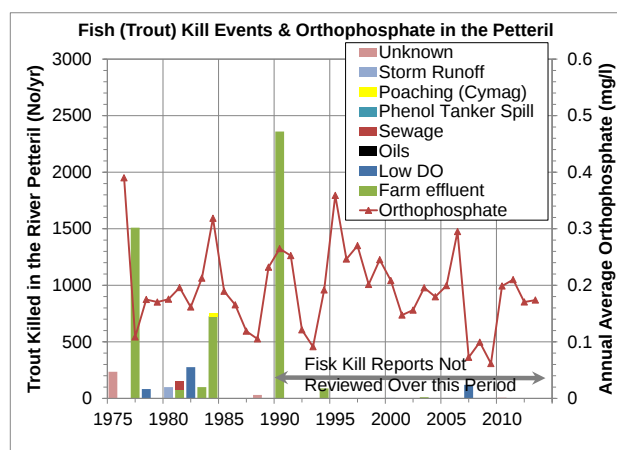


Note: All data are annual averages for any site sampled in that water body. Trout and salmon numbers (parr & adult), shown as observed divided by expected (dark blue points), have improved, but are still very poor. Invertebrates (ASPT EQR, cyan) have also improved. Unionised ammonia (orange) is above likely chronic levels, but overall has reduced and phosphate (dark red) has been at poor WFD status for ~40 years.

Water Quality and NIRS Data

It's also worth comparing water quality with pollution (e.g. NIRS) events as part of evidence gathering for the cause(s) of poor water quality. This first example uses fish kill data from old reports 1970-1990.

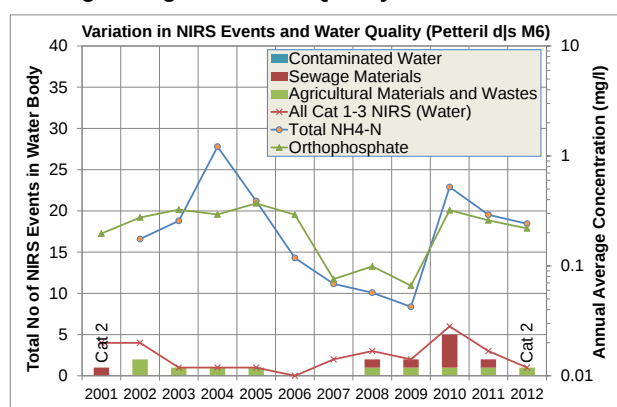
Linking Fish Kill Sources to Changes in Water Quality



Note: The fish kill data (columns) are from fisheries reports up to 1990, held by the EA, and from newspaper articles. The orthophosphate is the average of all sampling points in the Petteril catchment per year. Two big fish kills are related to farm effluents and associated with high orthophosphates, which in turn was probably accompanied by high unionised ammonia concentrations (toxic-to-fish).

Example 2 uses NIRS pollution data for 2001-2012.

Linking Changes in Water Quality to Pollution Events

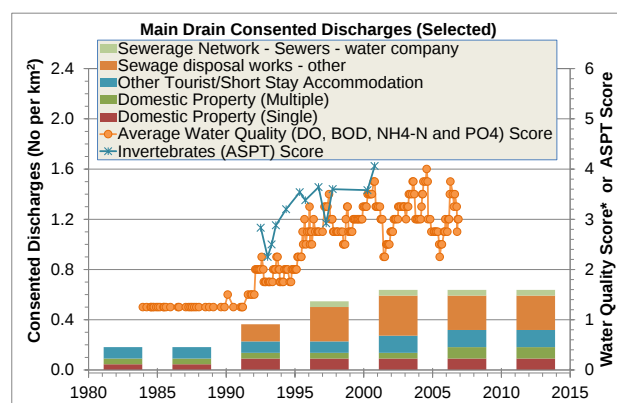


Note: The columns and the red line show category 1 to 3 (water) pollution events (NIRS) per year in the Petteril downstream of the M6 water body. There may be a link between poor water quality (green and blue lines) and sewage events in 2010, but poor water quality in 2001-6 does not have an obvious point source.

Water Quality and Consents Data

Understanding how discharges have changed over time can also give you a feel for how important a discharge may be on water quality and aquatic life:

Linking Changes in Water Quality to Consents



Note: *WFD status (right hand axis): High=5, Good=4, Mod=3, Poor=2, Bad=1. This chart shows that as controls on discharges tightened in the 1990s, particularly on non-water company sewage disposal and water company sewer storm overflow discharges (green and orange bars), water quality (orange circles) and invertebrates (blue crosses) improved. Sewage therefore used to be a problem.

Summary

If you look back at each of the examples and look only at data since about 2000-2005, we think you would not gain the same understanding of what has brought these catchments to their current position. We hope this inspires you to search for and collate time series data for your catchment and then use it with your stakeholders to build up a story they can relate to.

Find out More?

Ref 1: River Petteril Trial Catchment - Summary Slides for the Evidence and Measures Project. For Defra and the EA, 2014.

Ref 2: The Value of the Past - Use of Old Reports, Data and Opinions – 2-page note for the Evidence and Measures Project. For Defra and the EA, 2014.

¹ NIRS: EA National Incident Recording System

For further information on this work, contact:

Victor Aguilera Victor.Aguilera@defra.gsi.gov.uk
 Paul Logan paul.logan@environment-agency.gov.uk
 Paul Hulme paul.hulme@pjhydro.co.uk
 Nick Rukin rukun@rukhydro.co.uk

Evidence and Measures Projects

Evidence and Measures is a programme of work funded by Defra and the Environment Agency which has been working in a variety of catchments since 2008. It uses readily available evidence to help stakeholders identify locally-targeted measures aimed at delivering ecological improvements.

