

SCOTLAND RIVER TEMPERATURE MONITORING NETWORK (SRTMN)



Background

Water temperature (T_w) is important for the growth, production and survival of cold water adapted freshwater fish such as Atlantic salmon and brown trout. Consequently, there are increasing concerns that rising river temperatures under climate change could have detrimental effects.

Under certain circumstances, bankside trees can reduce high temperatures providing management options. However, fisheries and river managers need information on where rivers are hottest, where temperatures will increase most and where bankside tree planting would be most beneficial to target management actions.

It is possible to produce this information, but it requires carefully planned and managed temperature data collection and novel statistical approaches (models). To address this, the Scotland River Temperature Monitoring Network (SRTMN) was established in 2013.

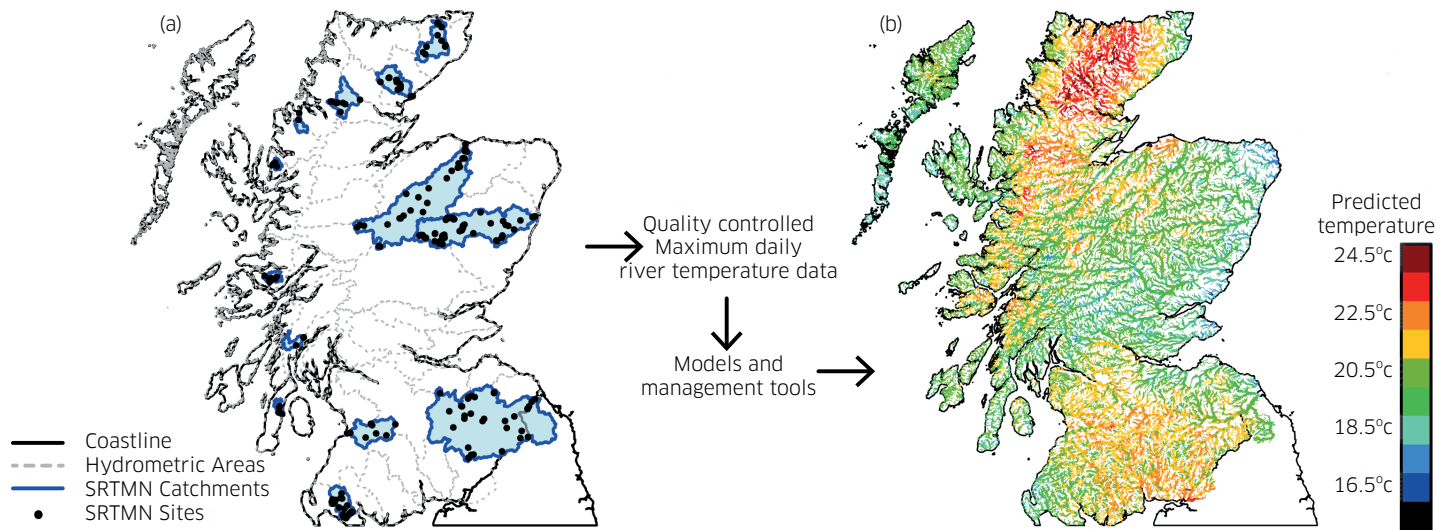
Objectives

Set up as a scientific collaboration between Marine Scotland Science (MSS) and the University of Birmingham, and supported by District Salmon Fishery Boards and fisheries trusts, the objectives of the SRTMN were to:

- Develop models to understand and predict river temperatures across Scotland
- Produce maps to show where rivers are hottest, will change the most under climate change and where trees can protect rivers
- Provide information on changing river temperatures

Designing the network of monitoring sites

The monitoring network was designed in 2013 to include sites across a wide environmental and geographic range to allow statistical models to be developed. Temperature dataloggers (automatically recording temperature sensors) were deployed between summer 2014 and 2015 to measure T_w , following stringent quality control procedures (see SRTMN webpages). The monitoring network is shown in Figure 1a.



A) SRTMN SITES B) NATIONAL MAXIMUM RIVER TEMPERATURE PREDICTIONS FOR THE HOTTEST DAY OF THE 2015/16 STUDY (DOY 182).

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Statistical Models

Models were developed to provide the information needed to make management decisions. An example of the outputs of these models is shown in Figure 1b, where T_w is predicted for the hottest day of the monitoring period.

The models allow predictions of:

- maximum T_w (where is hottest)
- climate sensitivity (how much T_w will change for a given change in air temperature)
- planting potential (where greatest benefits can be expected).

Predictions of T_w can be made for any river location on any day of the year using information on air temperature, location in the country (region), location on the river network and the characteristics of the river (elevation, bankside woodland and channel orientation).

Interactive maps of maximum river temperatures and climate sensitivity are available online to allow fisheries, river and land managers to plan for the future to protect Scotland's valuable rivers and fisheries resources from the detrimental effects of climate change. Information on how to decide where to plant trees to protect rivers from high

temperatures is also available in topic sheet 91 (see further information for all details).

Future Work

Monitoring will continue to provide important information on changing river temperatures in Scotland and to underpin improvements to T_w and juvenile salmonid density and assessment models.

Further Information:

SRTMN web page:

<http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/Freshwater/Monitoring/temperature>

Interactive maps:

<http://marine.gov.scot/information/scotland-river-temperature-monitoring-network-srtmn-predictions-river-temperature-and>

National T_w model:

<https://www.sciencedirect.com/science/article/pii/S0048969717323525?via%3Dihub>

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