Wye Salmon
Association
Cymdeithas
Eog Gwy

Long term temperature monitoring of Salmon (*Salmo salar*) spawning streams in the Wye river catchment

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Project update [March 2018]

The aim of this project is to continuously monitor the temperature in selected salmon spawning streams so that a better understanding of the effect of changes in stream temperatures on the spawning success and survival of juvenile salmon. The temperature data collected will be correlated with air temperatures, fry and parr numbers collected by NRW and other environmental and biological data. Data collected will assist NRW/EA in developing a management plan for salmon.

In 2016 NRW and EA completed the England/Wales salmonid fry and parr survey. The results of this survey indicated juvenile salmon densities across Wales in 2016 to be poor and in some catchments showing significant absences of salmon fry. The Wye catchment did not see these unexpected absences however average densities for both fry and parr were less than expected. They were roughly half compared to 2015 & the 5-year average. This is lowest level reordered since 2007 and the second lowest in survey history. Serious fish health issues have been ruled out, although other reasons, including a shortfall in numbers of spawning fish and damage arising from very high flows have not been. The decline was also evidenced in 2014 & 2015 classes and available data suggested this may be the result of unusually high-water temperatures throughout Nov and Dec 2015, the key spawning period for salmon.

Scientific studies show that breeding success and juvenile salmon survival rates are sensitive to higher than normal ambient temperatures. Maximum survival of well-formed fry at first food intake was found to between 6°C and 8°C, temperatures. Emilie Réalis-Doyelle, et al (2016) showed in one study at 12°C population fell dramatically (0.9% survival rate for well-formed fry at first food intake), and fry had almost no yolk sac at first food intake. At 10°C, there was also a lower survival rate (55.4% at first food intake). At 4°C, the survival rate was high (76.4% at first food intake), but the deformity rate was much higher (22% at first food intake) than at 6°C, 8°C, and 10°C.

Increased water temperatures also adversely affect other environmental factors such as the toxicity of many pollutants. The solubility of oxygen in water falls as temperatures rise. Salmonids are a cold adapted species, which require high levels of oxygenated water so lower oxygen levels and higher temperatures will adversely affect the young stages, which are more sensitive higher temperatures. The susceptibility of salmonids to pathogens and parasites will also be influenced by higher than normal temperatures.

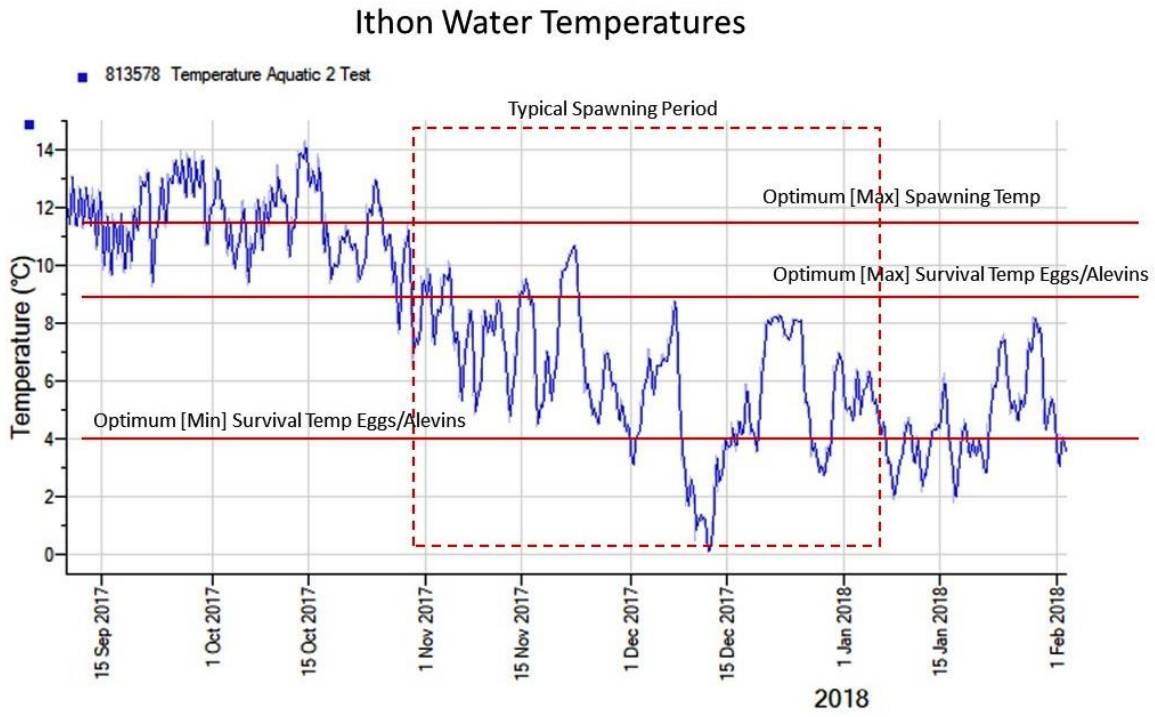
It is suggested where a choice is available, salmonids appear to avoid areas with temperatures outside their optimal temperature range spawning zone Lightfoot, G, et al (2008). The zone between the optimal range and lethal temperatures is called the critical range, over which increasing stress and disturbance to normal behaviour is apparent. Increasing temperature also increases the effect of pollutants and the susceptibility of fish to many pathogens.

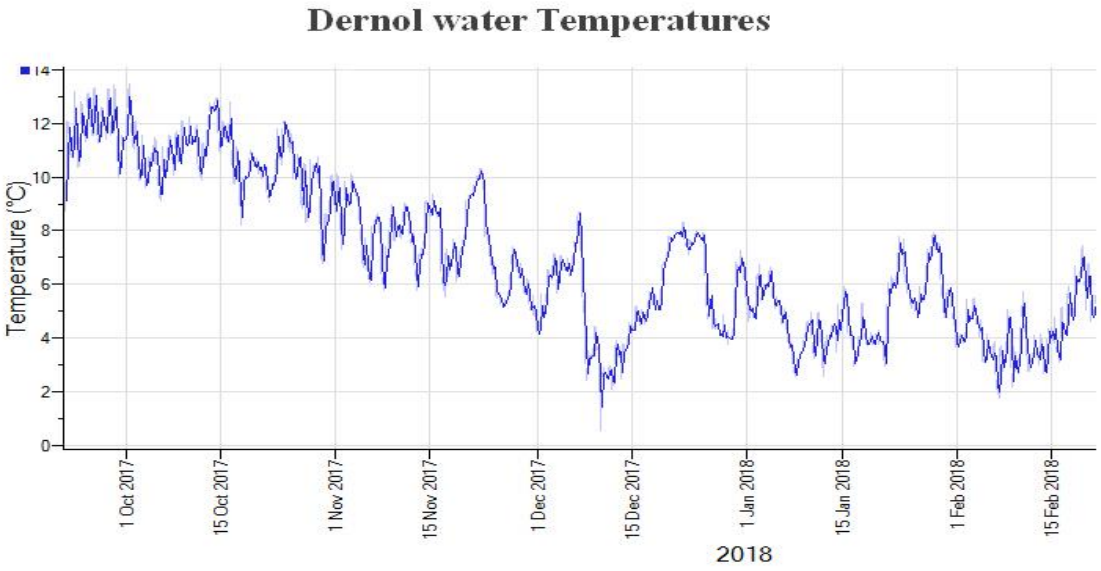
Lightfoot, G, et al (2008) also suggests that spawning appears to be timed so that the fry start to feed at the optimum time in the spring. The rate of egg development is temperature dependent so there is a variation in spawning time and also hatching and 'swim up' time, this is presumably under genetic control. Successful spawning is considered to only occur within a limited temperature range, i.e. below 11.5°c for Atlantic salmon and above about 4°c Lightfoot, G, et al (2008) and Emilie Réalis-Doyelle, et al (2016).

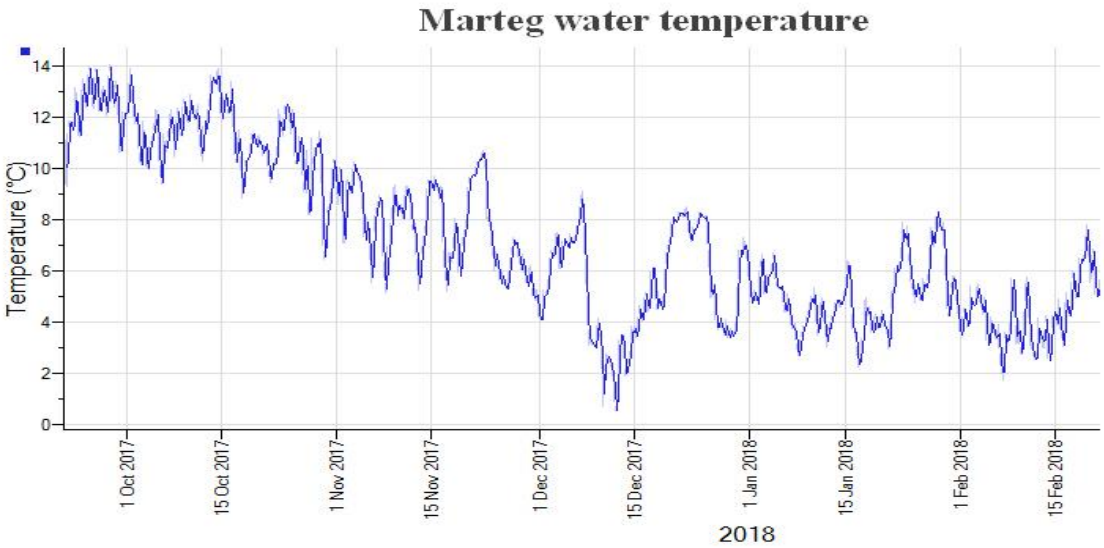
To monitor the temperature profile of significant spawning streams Gemini Tiny Tag Aquatic 2 temperature data loggers are being deployed in 11 streams. The streams in which we have placed the temperature monitors are: Dernol, Marteg, Chwefri, Sgithwen, Clywedog, Ithon, Edw, Duhonw, South Dulas-Irfon, Garth Dulas and Llanwrthwl Dulas. These streams have been identified by NRW as significant salmon spawning streams. Data is recorded every hour since Sept 2017. WSA are carrying out this project with volunteers who are members of this organisation.

Currently we are completing gathering data from each site for the 2017/8 spawning period. This will be corelated with NRW Electro fishing results that will take place during the Autumn 2018. We expect to continue this project for at least another 2 spawning cycles before completing our analysis and findings in conjunction with NRW Fisheries staff.

Examples of data collected from the river Ithon, Dernol and Marteg is seen below.







The data collected this year seems to indicates that during the critical period for spawning the stream temperature was within the optimal temperature range for successful spawning of salmon and development of the salmon ova.

Water temperature is not the whole reason for low juvenile survival, there are other contributory factors such; as the contribution of ground water to the temperature profile of the stream; oxygen levels within redds; effects of raised river flow; higher than normal levels

of fine suspended solids and organic matter; raised levels phosphates and nitrates. All these environmental factors will have an effect on successful spawning and survival of the young salmon.

References

Emilie Réalis-Doyelle, et al (2016) Strong Effects of Temperature on the Early Life Stages of a Cold Stenothermal Fish Species, Brown Trout (Salmo trutta L.)
https://doi.org/10.1371/journal.pone.0155487

Lightfoot, G, et al. (2008) Thermal biology of brown trout and Atlantic salmon. ISBN: 978-1-84432-932-8 Dec 2008
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