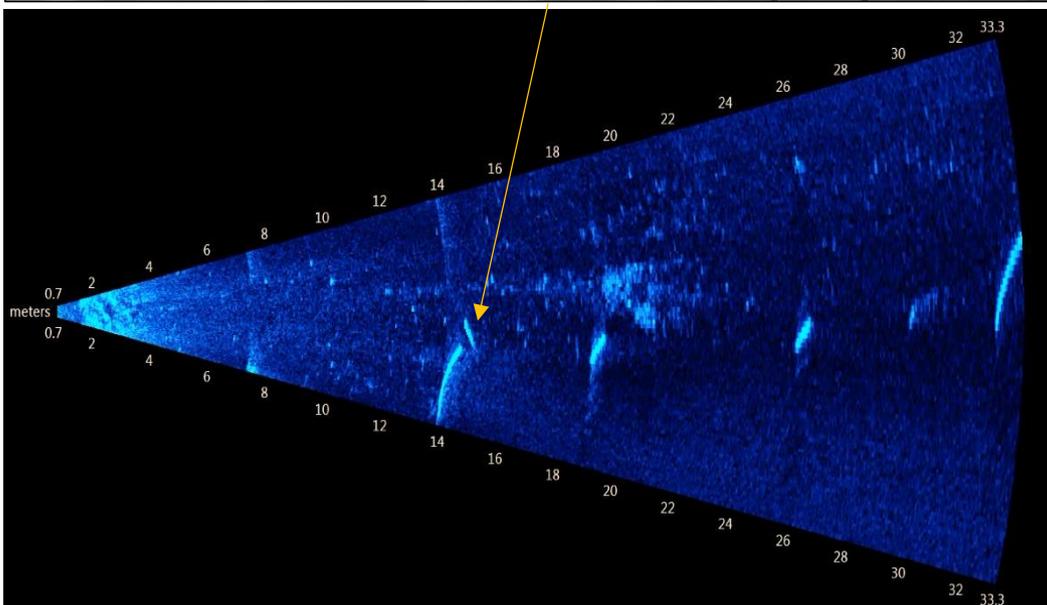
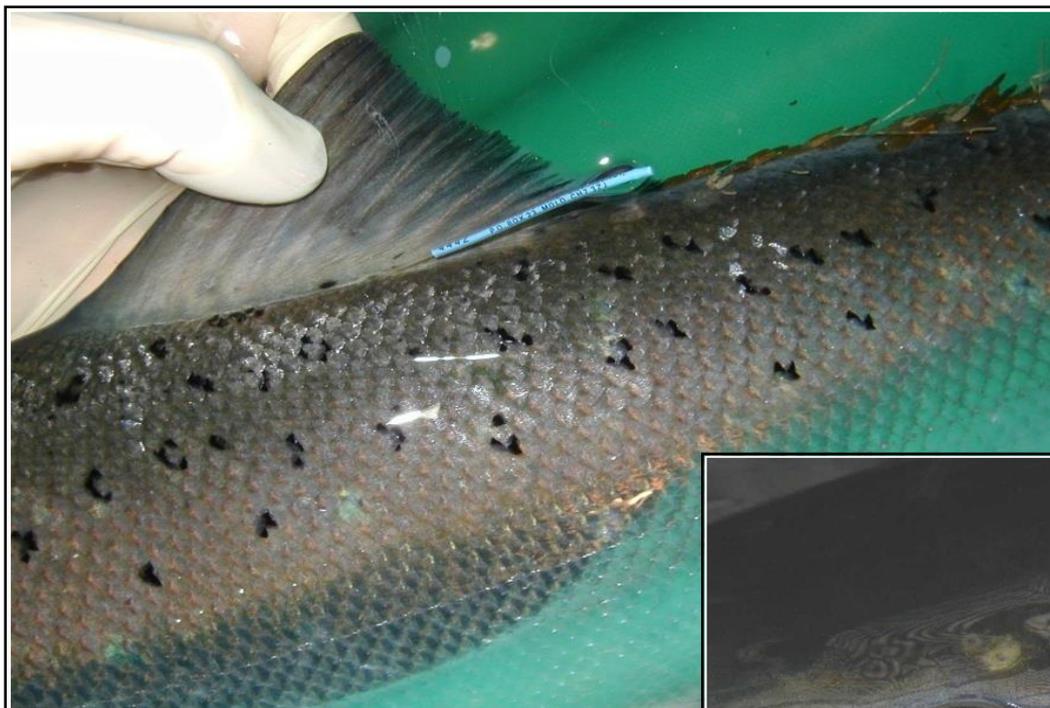


DEE STOCK ASSESSMENT PROGRAMME ANGLER REPORT 2016



Cyfoeth Naturiol Cymru
Natural Resources Wales

Front cover: 18lb salmon moving through Bala sluice gates & ARIS image (photo Pete Clabburn)



Photos: Floy tagged salmon and VI (Visible Implant) tagged sea trout.

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1. Introduction

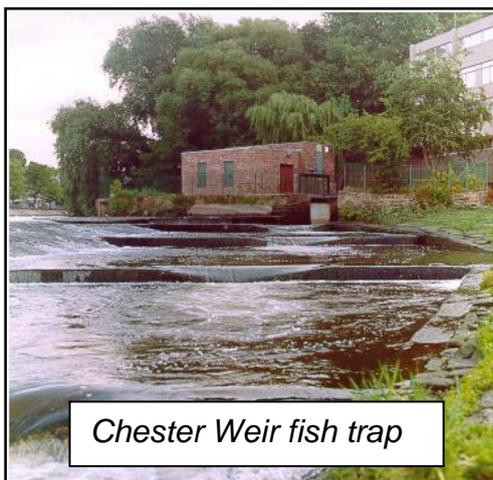
This report summarises provisional findings of the Dee Stock Assessment Programme (DSAP) and related work for 2016.

It is the fourth of these reports produced by Natural Resources Wales (NRW) - the organisation which, since the 1st April 2013, has taken on the duties of the Environment Agency in Wales (along with the Countryside Council for Wales; the Forestry Commission Wales and some functions of Welsh Government).

2. Trapping and tagging at Chester Weir

Trapping and tagging of adult salmon and sea trout at Chester Weir have been carried out since 1991 to (i) estimate the total run of fish returning each year and (ii) collect information on their biology (e.g. age, size, sex, general condition). Combining this information allows individual generations of fish to be followed through time and is used to help improve our understanding of the factors affecting survival and abundance and inform our management in the widest sense (local, national and international).

Very few rivers have facilities (counters or traps) to estimate the numbers of salmon or sea trout returning each year. Out of more than 60 principal salmon and sea trout rivers in England and Wales (E&W), only 9 currently provide run estimates for salmon of which just 5 produce the same estimates for sea trout. Among these rivers, only four (the so called 'Index Rivers': Tyne, Tamar, Dee and Lune) also collect biological information via trapping or fishery based sampling programmes. The Dee is the only river in Wales in the group of 9 counted rivers and has the longest running programme among the Index Rivers.



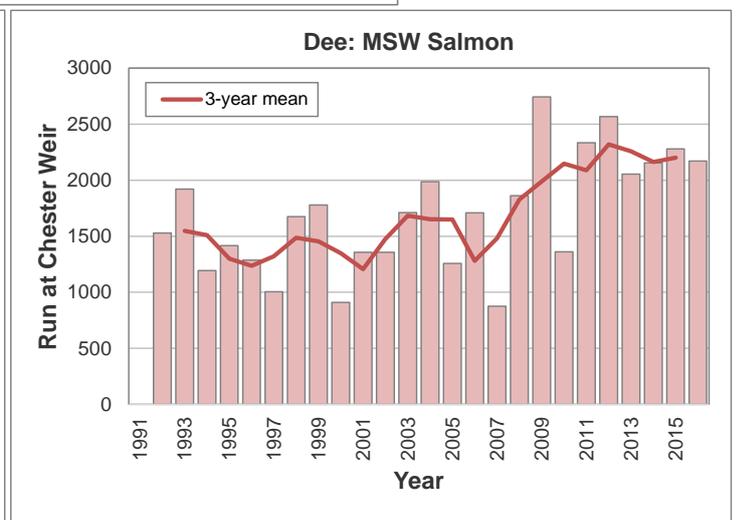
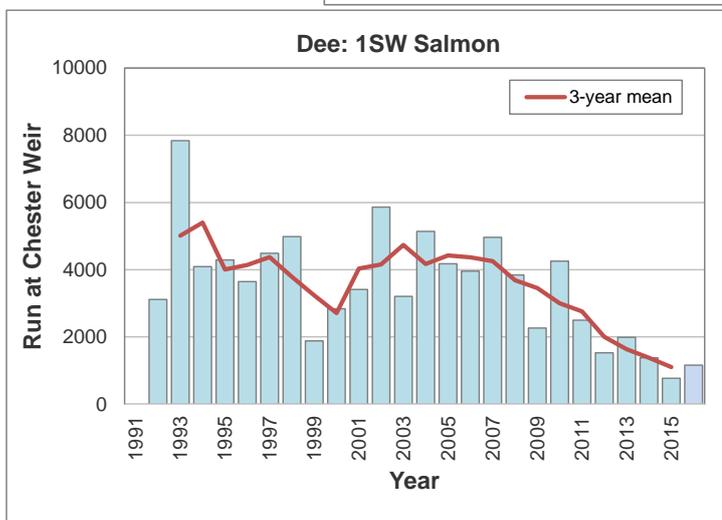
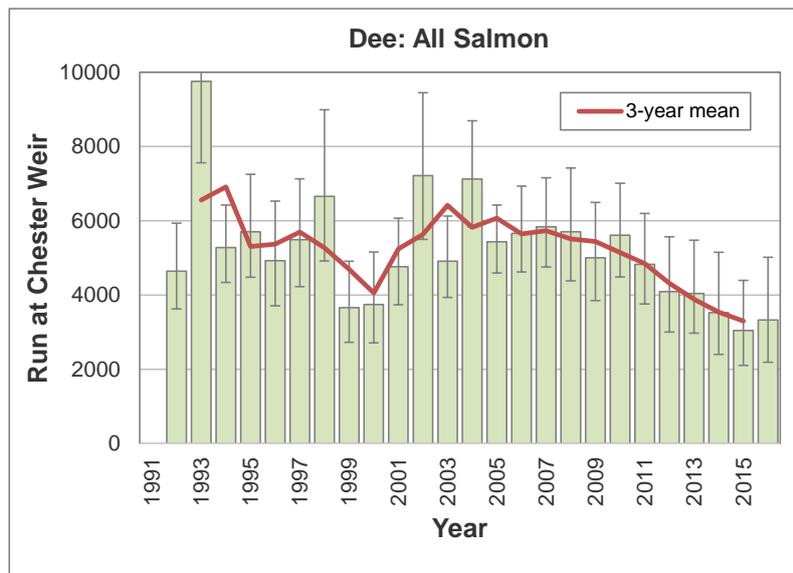
Trapping at Chester Weir is carried out throughout the year (January - December) but not continuously. When the trap is not being fished (around 40% of the time) it becomes an open channel through which fish can freely pass. For this reason, and because fish are able to cross the weir and bypass the trap in high flows and on big (~9m) tides, the trap is a partial one. Tagging and recapture estimates (below) indicate that, on average, 20-30% of the run is trapped at Chester.

Virtually all salmon and the majority of sea trout captured at Chester Weir are tagged using Floy and VI (Visible Implant) tags, respectively (see photos on inside front cover). In both cases, run estimates require a second catch from which the ratio of tagged to untagged fish can be obtained. For salmon, this relies on anglers reporting the tagged and untagged fish they catch in the same year they were tagged. In the case of sea trout, however, (where, unlike

salmon, multiple spawners are common) the second catch takes place back at Chester Weir trap one year after tagging. In both instances, the ratio of tagged to untagged fish in the second catch is used to raise the total number tagged to obtain a run estimate. For example, if 1,000 salmon were tagged at Chester Trap, and 1 in 5 of the salmon caught by anglers were tagged, then it is assumed that 1/5th of the run has been tagged - producing a run estimate at Chester of 5,000 fish.

A £7 reward is offered to encourage anglers to report any tagged salmon they catch. This reward is increased to £14 for anglers who returned a logbook in the previous season. The reason for this is that records of tagged and untagged salmon submitted by logbook anglers are considered the most reliable - simply because of the effort required to maintain a detailed record of each fishing visit. Hence, only the catch and recapture details from logbook anglers are used to generate salmon run estimates.

Fig. 1 Annual run estimates for salmon at Chester Weir, 1992-2016
(error bars indicate 95% confidence intervals)



The run of salmon entering the Dee after the end of the angling season (on average less than 10% of the total) is derived from the trap catch and an estimate of trap efficiency from the in-season period.

3. Dee Salmon in 2016

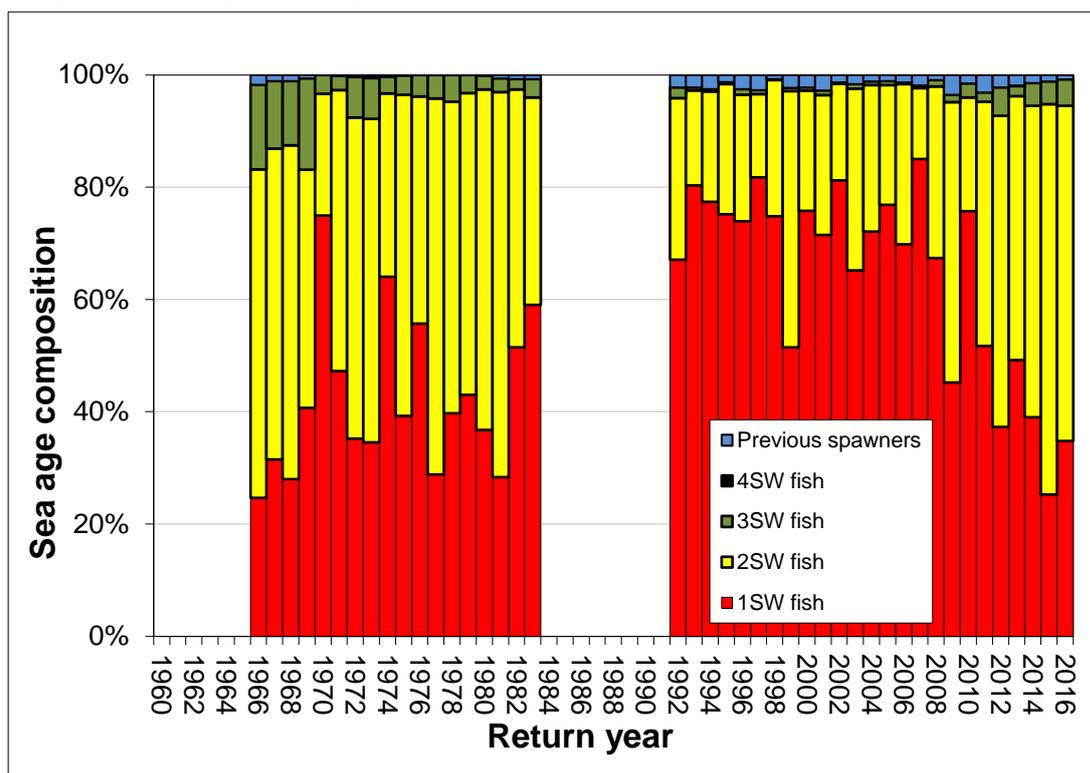
Run size and composition: Provisional results indicate a run of 3,330 salmon (fish of all sea ages) at Chester in 2016 - a modest improvement on last year's figure 3,051 but still the second lowest run to date (Fig. 1). The corresponding trap catch in 2016 was 350 fish.

While the slightly better return in 2016 may have moderated, a little, the decline in the Dee salmon run as a whole since the mid-2000s, the downward trend remains a cause for significant concern (as it does for many of the counted rivers in E&W which show a similar pattern).

As described in previous reports, it appears that the decline in the salmon run on the Dee (and other rivers) is being driven by a marked fall in the return of 1-sea winter (1SW) fish or grilse. Grilse have made up around 75% of the Dee run for most of the last 20+ years but now represent less than half of the return (only 25% in 2015 and 35% in 2016) - the remainder made up of mainly 2SW salmon (Fig. 2).

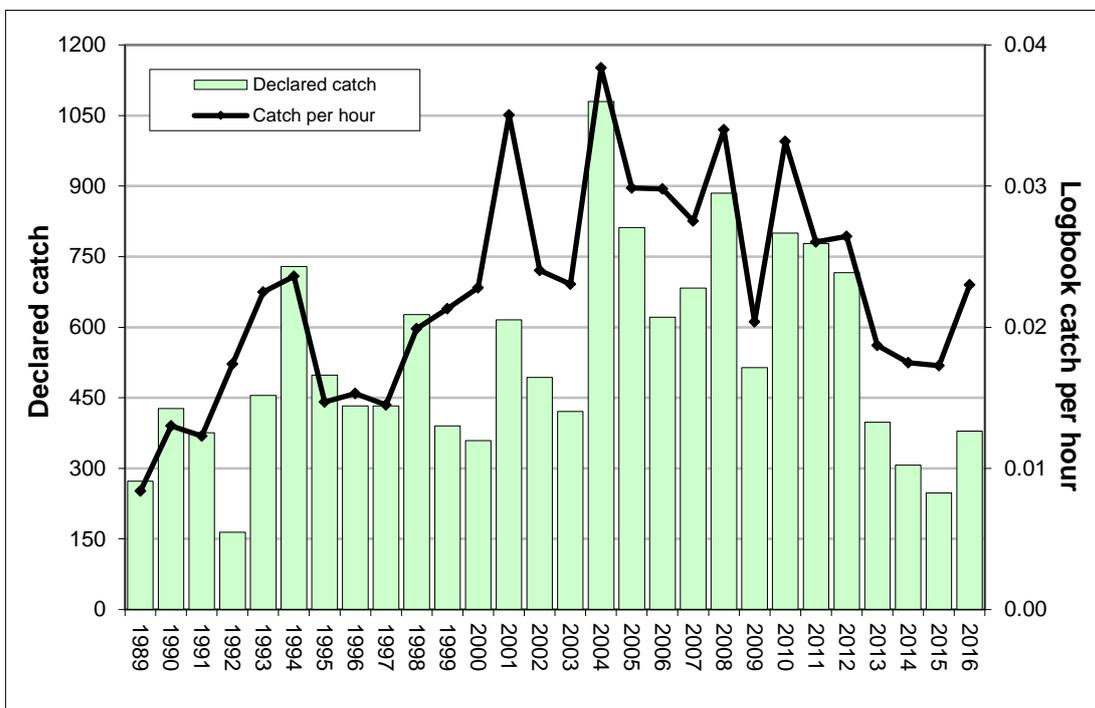
This change corresponds to a grilse run of under 2,000 fish in each of the last 4 years (only 771 fish in 2015 and 1,158 fish in 2016) compared to a long-term average of over 3,500 (Fig. 1). In contrast, the estimated return of MSW salmon has been increasing since the mid-2000s - from an average of ~1,500 fish to around 2,000 in recent years.

Fig. 2 Sea age composition of the Dee salmon run, 1966-2016



Rod catch: Licence returns to date indicate a declared rod catch of 379 salmon. While this represents an improvement on the 248 fish reported in 2015 (the latter the second lowest catch in records going back to 1951) it is still some way below the long-term average catch of 538 fish (Fig. 3). Of the 379 fish caught in 2016, 328 or 86.5% were released by anglers.

Fig. 3 Declared salmon rod catch and logbook catch effort, 1989-2016

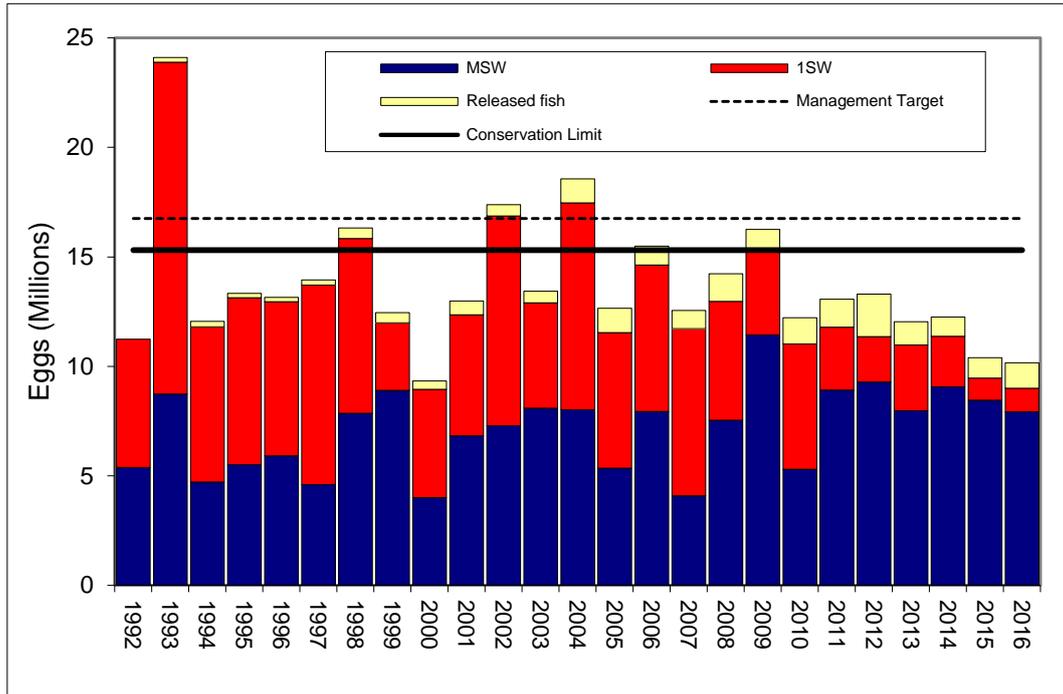


Spawning escapement: Estimates of the numbers of spawning salmon and the eggs they deposit are based on the run at Chester Weir minus losses to the rod fishery and other sources of mortality. Estimates also take account of the sex ratio of returning fish sampled at Chester (as judged from external appearance - the ratio is usually close to 1:1) and their average size (which relates to their likely egg contribution).

The provisional estimate of egg deposition for 2016 is 10.16 million eggs produced by ~3,000 spawners. Of these, around 300 spawners were estimated to have been rod-released fish contributing 1.17 million eggs. For the seventh year running, egg deposition was below the Conservation Limit for the Dee of 15.3 million eggs and well short of the associated Management Target of ~17 million eggs (Fig. 4).

Compliance failure against the Conservation Limit clearly remains a concern on the Dee - and particularly as the river is a 'Special Area of Conservation' (SAC) for salmon (one of only 6 SAC rivers in Wales with salmon as a feature). Salmon stocks on most rivers in Wales and many in England are in a similar position to the Dee with respect to Conservation Limit compliance - leading to more widespread concerns about the status of salmon stocks generally (concerns also expressed by neighbouring countries in the southern Atlantic).

Fig. 4 Salmon egg deposition, 1992-2016



The situation has become particularly acute in recent years as marine survival rates appear to have fallen further and some of the biological characteristics of returning salmon have become less favourable (e.g. fish which are smaller and in poorer condition than in former times).

As a consequence, for more than a year now, Natural Resources Wales has been liaising with fisheries interests to examine options to reduce the numbers of fish killed by the fisheries as one approach to conserving threatened salmon (and sea trout) stocks.

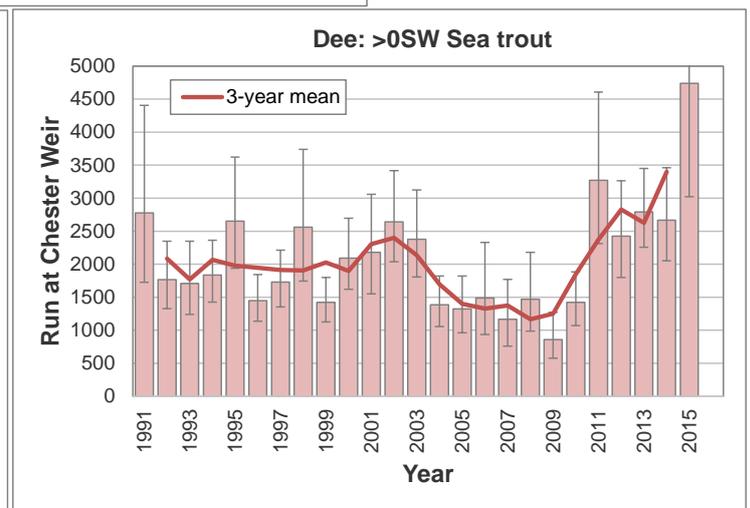
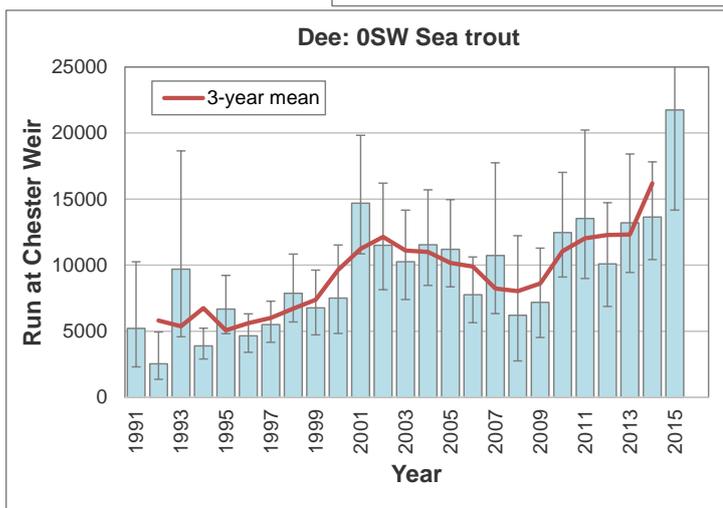
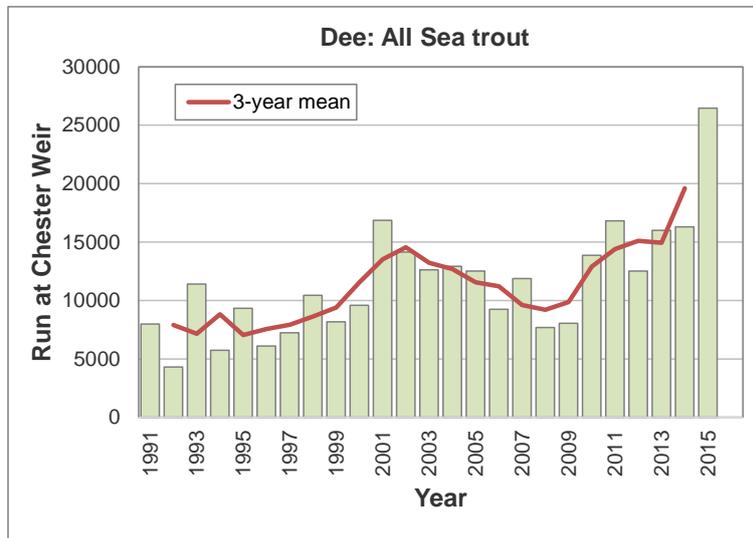
NRW's preferred option is for mandatory catch-and-release fishing for salmon (alongside additional controls on angling methods) on rivers where stocks are in the worst risk categories. This includes the Dee and almost all other rivers in Wales. The preferred option for sea trout is for similar catch control measures where there are concerns about the status of stocks.

NRW intends to begin a formal 12-week public consultation on its proposals in April 2017 with the aim of introducing any new regulations at the start of the 2018 fishing season. The outcome of the consultation and the timetable for the implementation of new measures cannot be pre-judged. However, across Wales, the status of salmon stocks, in particular, remains a matter for great concern, and so we urge fisheries and fishermen to introduce their own voluntary measures now to ensure no salmon are killed in 2017.

4. Dee sea trout in 2015

Run size: As described in Section 2, run estimates for sea trout on the Dee rely on the recapture of tagged fish back at Chester trap in the year after tagging - and so are 12 months behind those of salmon.

Fig. 5 Annual run estimates for sea trout at Chester Weir, 1991-2015
(error bars indicate 95% confidence intervals)



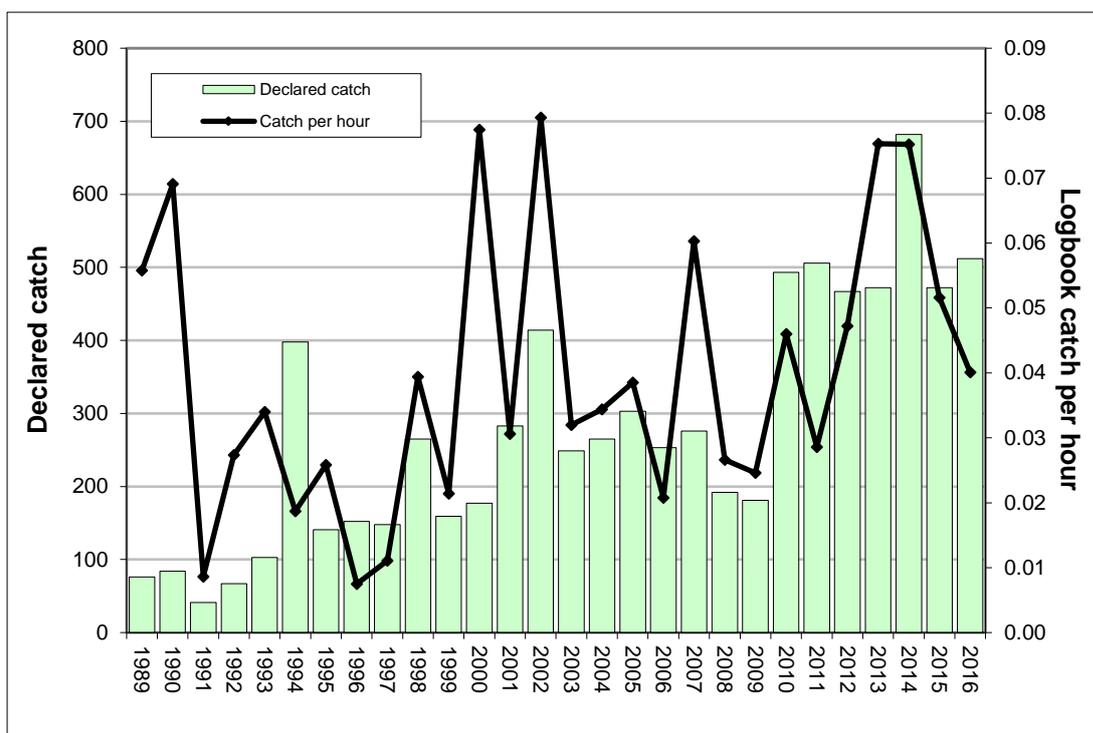
Separate run estimates are obtained for whiting (0SW) sea trout (i.e. fish which spend only a few months at sea and weigh around 1lb or less on their return) and older (>0SW) fish. Provisional estimates for 2015 are the highest to date for both these groups at 21,732 for whiting and 4,738 for older fish (Fig. 5).

In 2016, a total of 2,067 0SW and 551 >0SW sea trout were captured at Chester trap - a substantial reduction on the 2015 record trap catch which comprised 5,391 0SW sea trout and 1,058 older fish. This suggests the run estimates for these sea age groups in 2016 will be much reduced on the peak of 2015, although they may still be relatively high given that returns of sea trout to the Dee in the last few years have been among the best to date.

This positive picture for sea trout returning to the Dee is consistent with improved catches seen on the rod fishery (below) and with a general upturn in the abundance of juvenile trout evident from electrofishing surveys. It is also apparent that this pattern is repeated (e.g. for rod catches) on a number of rivers in North Wales and suggests that local marine conditions (about which we know relatively little) may be an important factor.

Rod catch: Provisional sea trout rod catch figures for the Dee in 2016 stand at 512 fish - up slightly on last year's total of 472, but still among the cluster of recent years when catches have exceeded 400 fish (Fig. 6).

Fig. 6 Declared sea trout rod catch and logbook catch effort, 1989-2016



At present no national assessment method has been developed for sea trout equivalent to the Conservation Limit procedures in place for salmon. However, the performance of rod fisheries on all principal sea trout rivers in E&W is routinely examined using catch-effort data collected from the licence return. On this basis, no concerns have been raised about the status of the River Dee sea trout stock.

5. Recruitment of juvenile salmonids in 2016

Following summer electrofishing surveys in 2016, extremely low numbers of juvenile salmonids, particularly salmon fry, were reported on many rivers in England, Wales and Scotland, and further afield.

This was the case on most rivers in Wales, with systems such as the Usk, Tywi and Clwyd reporting the absence or virtual absence of young salmon at several formally productive sites.

The widespread nature of these observations suggests common factors operating at a broad scale. Among the most likely causes are (i) poor numbers of adult salmon returning to spawn in 2015; (ii) unseasonably warm winter temperatures which may, through various mechanisms, have adversely affected spawning success and (iii) extreme flows over the spawning period linked to winter storms and leading to destruction of redds.

It is unlikely that these factors (and perhaps others) would have operated to the same degree on all rivers. For example, northern UK rivers are unlikely to have experienced similar temperature regimes to southern ones.

On the Dee, abundance estimates for salmon fry obtained from timed (5-minute) electrofishing surveys (EF) in 2016 were particularly poor, although trout fry appeared to fare better (Figs. 7 and 8). This was notably so in the lower catchment where average salmon fry counts (per 100m²) were the poorest on record on the Ceiriog and lower and middle sections of the main Dee (Fig. 7). These reaches would be expected to make a significant contribution to total salmon fry production on the Dee, and it is likely that their marked decline in 2016 (extending downward trends evident over the last few years) will have adverse consequences for smolt output and adult returns in subsequent years. *[In contrast, trout fry abundance on the Ceiriog was good in 2016 - continuing the pattern of recent years. No equivalent comparison could be made of trout fry abundance in the lower and middle main river as few trout are caught in these wide river habitats.]*

One factor which could explain the demise of salmon fry in the middle and lower catchment in particular would be a tendency (established from radio-tracking studies on the Dee in the early 1990s) for salmon entering later in the season (September onward) to spawn in these reaches (e.g. in contrast to early and mid-season entrants which predominantly spawned in the upper part of the catchment). Historically, grilse have made up the vast majority of later running salmon on the Dee but are the sea age component which has experienced the greatest decline in the last few years (see above).

Fig. 7 Abundance estimates for salmon fry from timed (5-minute) EF surveys on the Dee, 1991-2016

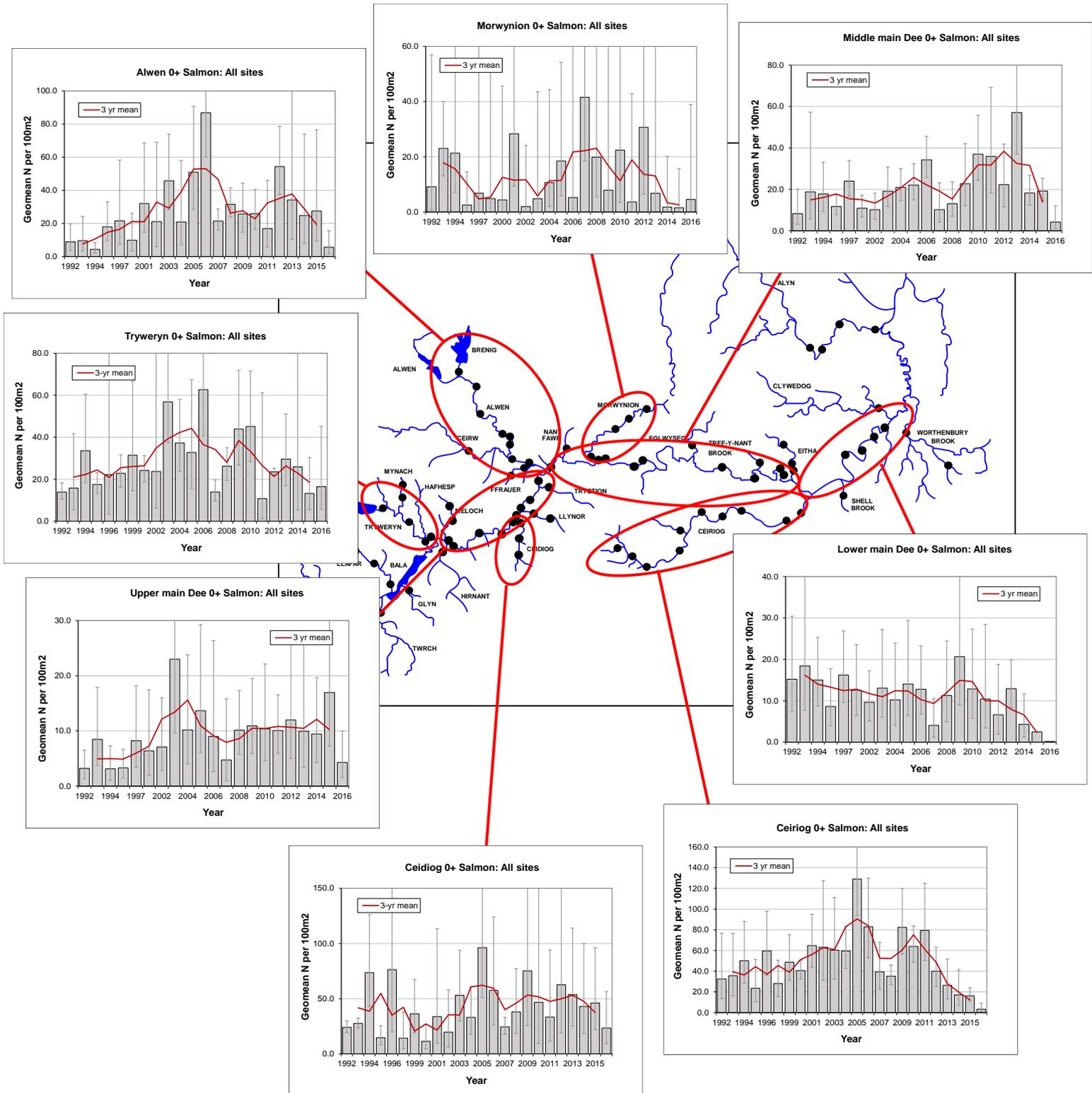
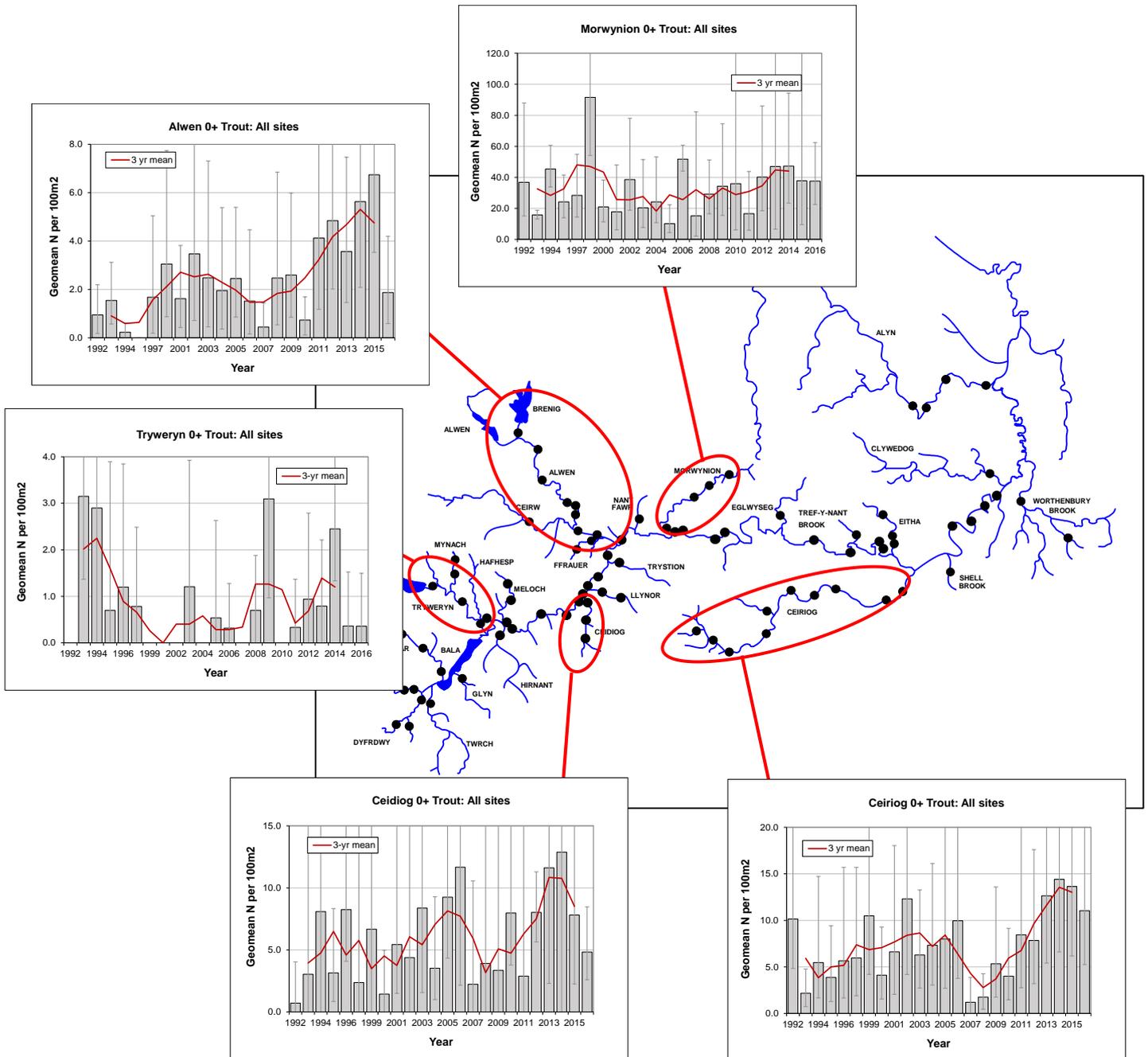


Fig. 8 Abundance estimates for trout fry from timed (5-minute) EF surveys on the Dee, 1991-2016.



Aside from a shortfall in the numbers of salmon spawners (and particularly grilse) in 2015 (the lowest total return in 25 years of monitoring), river temperatures and flows at Manley Hall during the winter of 2015 were, for a period, the highest in 50 years of records (Figs. 9 and 10).

Fig. 9 Weekly mean temperature, main River Dee at Manley Hall, 1965-2015

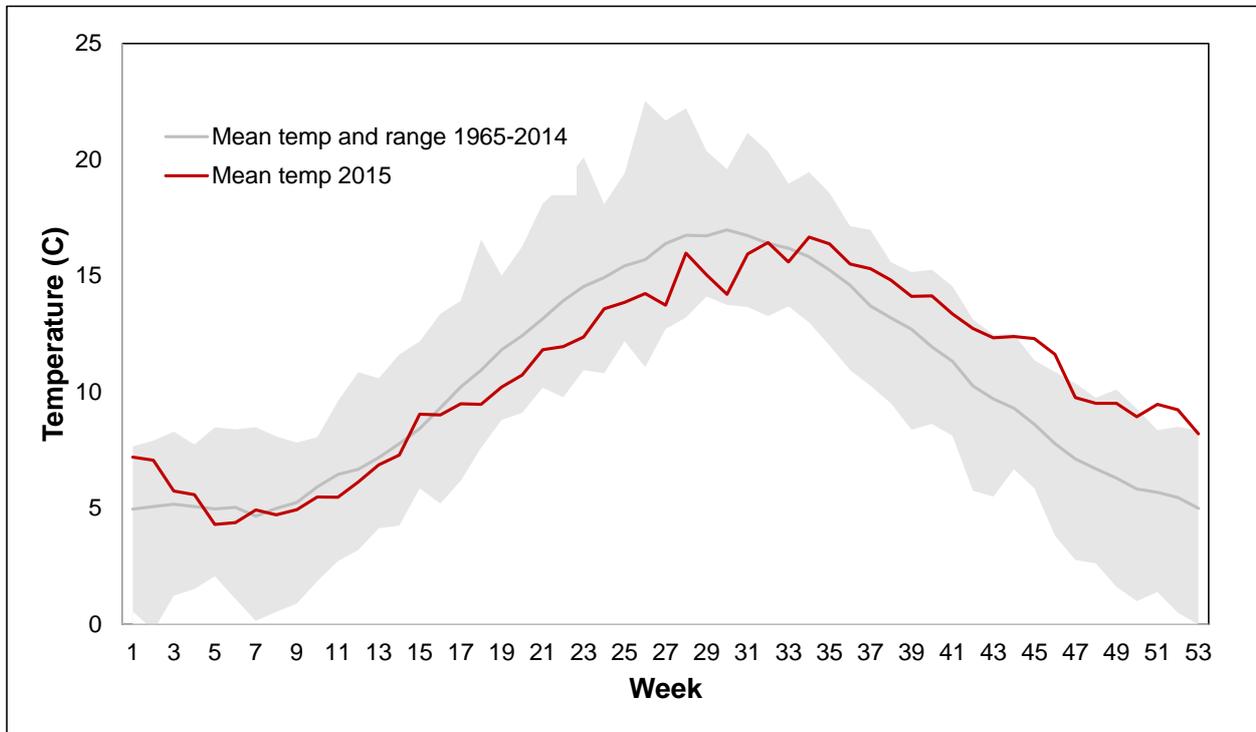
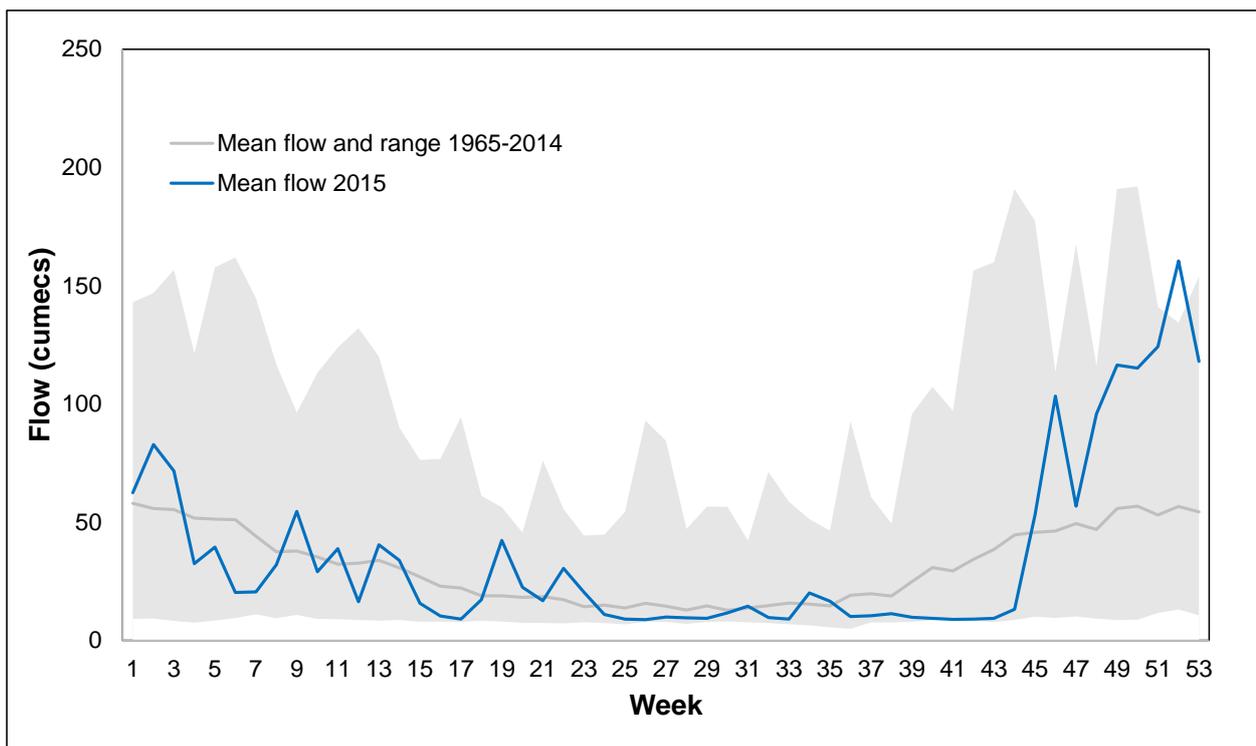


Fig. 10 Weekly mean flow, main River Dee at Manley Hall, 1965-2015



The combination of these extreme conditions may provide much of the explanation for the poor fry densities observed in 2016, although the importance of individual factors (poor spawning levels, high winter temperatures and high winter flows) is difficult to determine and likely to vary from river to river.

Climate change scenarios suggest such environmental extremes are likely to occur more not less frequently into the future and this is particularly worrying where stocks are already depleted (as most of our salmon stocks are) and less able to withstand such random 'shocks'.

Hence the urgent need to protect and conserve weakened stocks by whatever means we can. Even small numbers of additional fish surviving to spawn will, over the generations, help build resilience in populations either (i) allowing them to better withstand additional pressures and possibly making the difference between a population collapsing altogether or maintaining itself at a low level, or (ii) enabling phases of recovery as more favourable conditions allow.

6. Developments: Alternative Mitigation Project

Recently a project was delivered on the Afon Tryweryn to provide additional spawning gravels for salmon. It was identified that there is a lack of gravel in the Tryweryn due to the dam restricting the free movement of gravel through the system. A low level stone structure was created and 200 tons of graded stone and gravel was imported and strategically positioned. Electro fishing surveys will be carried out this summer to see if any salmon used the area last winter.





Photos: Gethin Morris

7. Spawning season

Salmon spawning in the upper Dee catchment was generally quite good this winter (2016/17) with salmon redds observed in most of the upper tributaries with the Tryweryn and Hirnant showing improved numbers compared to the last few years. As a result of low flows in late December and early January a full redd count was done by boat on the main river from Bala sluice gates to the Alwen Junction where 239 salmon redds were recorded.

Photo of a salmon redd on the Hirnant (Gethin Morris)



Report links

The Celtic Sea Trout Project (CSTP) Technical Report presents extensive chapters on sea trout fisheries inventory, stock identification, freshwater production, life histories and marine ecology across its distribution around the Irish Sea. Available at link <http://celticseatrout.com/downloads/technical-report/>

The following provides the links to the ICES background report and latest assessment report, respectively:

<https://www.gov.uk/government/publications/assessment-of-salmon-stocks-and-fisheries-in-england-and-wales>

<https://www.gov.uk/government/publications/salmon-stocks-and-fisheries-in-england-and-wales-in-2015>