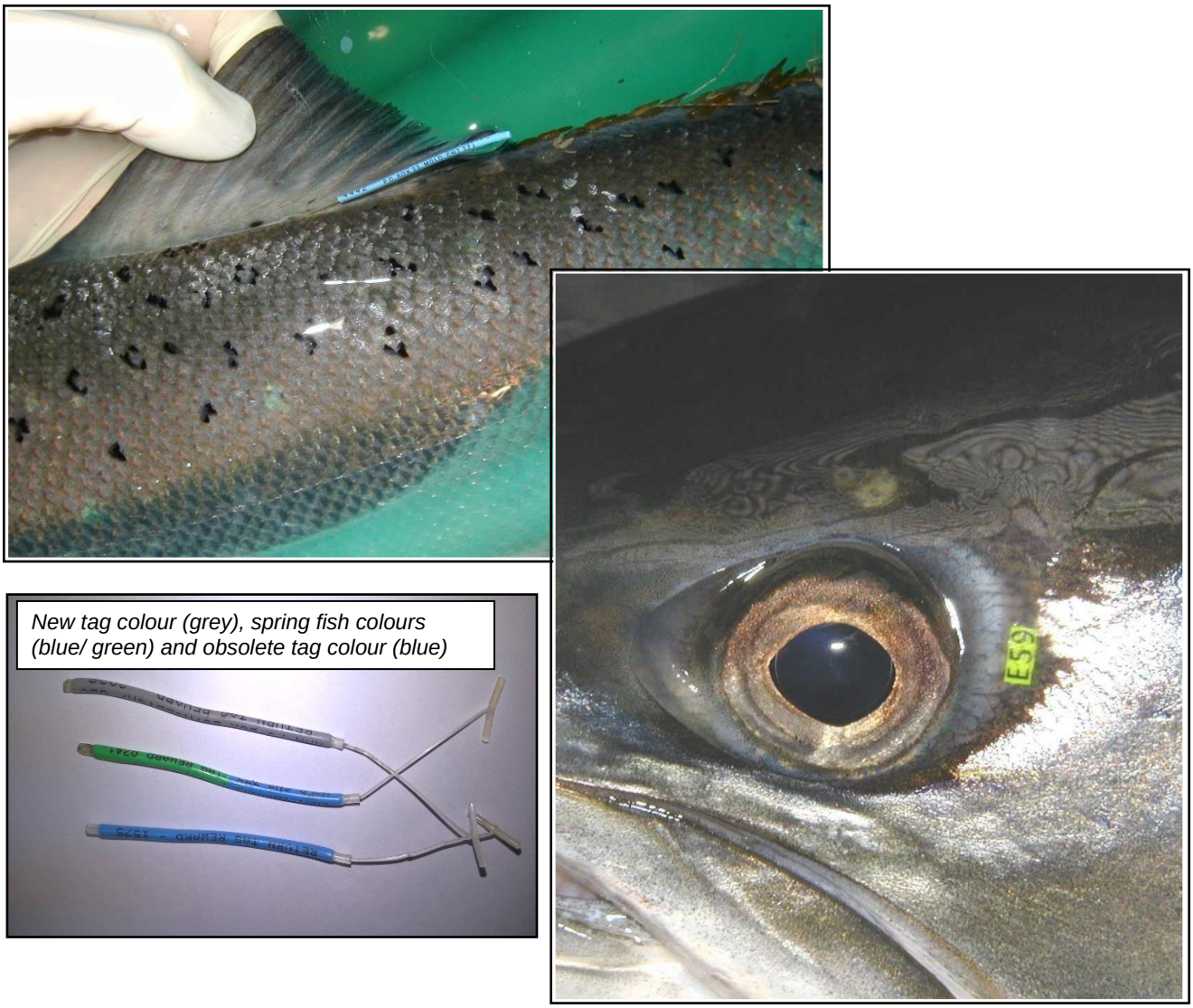
DEE STOCK ASSESSMENT PROGRAMME
ANGLER REPORT 2018

Cyfoeth Naturiol Cymru
Natural Resources Wales

Front cover: Catch & release at Erbistock weir, River Dee.



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

NATURAL RESOURCES WALES
FREEPOST CS1121
CHESTER ROAD
BUCKLEY
FLINTSHIRE
CH7 3ZZ

I.C. DAVIDSON
R.J. COVE

TELEPHONE: 03000 653897 or 653850

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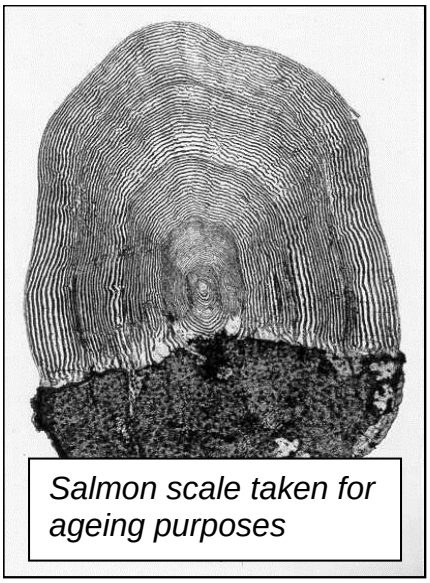
EMAIL: ian.davidson@naturalresourceswales.gov.uk
richard.cove@naturalresourceswales.gov.uk

1. Introduction

The River Dee is one of very few 'index' monitored rivers for Atlantic salmon and sea trout in Europe or the wider North Atlantic area.

In this context, the term 'index' river is applied to systems where intensive, long-term monitoring programmes are carried out to collect detailed information on the key life-stages of these fish species.

Over time, this builds a picture of changes in the abundance and biological characteristics of fish stocks in order to improve understanding of complex population processes and the factors which influence them.



Salmon scale taken for ageing purposes

In turn, this detailed information is used to inform stock assessment and fisheries and environmental management in the widest sense: local, national and international. Hence the benefits are not just confined to the index rivers.

The index river programme on the Dee - or 'Dee Stock Assessment Programme' (DSAP) - began in 1991 with construction of a head-of-tide fish trap at Chester Weir.

This trap is designed to capture and sample upstream migrating adult fish and estimate their total return, as well as provide information on their biology (e.g. size, age, sex, etc.). Further details of the trapping programme are given below.

Other elements of the Dee programme include:

(i) lower river downstream trapping programmes in Spring to estimate the abundance and survival of out-migrating smolts;

(ii) extensive (5-minute timed) electrofishing surveys in late summer to monitor the abundance and distribution of juvenile salmon and trout (fry and parr) at 85+ tributary and main river sites.

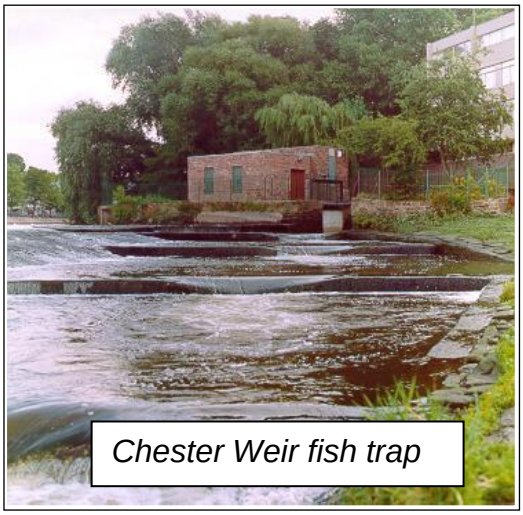
Salmon and trout fry sampled by electrofishing

(iii) circulation (with this report) of a fishing logbook to ~400 Dee anglers to collect detailed information on rod catch and fishing effort around the catchment - supplementing the licence based catch return and fostering support for the Dee programme including the reporting of tagged fish.

The purpose of this report is to provide provisional findings on aspects of the Dee programme and related work for 2018. It is one of a series of annual reports on the Dee programme produced by Natural Resources Wales (NRW) and predecessor bodies.

2. Trapping and tagging at Chester Weir

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 rivers and around 80 principal sea trout rivers in England and Wales (E&W), only 12 currently provide run estimates for salmon (including the Taff, Teifi and Dee in Wales) and just 5 produce the same estimates for sea trout (only the Dee in Wales). Among these rivers, only four 'index' rivers: Tyne, Tamar, Dee and Lune, also collect biological information from adult fish via trapping or fishery-based sampling programmes (of which the Dee is the longest running).



Chester Weir fish trap

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.

The tagging and recapture method means that run estimates for salmon and sea trout can be obtained from a partial trapping programme; i.e. they do not require trapping to be carried out all the time and do not depend on a constant trapping efficiency (as the latter can be estimated from tagging).

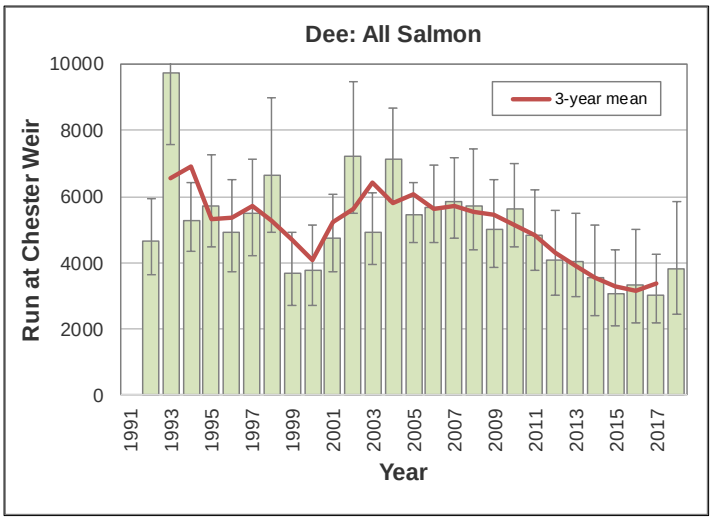
A £7 cash reward is offered to encourage anglers to report any tagged salmon they catch. This reward is increased to £14 for anglers who returned a logbook in the previous season. The reason for this is that records of tagged and untagged salmon submitted by logbook anglers are considered the most reliable - 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.

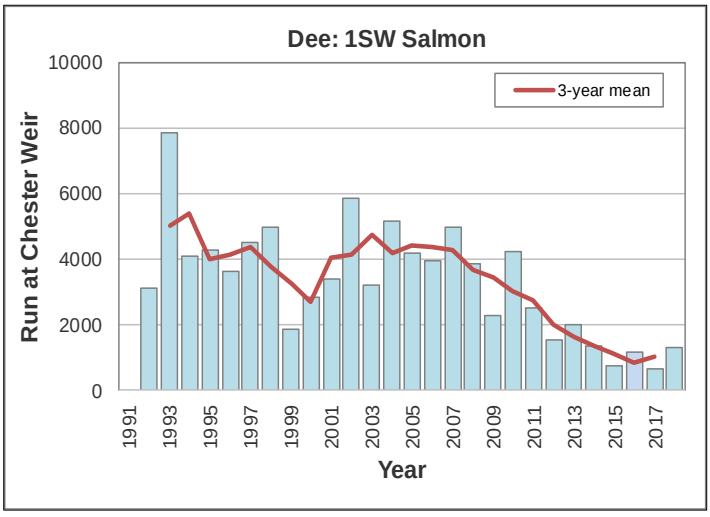
The run of salmon entering the Dee after the end of the angling season (on average less than 10% of the total) is derived from the trap catch and an estimate of trap efficiency from the in-season period.

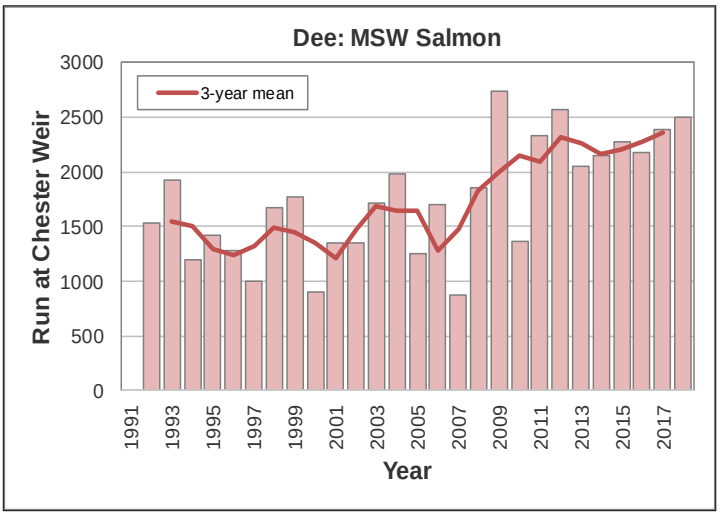
3. Dee Salmon in 2018

Run size and composition: Provisional results indicate a run of 3,796 salmon (fish of all sea ages) at Chester in 2018 - an increase of more than 750 on the 3,043 fish reported in 2017 (the latter, lowest return on record) (Fig. 1). The corresponding trap catch in 2018 was 546 fish.

Fig. 1 Annual run estimates for salmon at Chester Weir, 1992-2018
(error bars indicate 95% confidence intervals)







The 2018 return marks a break in a near year-on-year decline in the Dee salmon run evident since the early 2000s - resulting in a current 3-year average return (~3,400 fish) which is around half of the peak return of 2002-2004 (~6,400 fish).

As described in previous reports, this decline in the salmon run is being driven by a marked fall in the return of 1-sea winter (1SW) fish or grilse such that current levels are only around 20% of what they were less than 20 years ago.

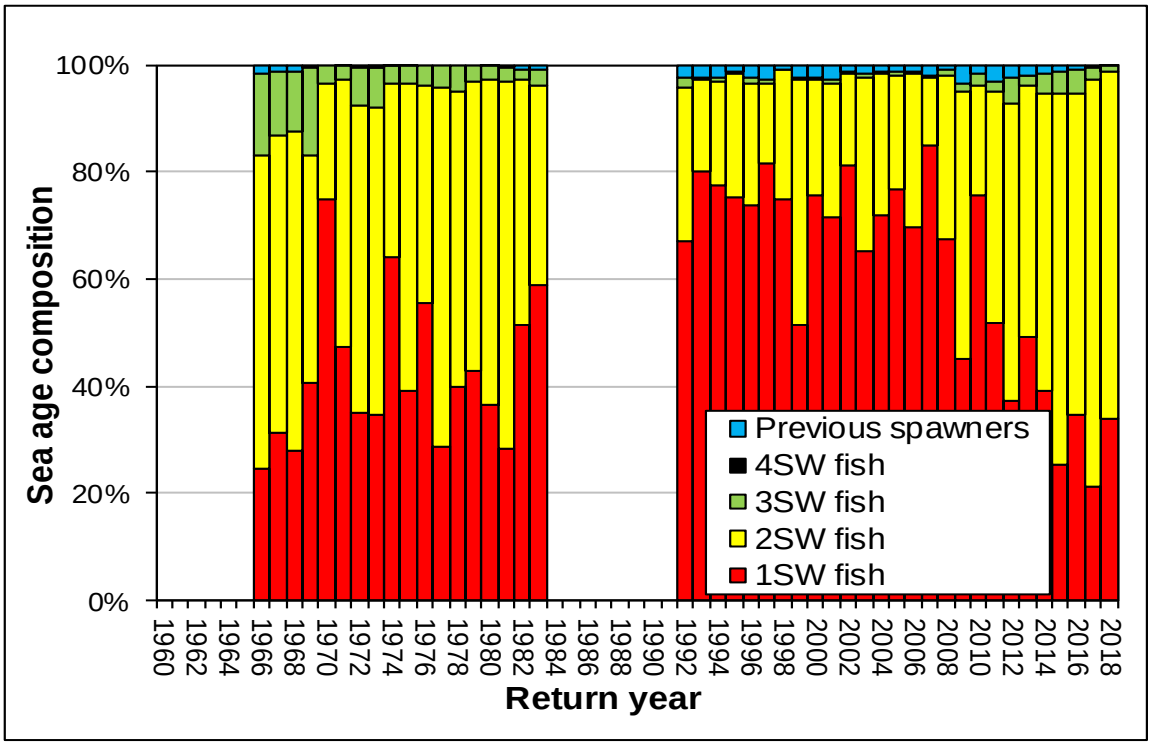
The better news is that numbers of multi-sea winter (MSW) salmon returning to the Dee have been increasing in recent years. The estimated run of MSW salmon at Chester in 2018 (mainly 2-sea winter fish) was 2,503 - the third highest to date (maximum 2,744 fish in 2009).

This means that MSW fish now dominate the salmon run on the Dee comprising 66% of the total, when, less than 20 years ago, grilse made up 70-80% of a much larger return.

The Dee is not alone in experiencing a marked reduction in the overall abundance of returning salmon in recent years linked to a decline in grilse numbers. For example, the same pattern of decline is also evident on most index/counted rivers in E&W.

The long-term data set from the Dee indicates that this may be part of a cyclical pattern - with the contribution of 1SW salmon in the last few years appearing similar to that 50 years ago when around 80% of the return was made up of MSW salmon (Fig. 2).

Fig. 2 Sea age composition of salmon on the Dee, 1960-2018



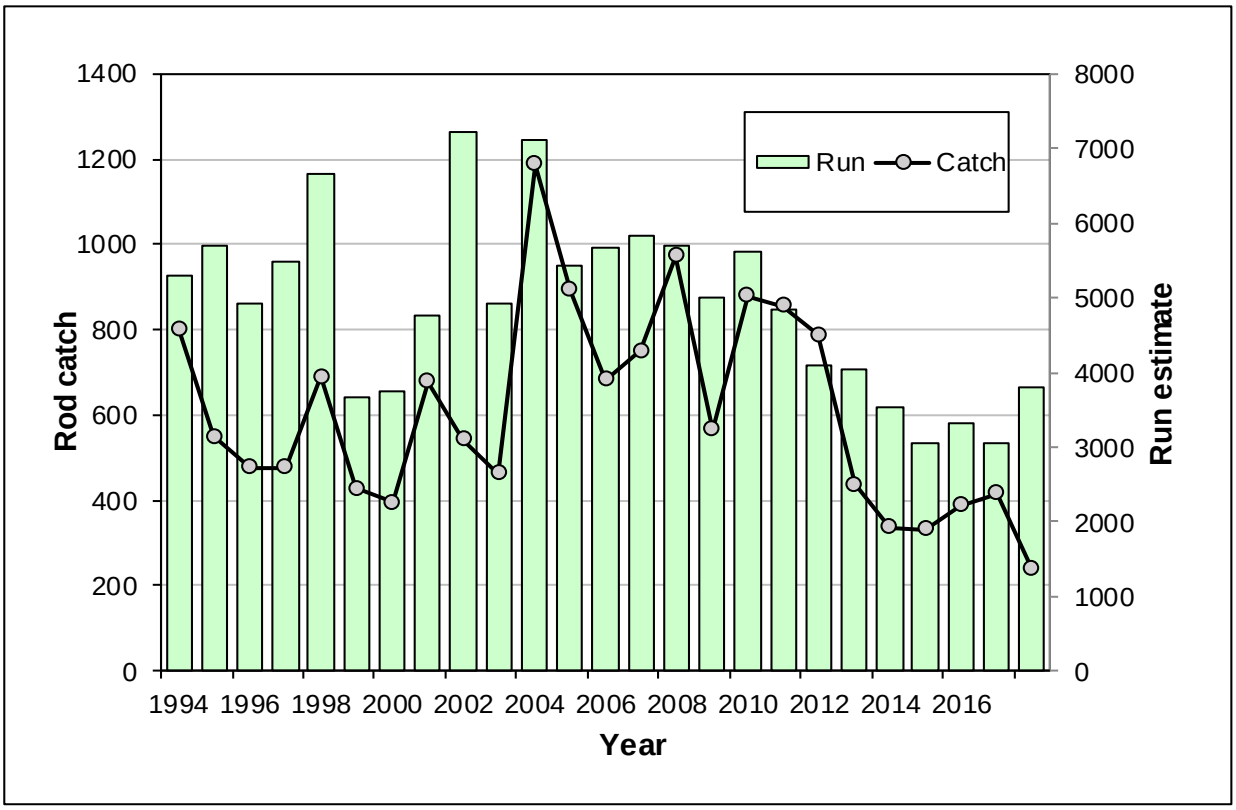
Others have commented on the long-term cyclical changes in abundance of grilse and multi-sea winter salmon evident from historic data sets and have linked these to similar cyclical processes affecting environmental conditions in the North Atlantic. See, for example, the recent video produced by the Tweed Foundation: https://www.youtube.com/watch?v=5DjuyMzxpt4

While we may be experiencing the trough of such a cycle now, there is no certainty that this is the case. Factors such as global warming - not so evident or potentially damaging 50 years ago may also be at play. The precautionary response is to take steps now to protect stocks and not to be complacent and expect a natural recovery which may take a decade or more to be realised, if at all.

Rod catch: Licence returns to date indicate a declared rod catch on the Dee of 238 salmon. As it stands, this is the lowest catch on record (back to the 1950s). In part this reflects the low numbers of salmon returning to the Dee last year (as described above), but also the poor angling conditions experienced in 2018 - affected by the warm, dry summer. As a likely consequence of the latter, the estimated angling 'exploitation rate' on Dee salmon in 2018 (i.e. the proportion of the annual run caught by rod fishermen) was the second lowest to date at 7.6%. This compares, for example, to the previous 10-year average rate of 14.0%.

Of the 238 salmon caught in 2017, 224 or 94.1% were released by anglers - the highest catch-and-release rate to date and the second year in succession that release rates have exceeded 90%.

Fig. 3 Salmon rod catch and run estimates at Chester Weir, 1994-2018



As might be expected, there is a good degree of correspondence between the salmon rod catch on the Dee and the estimated run of fish at Chester Weir (Fig. 3). This is also true for a number of counted rivers - where angling catches and counts of returning fish are also highly correlated. These relationships provide assurance that catch data serve as meaningful indices of the numbers of salmon (and sea trout) returning to our rivers.

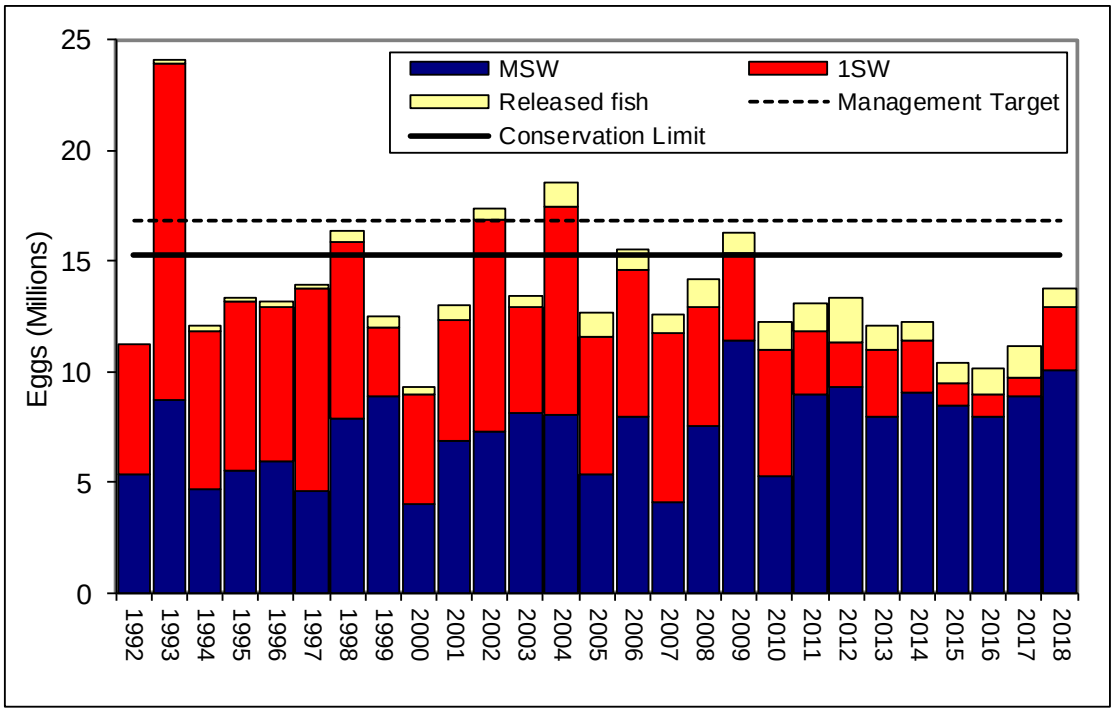
Spawning escapement: Estimates of the numbers of spawning salmon and the eggs they deposit are based on the run at Chester Weir minus losses to the rod fishery and other sources of mortality. Estimates also take account of the sex ratio of returning fish sampled at Chester (as judged from external appearance - 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 on the Dee in 2018 is 13.79 million eggs produced by ~3,400 spawners. Of these, just under 200 spawners were estimated to have been rod-released fish contributing 0.85 million eggs. For the ninth 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).

The 'Management Objective' for all salmon rivers in Wales (and England) is that stocks should meet or exceed their Conservation Limit 80% of the time, or 4 years out of 5, in the long term.

To assess whether this Management Objective is being met, a trend based statistical compliance procedure is applied to egg deposition estimates from the last 10 years. This procedure tests whether a stock is formally passing ('not at risk') or failing ('at risk') its Conservation Limit, or has some intermediate status ('probably not at risk' or 'probably at risk').

Fig. 4 Salmon egg deposition 1992-2018



The Management Target provides an indication of the average number of spawners required (expressed as eggs or adults) to ensure compliance with the Management Objective.

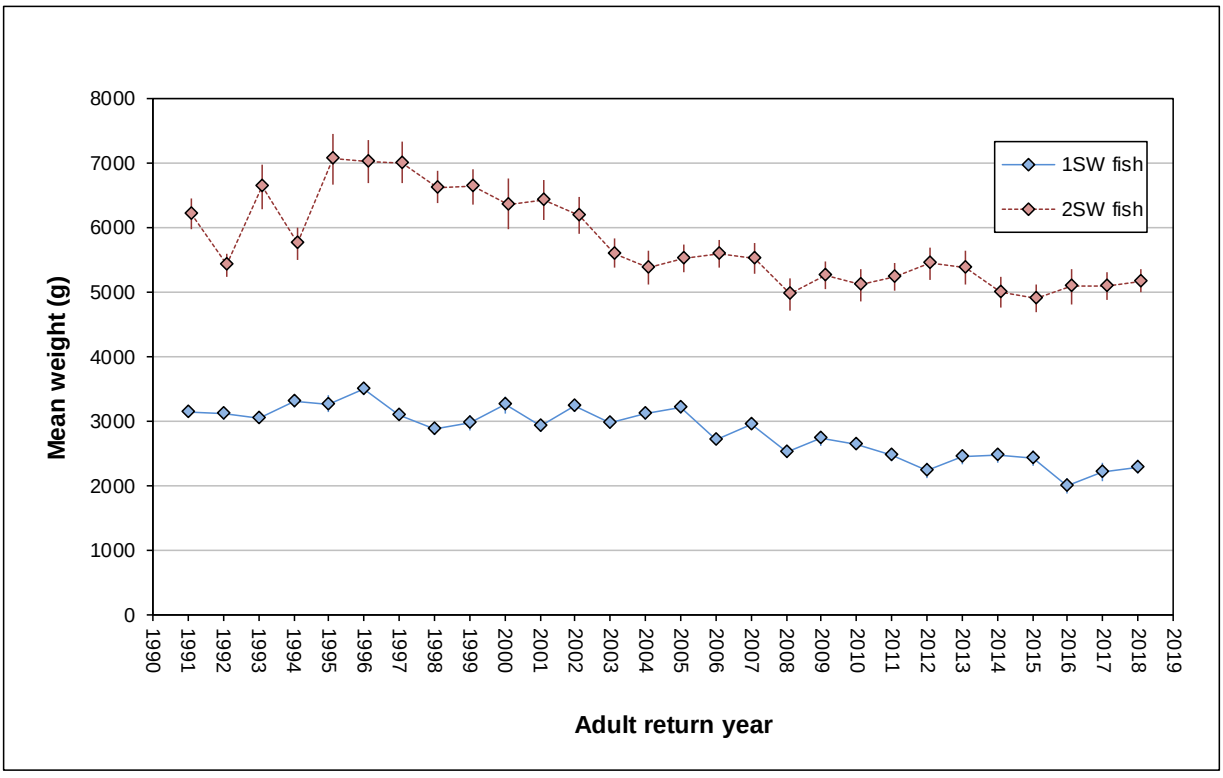
The Management Target is a 'target' reference point (i.e. something to 'aim at') whereas the Conservation Limit is a 'limit' reference point (a lower threshold below which stocks become increasingly vulnerable and which we want to avoid). Statistical compliance procedures ensure there is a high probability (in our case an 80% probability) that stocks classified as healthy are indeed above their Conservation Limit.

This terminology and the associated assessment procedures - in place in E&W since the early 1990s - are in line with the now long-standing recommendations of ICES (International Council for the Exploration of the Sea) and NASCO (North Atlantic Salmon Conservation Organisation). Conservation Limits are applied in a similar way by other jurisdictions (e.g. in Ireland and Scotland), with similar management consequences for failing stocks.

Conservation Limit compliance assessment in Wales in 2017 classified virtually all river stocks of salmon as either 'at risk' or 'probably at risk', with most exhibiting a declining trend over the last decade. Provisional results for the Dee in 2018 classified the stock as being 'probably at risk', a slight improvement on the last three years when the Dee stock has been in the worst 'at risk' category.

Changes in the size and condition of Dee salmon: As noted in earlier reports, the size of salmon returning to the Dee has shown a general pattern of decline over the last ~25 years.

Fig. 5 Variation in the weight of Dee salmon, 1991-2018



For example, Fig. 5 shows changes in the average weight of 1SW and 2SW fish sampled at Chester trap since the Dee programme began in 1991. This indicates that the average weight of 1SW and 2SW salmon in the last 5 years at 2.3 and 5.0kg (or around 5 and 11lbs, respectively) has, in both cases, fallen by around 30% compared to fish returning in the late 1990s.

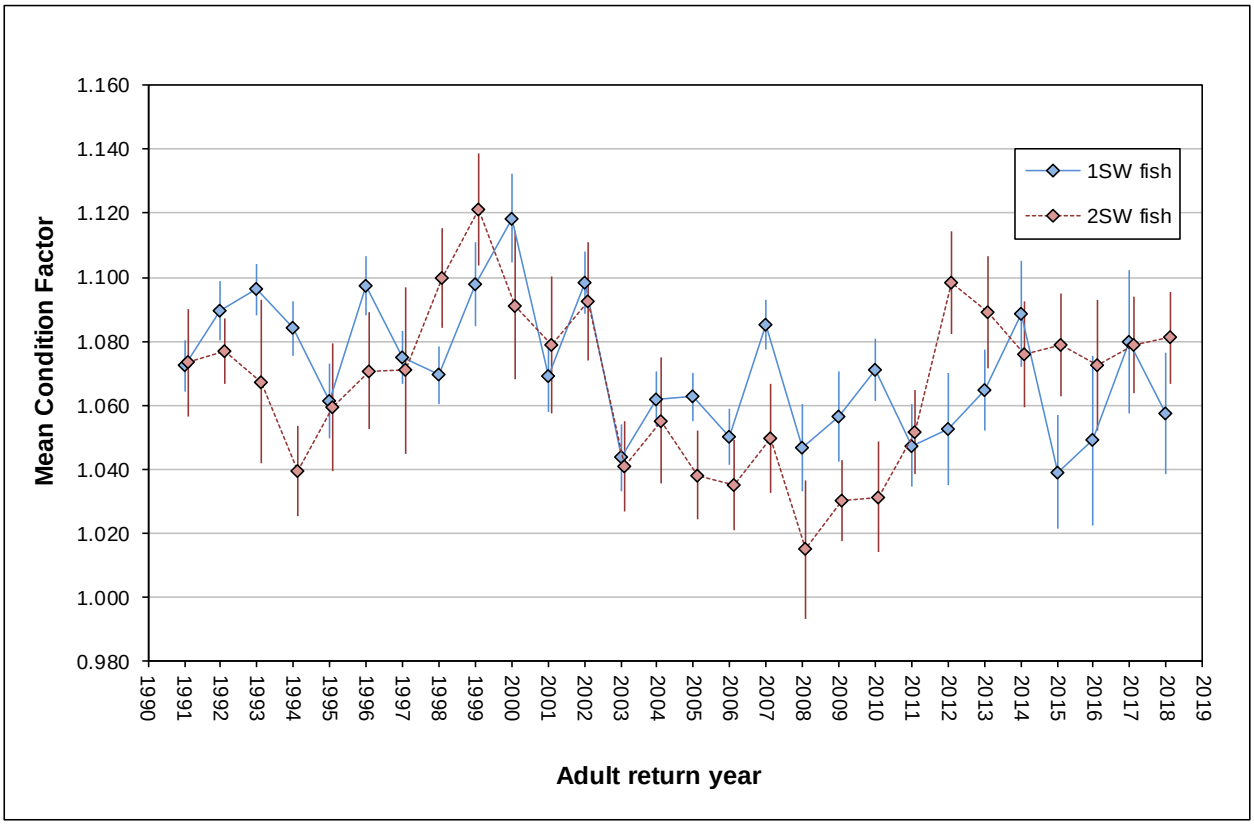
Furthermore, this equates to a similar rate of decline in the estimated numbers of eggs carried by those fish. Hence the decline in egg deposition on the Dee in recent years (with associated consequences for compliance with Conservation Limits) has resulted not only from fewer fish returning to the river, but smaller fish.

This is pattern of decline in the size of returning salmon is not just evident on the Dee but has been on reported on other monitored rivers, and suggests that common factors are involved, for example, relating to feeding conditions at sea.

On the Dee, complete closure of the net fishery in 2010 through buy-out by fisheries interests, coupled with the significant efforts of anglers over recent years to increase catch-and-release levels, will have moderated the adverse effects of these changes on egg deposition levels. These measures continue to help conserve the Dee salmon population and build resilience in difficult times.

In addition to the general pattern of decline in the size of salmon, there has also been concern in recent years about the condition or 'fatness' of retuning fish - evidenced, for example, in reports of 'skinny grilse' and studies linking poor condition to falling sea survival.

Fig. 6 Variation in the condition of Dee salmon, 1991-2018



'Condition Factors' calculated for salmon sampled at Chester Weir (Fig. 6) indicate that, following a general downturn in the condition of 1SW and 2SW recorded in the 2000s, there has been some recovery to more usual levels (but with a good degree of year-to-year variation, particularly among 1SW fish).

Run timing: The marked decline in the return of 1SW salmon (or 'grilse') reported on the Dee (and elsewhere) in the last few years has also been accompanied by changes in run timing - with the grilse return now much earlier, on average, and more 'compact' than in former years.

This is illustrated in Fig. 7 below where, for example, in 2009 the average return date for grilse at Chester was the 24th September, with half the fish (identified by the 'boxed' area in each annual symbol in Fig. 7) arriving between the 11th September and the 2nd October. In 2018, the average return date was much earlier - namely the 8th August, with half the fish arriving between the 1st and 22nd August - i.e. a notable change in run timing in the space of 10 years or so. Furthermore, the open circles in Fig. 7 ('outliers' from the main body of returning fish) indicate that late run 'out-of-season' fish occur much less frequently then they used to.

In contrast to grilse, the run timing of 2SW salmon at Chester has been more consistent over the time-series (Fig. 8).

Fig. 7 Changes in run timing of 1SW salmon at Chester Weir, 1992-2018

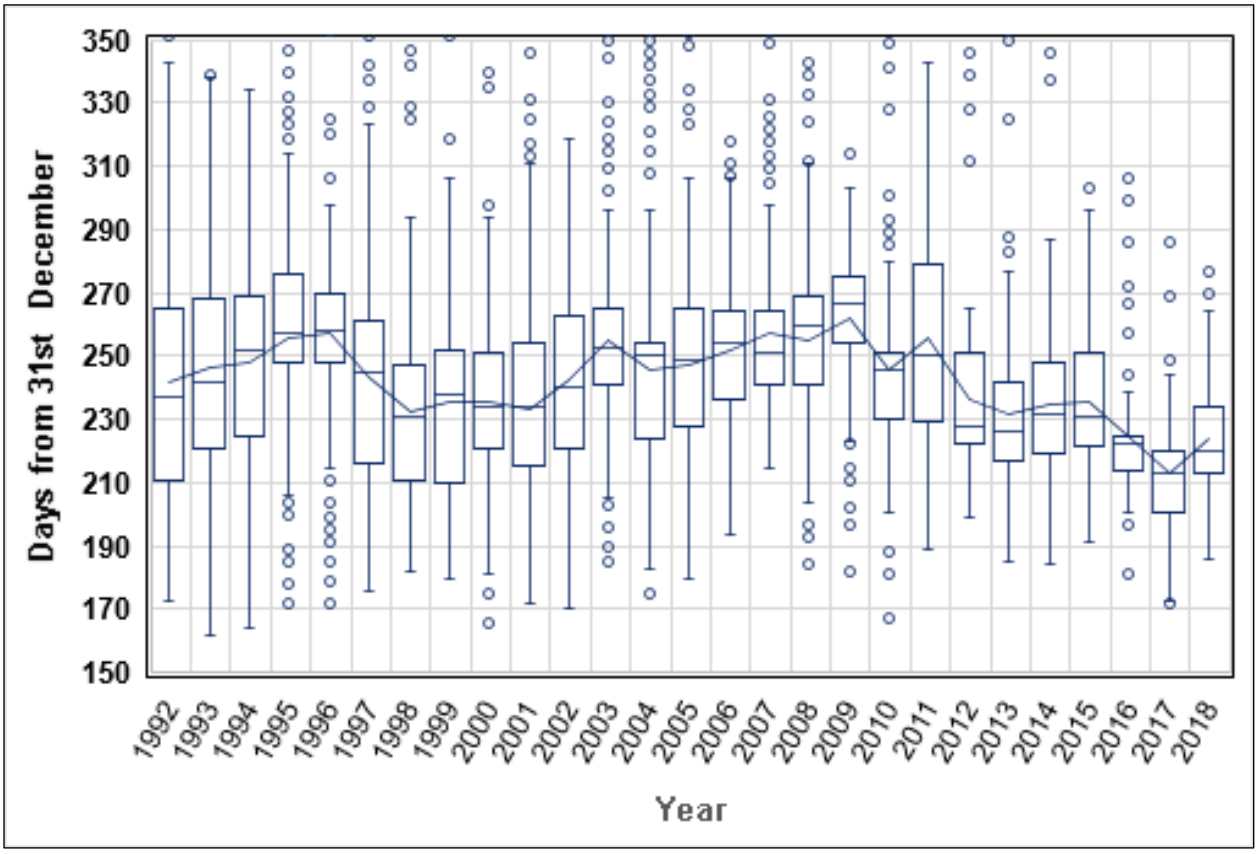
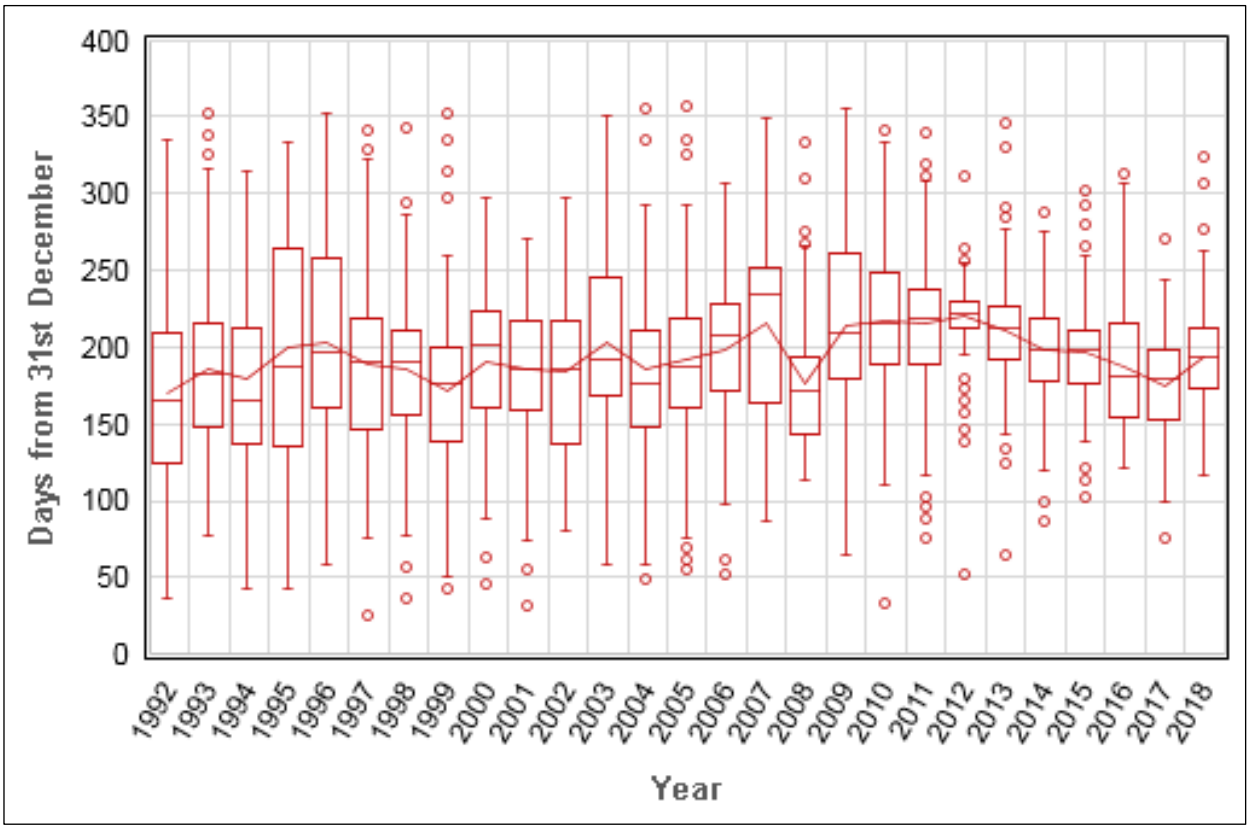


Fig. 8 Changes in run timing of 2SW salmon at Chester Weir, 1992-2018



4. Dee Sea Trout in 2018

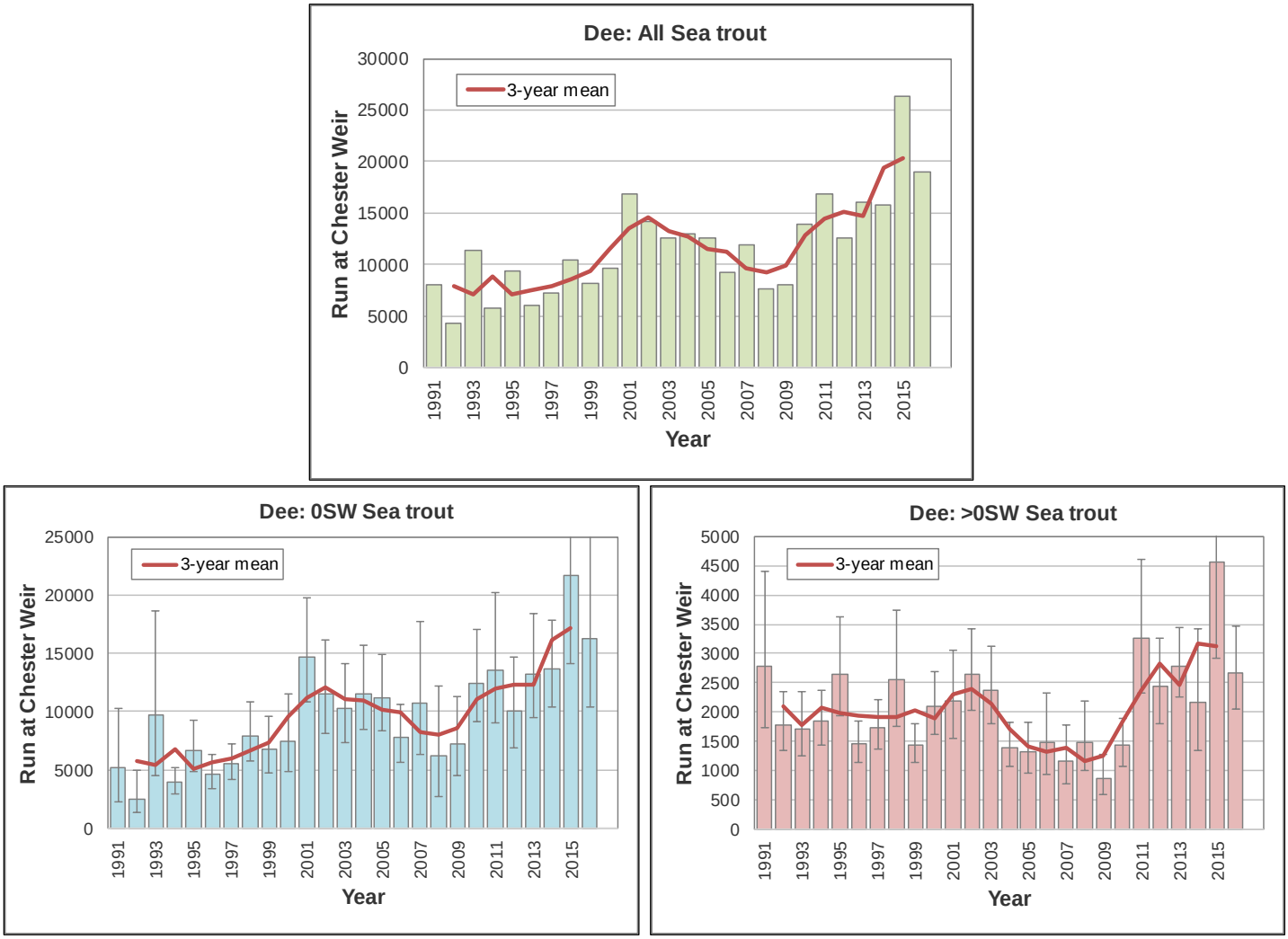
Run size: As described in Section 2, run estimates for sea trout on the Dee rely on the recapture of tagged fish back at Chester trap in the year after tagging - and so are 12 months behind those of salmon.

Sea trout run figures for 2017 are still being worked up and so are not available for this report, however, run estimates for the years up to 2016 are shown in Fig. 9.

Separate run estimates are obtained for whitling (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. The provisional estimate for whitling in 2016 was the second highest to date at 16,309, and follows a peak run of 21,732 fish in 2015. Numbers of older sea trout were down to 2,670 fish in 2016, but remained above the long-term average of ~2,000 fish (Fig. 6).

In 2018, a total of 2,300 0SW and 872 >0SW sea trout were captured at Chester trap. The catch of 0SW fish was similar to that in 2017 (1,954), but numbers of >0SW fish were more the double the catch in 2017 (411).

Fig. 9 Annual run estimates for sea trout at Chester Weir, 1991-2016
(error bars indicate 95% confidence intervals)



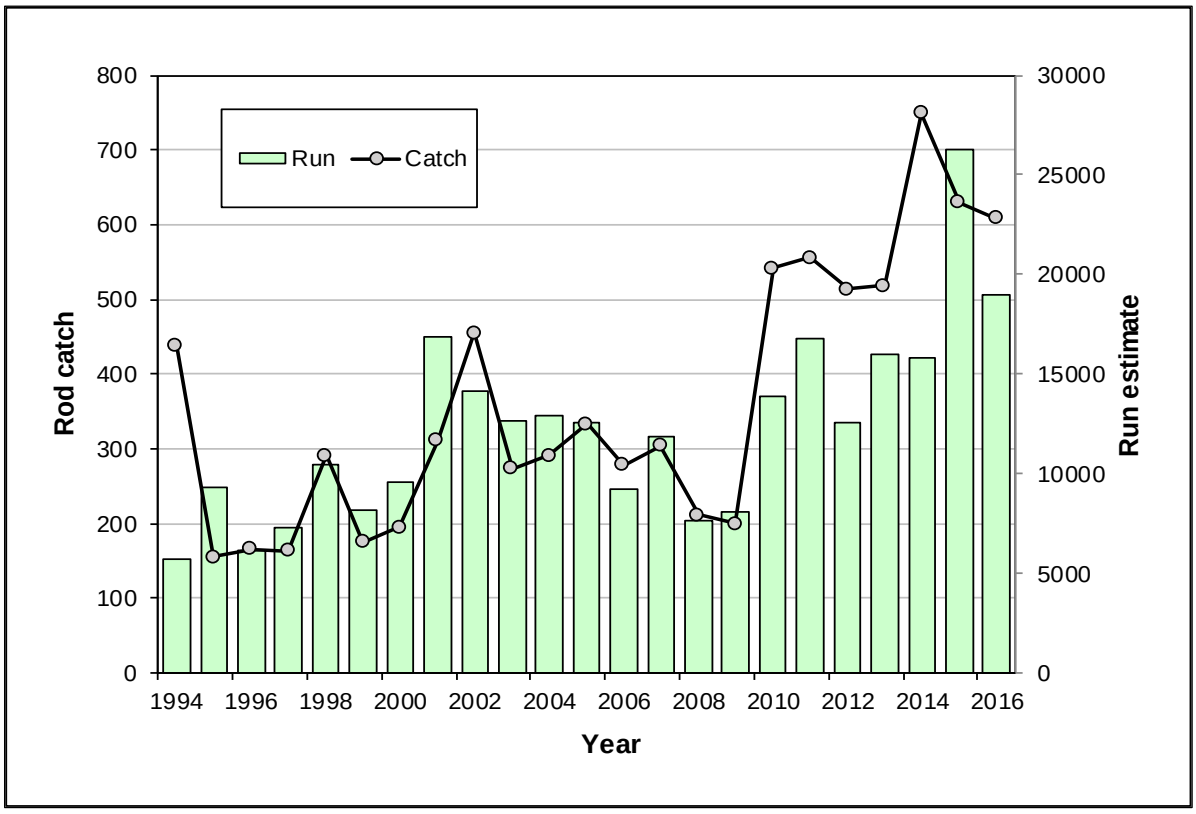
Rod catch: Provisional sea trout rod catch figures for the Dee in 2018 stand at 219 fish - the lowest catch in nine years and below the long-term average catch of 281fish. As with salmon, there is strong correspondence between declared rod catches of sea trout on the Dee and estimates obtained from the tagging and recapture programme at Chester trap (Fig. 10).

In 2017, a new method was introduced in Wales to evaluate the status of sea trout stocks. This derives Conservation Limits for individual river stocks and assesses compliance using approaches similar or identical to those used in salmon (for further details see:

https://naturalresourceswales.gov.uk/guidance-and-advice/business-sectors/fisheries/salmon-and-sea-trout-stocks-in-wales/?lang=en

Using these approaches the Dee sea trout stock was classified as ‘probably not at risk’ in 2017.

Fig. 10 Sea trout rod catch & run estimates at Chester Weir 1991-2016



5. Other developments.

Byelaw proposals: The Local Inquiry into the 'all Wales' net and rod byelaws, held at Newtown and latterly Welshpool, closed on the 7th March The Inquiry began on the 15th January but, because of over-run, was conducted in two sessions lasting around four weeks in total.

The Inquiry Inspector aims to report his findings to the Welsh Government Minister by the end of the week of the 13th May. Those findings will not be made public until a decision is made by the Minister.

In the meantime, net and rod fishing byelaws remain unchanged from last season. Virtually all Welsh salmon and some sea trout stocks remain in a poor state ('at risk' or 'probably at risk') and anglers are encouraged to practice full catch-and-release (C&R), building on the high levels of C&R recorded on many rivers last season.

Dee alternative mitigation: A number of projects have been underway in the last year including:

(i) In-river habitat improvement works on the main Dee downstream of the Bala gauging weir.

(ii) In-river habitat improvement works and construction of fencing and soft woody revetments on the Meloch.

(iii) Ranunculus removal and spawning gravel cleaning on the main Dee at Corwen above the A5 road bridge.

(iv) Provision of fencing schemes and buffer strips, easements and gravel traps on the Afon Hesgyn.

(v) Construction of a third large gravel trap on the Tryweryn (gravel areas created by this and previous traps have already been utilised by spawning fish).

Removal of *Ranunculus*

Placing boulders to create juvenile habitat

Hesgyn prior to work

Hesgyn post work

Tryweryn gravel trap

River Dee - LIFE bid: In 2018, NRW applied for EU LIFE funding for project work on the River Dee. The first-round bid was successful and has recently been followed by a full application for funding. The proposed LIFE project aims to modify a number of barriers to fish migration in the Dee catchment, improve instream habitat, and address poor land-use practices for the benefit of all the Dee Special Area Conservation (SAC) features (of which the salmon is one). If the bid is successful, the project should start in 2020 and run for five years.

Monitoring of Atlantic salmon and European eel in Wales is part-funded by the EU Data Collection Framework 2014-2020.
EU Funds: Investing in Wales

Cronfeydd Strwythurol a Buddsoddi Ewropeaidd
European Structural and Investment Funds