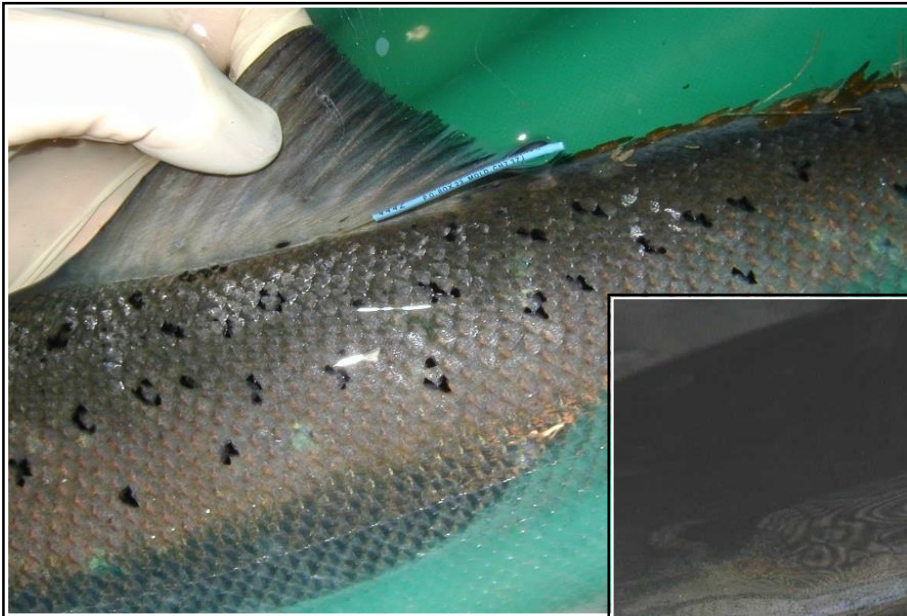


DEE STOCK ASSESSMENT PROGRAMME ANGLER REPORT 2015



Cyfoeth Naturiol Cymru
Natural Resources Wales

Front cover: Angling at Llandderfel (photo Gethin Morris)



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

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MARCH 2016

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1. Introduction

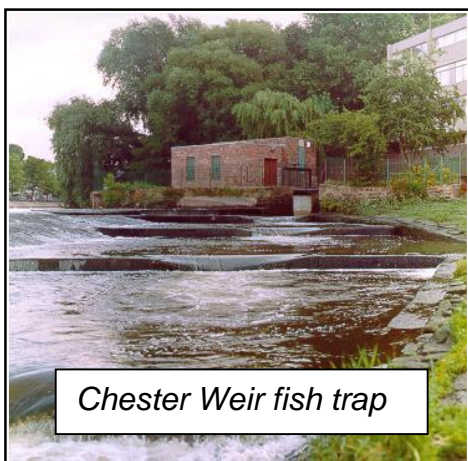
This report summarises provisional findings of the Dee Stock Assessment Programme (DSAP) and related work for 2015.

It is the third 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.



Chester Weir fish trap

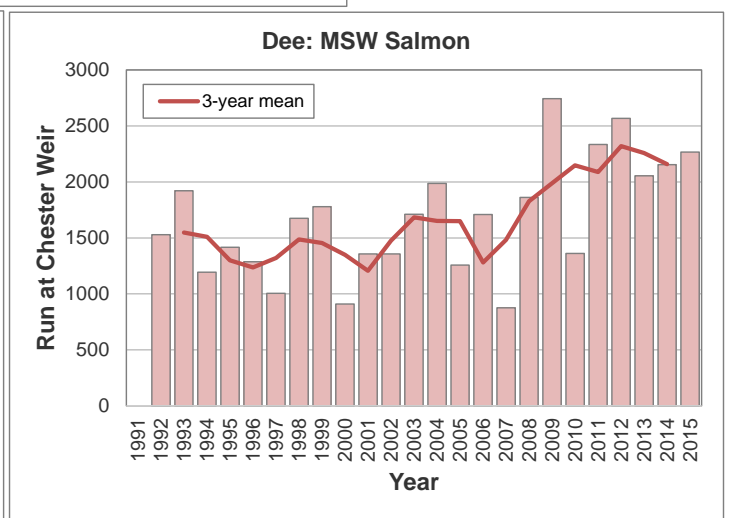
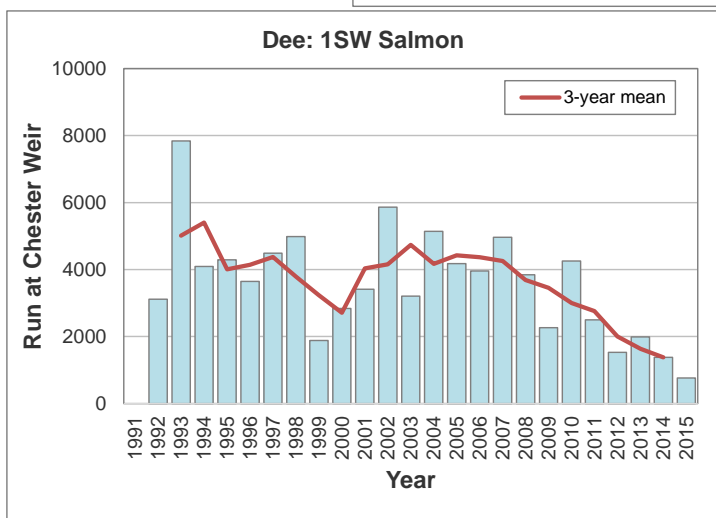
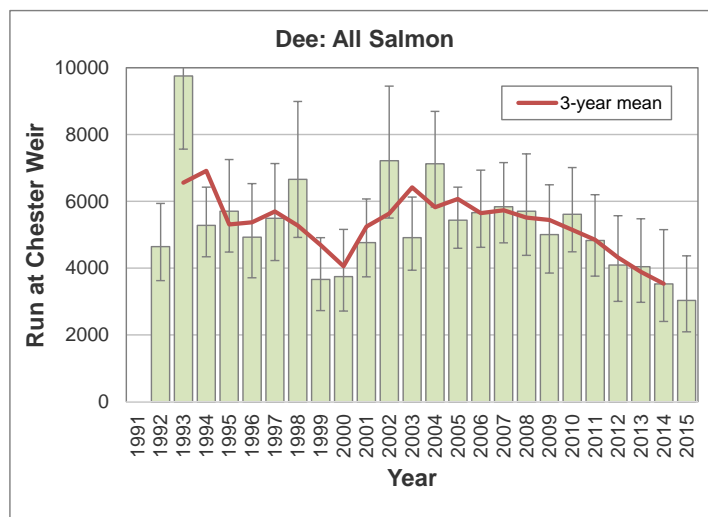
Trapping at Chester Weir is carried out throughout the year (January - December) but not continuously. When the trap is not being fished (around 40% of the time) it becomes an open channel through which fish can freely pass. For this reason, and because fish are able to cross the weir and bypass the 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.

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.

Fig. 1 Annual run estimates for salmon at Chester Weir, 1992-2015
(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 2015

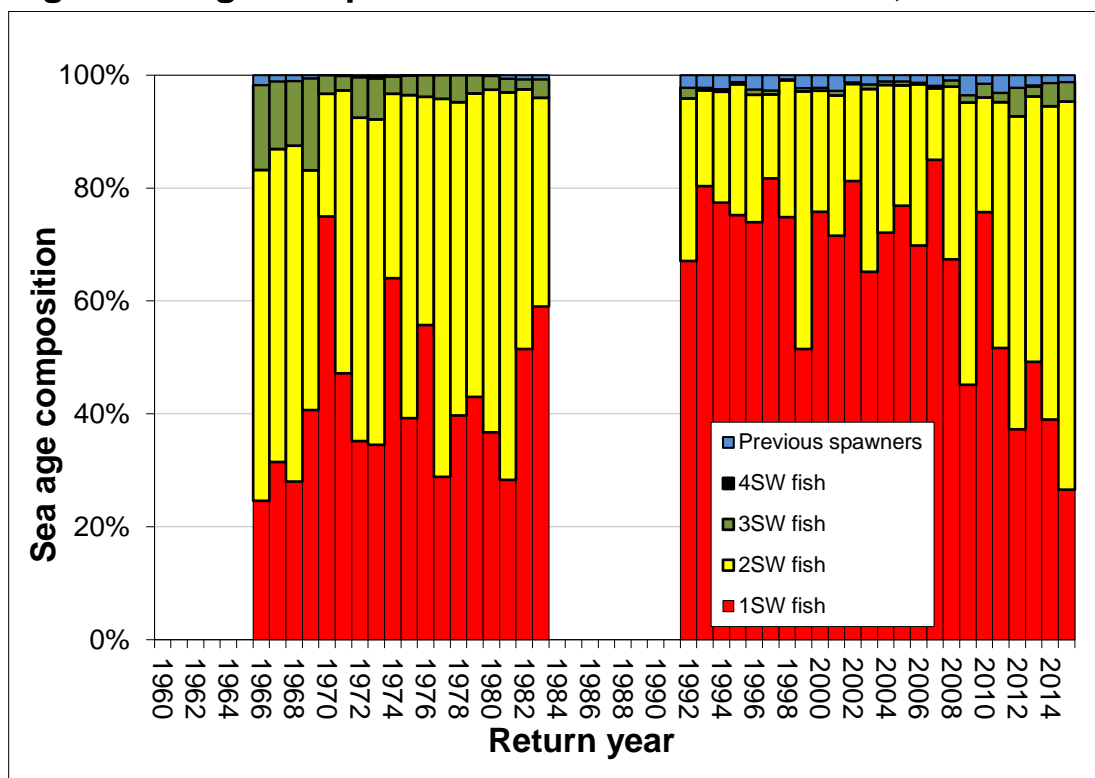
Run size and composition: Provisional results indicate a run of only 3,051 salmon (fish of all sea ages) at Chester in 2015; this is the lowest run to date and follows a previous minimum of 3,530 fish in 2014 (Fig. 1). The corresponding trap catch in 2015 was 493 fish.

The poor return in 2015 continues a worrying decline in the Dee salmon run as a whole since the mid-2000s - a pattern evident on many of the counted rivers in E&W and elsewhere in the UK.

This decline (on the Dee and other rivers) appears to be driven by a marked fall in the return of 1-sea winter (1SW) salmon or grilse. Grilse have dominated the Dee run (~75%) for most of the last 20+ years but now represent less than half of the return (only 27% in 2015) - the remainder made up of mainly 2SW salmon (Fig. 2).

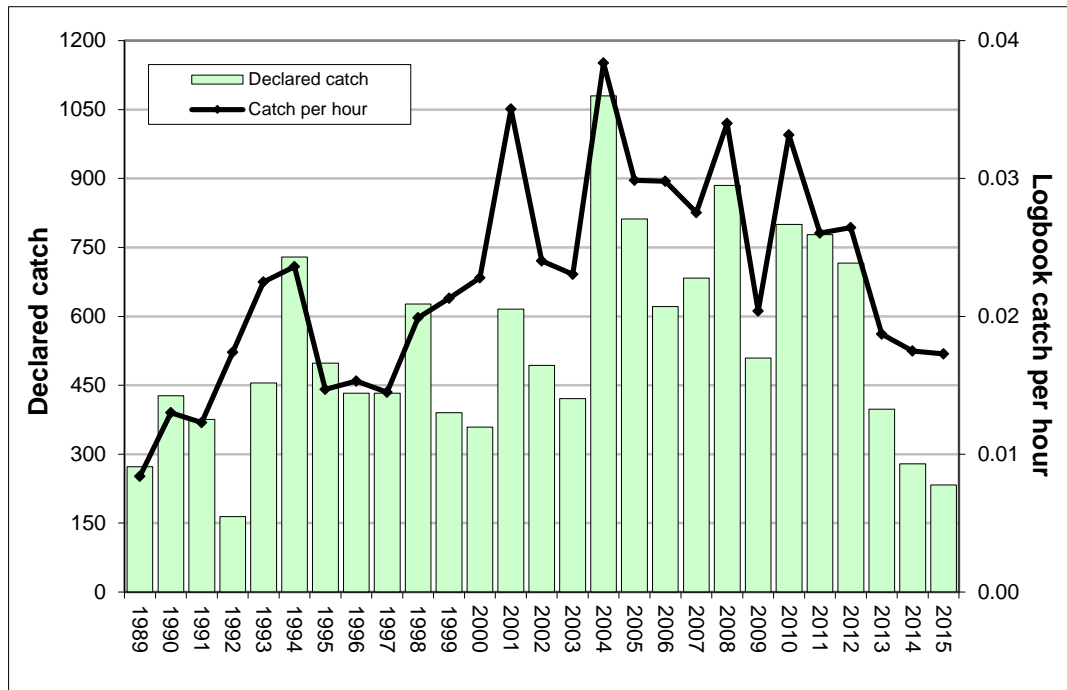
This change corresponds to a grilse run of under 2,000 fish in each of the last 4 years (only 766 fish in 2015) compared to a long-term average of over 3,500 (Fig. 1). In contrast, the estimated return of MSW salmon has been increasing since the mid-2000s - from an average of ~1,500 fish to over 2,000 in the last three years.

Fig. 2 Sea age composition of the Dee salmon run, 1966-2015



Rod catch: Licence returns to date indicate a declared rod catch of 233 salmon. Excluding 1992 - when the introduction of a single national licence meant catches were significantly underreported, this was the lowest catch in records going back to 1951 (the second lowest catches of 273 fish were declared in 1984 and 1989). Catch per hour figures from logbook returns reflect the poor catch in 2015 (Fig. 3).

Fig. 3 Declared salmon rod catch and logbook catch effort, 1989-2015



The salmon angling exploitation rate last season (i.e. the proportion of the total run caught) at 8.8% was among the lowest recorded. This was well down on the long-term average rate of 13% and the third season in a row when rates have been at or below 10% - a pattern probably related to a succession of relatively dry fishing years and particularly so in the latter part of the season (July onward).

Of the 233 fish caught, 201 or 86.3% were released by anglers. This is slightly less than last year's catch-and-release rate of 87.6% and remains below the 90+% target rate.

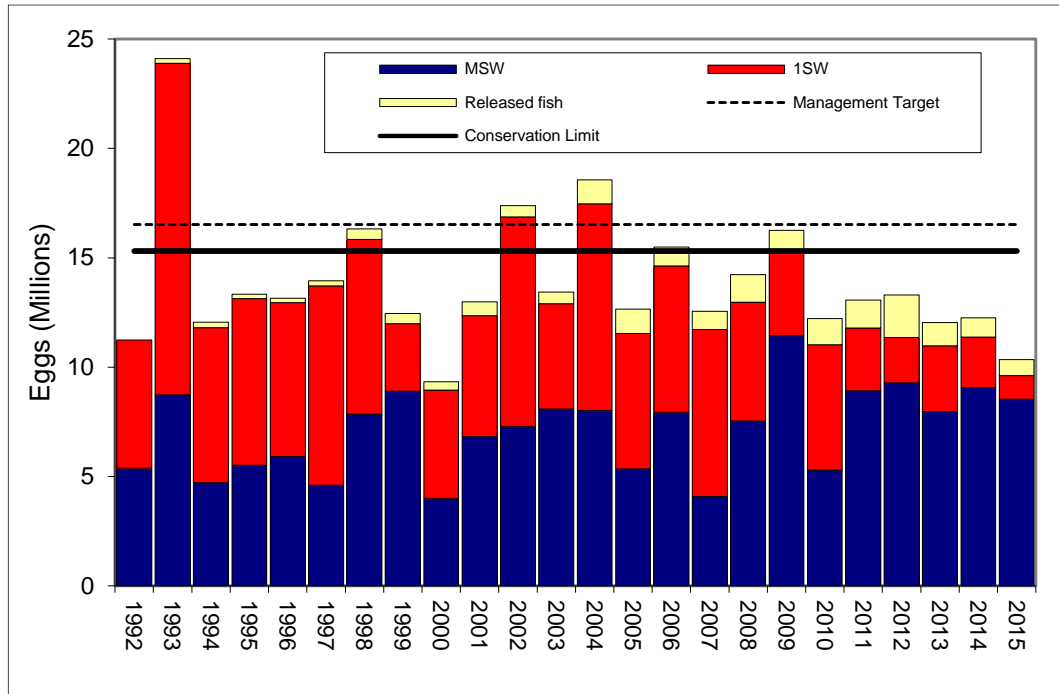
Spawning escapement: Estimates of the numbers of spawning salmon and the eggs they deposit are based on the run at Chester Weir minus losses to the rod fishery and other sources of mortality. They also take account of the sex ratio of returning fish sampled at Chester (as judged from external appearance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

The latest estimate of egg deposition for 2015 is 10.34 million eggs produced by around 2,700 spawners. Around 221 spawners were estimated to have been rod-released fish contributing 0.73 million eggs. For the sixth 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). However, 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, 1992-2015



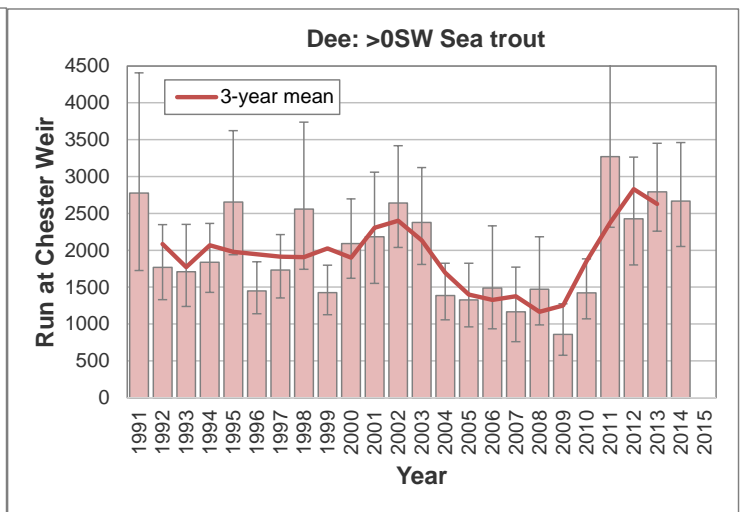
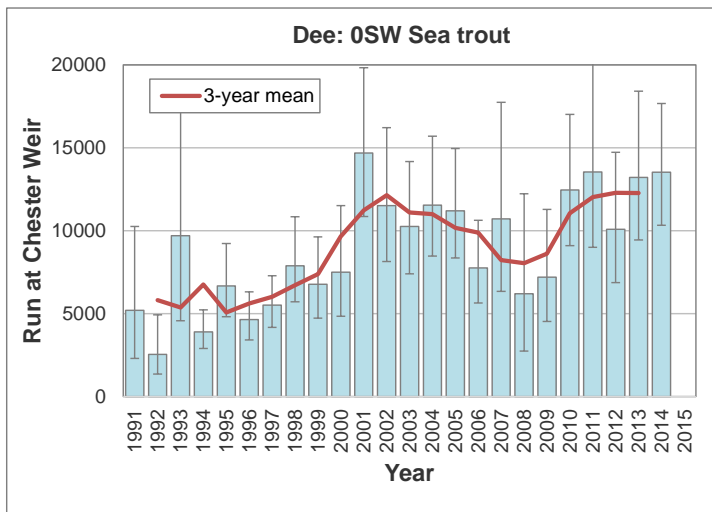
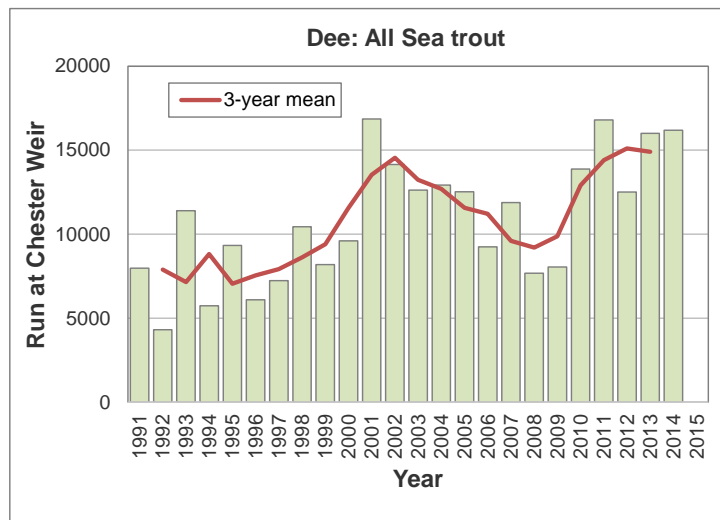
The situation has become particularly acute in recent years as marine survival rates appear to have fallen further and some of the biological characteristics of returning fish have been less than favourable (e.g. fish which are smaller and in poorer condition than in former times - see Section 5).

As a consequence, both Natural Resources Wales and the Environment Agency are considering options to better support and protect salmon stocks at what appears to be a critical time. This includes measures to improve environmental quality and river connectivity as well reduce the numbers of fish killed by the fisheries. For the latter, a questionnaire has been circulated to fishing interests in Wales to seek their views on options to increase C&R and post-release survival rates. For now, anglers across Wales are asked to continue improving C&R rates. In practice, on the Dee and many other rivers, this means aiming to release all salmon caught.

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, 1991-2014
(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 2014 are above the long-term average for both these groups at 13,523 for whiting and 2,667 for older fish (Fig. 5).

Whiting abundance has varied markedly over the years, reaching a peak of ~15,000 fish in 2001, followed by a general decline to just over 6,000 in 2008 (although numbers still remained above those recorded in most years in the 1990s). Since then, numbers have been building again to give an average run over the last five years of over 12,000 fish.

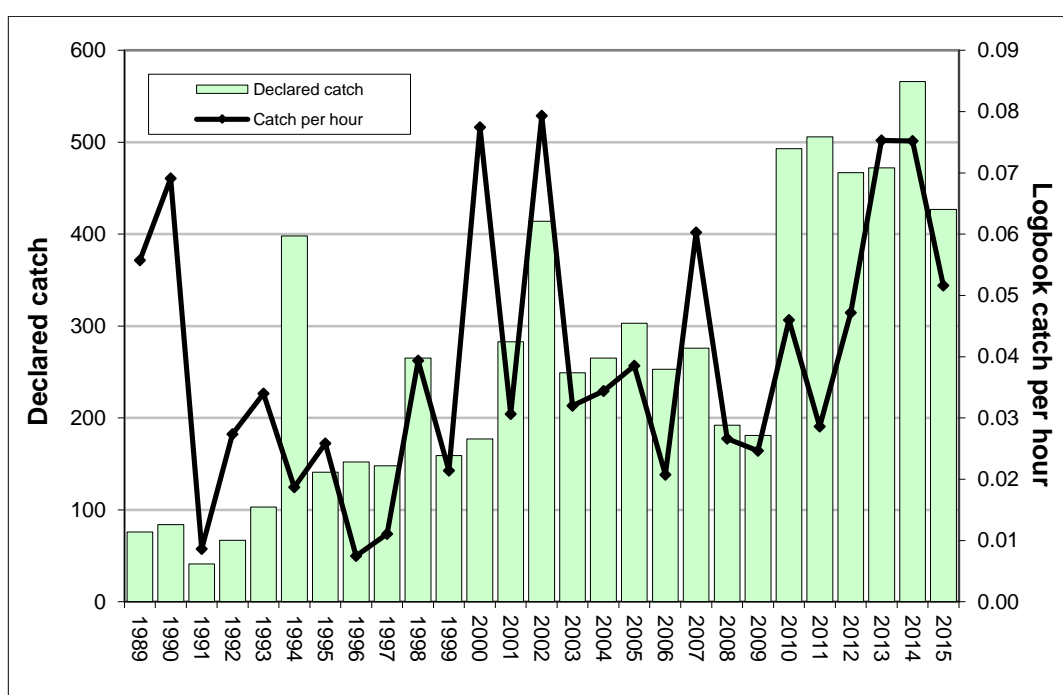
In contrast to whiting, the run of older sea trout has remained relatively stable over the last 20 years. After a period of gradual decline from the early 2000s, numbers have picked up sharply to levels close to or exceeding 2,500 in each of the last four years.

In 2015, the total trap catch of sea trout was the best to date at almost 6,500 fish, indicating another good year for both whiting and older fish.

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 across North of 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 2014 stand at 427 fish - down on last year's record total of 682, 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, 1989-2015



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 Dee sea trout stock.

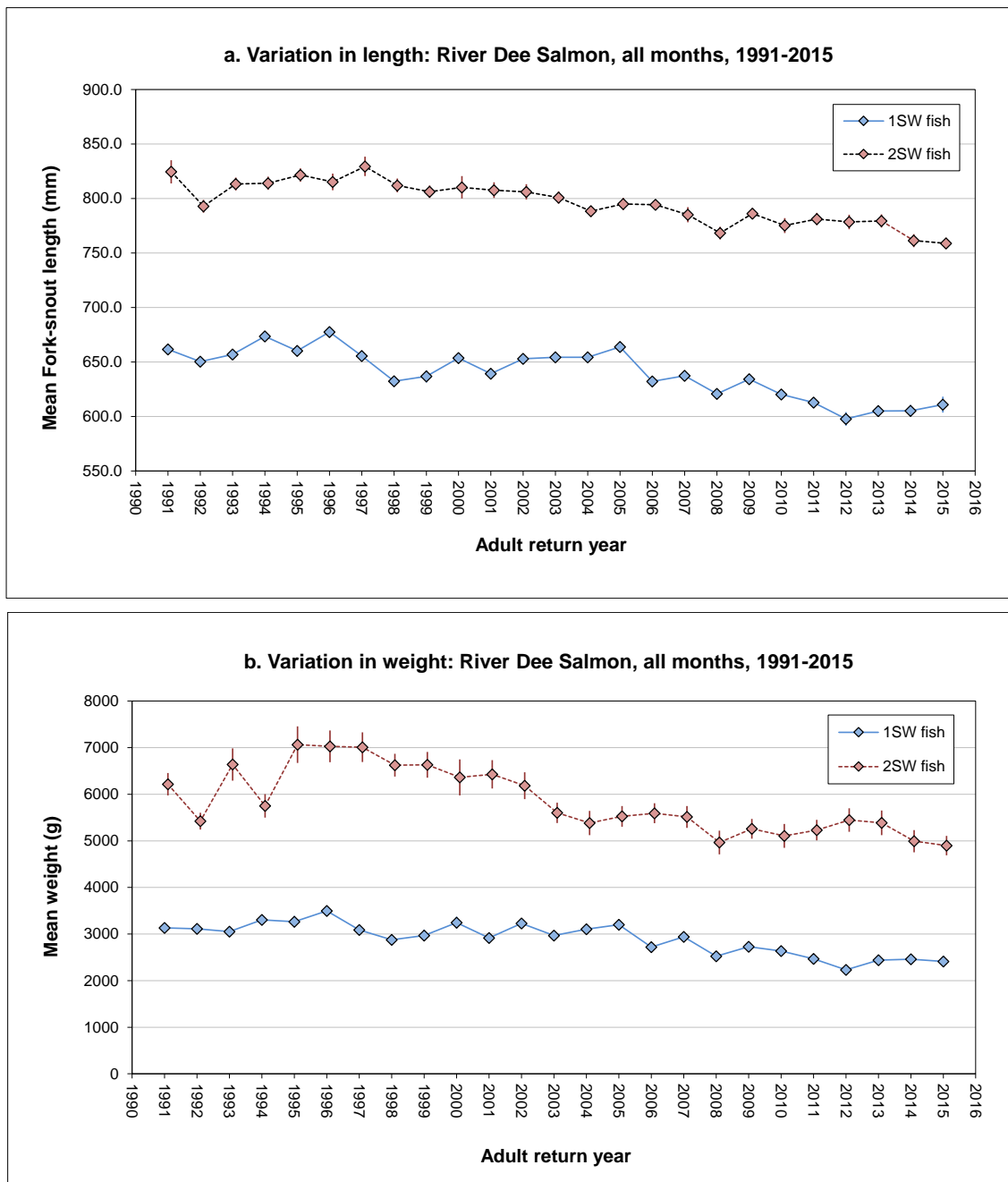
5. Biological characteristics of salmon and sea trout

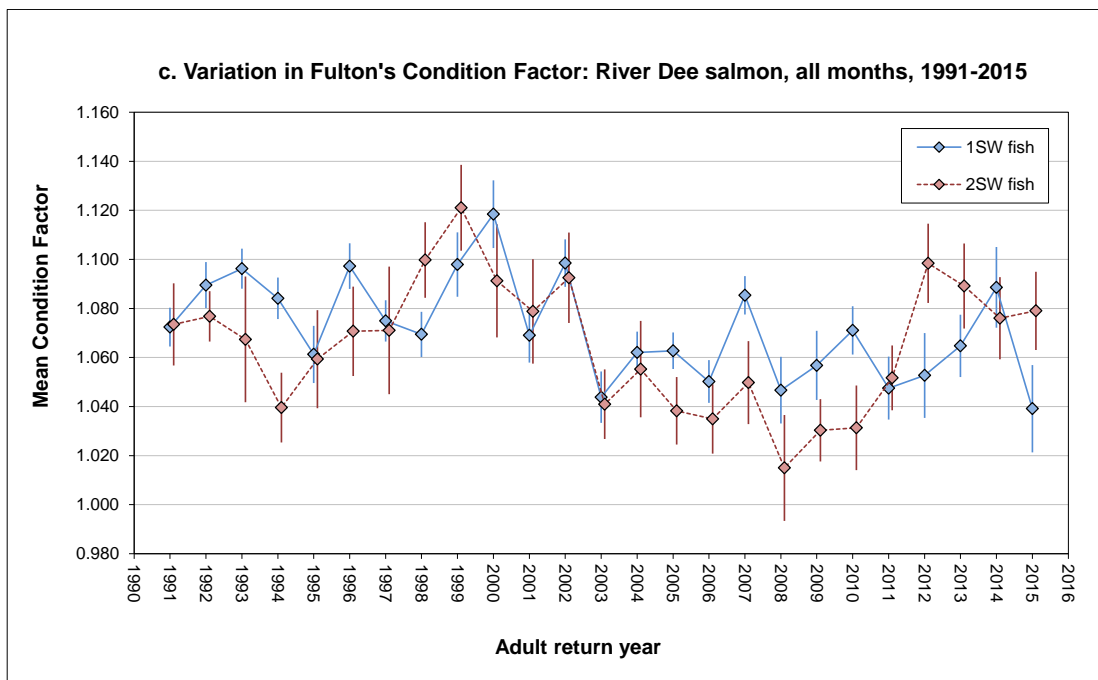
Alongside the marked changes in the sea age composition of salmon returning to the Dee in recent years - i.e. the decline in 1SW fish but upturn in numbers on MSW salmon, other changes, most notably in the size of adult fish, have been apparent.

For example, the average length and weight of both 1SW and MSW salmon sampled at Chester has declined steadily over the last 20+ years, and particularly so, it seems, from the mid-2000s (Figs. 7a and b). For the first 10 years of this period, 1SW and 2SW salmon had average weights of 3.2kg (6lb 15oz) and 6.5kg (14lb 4oz). In the last decade, those numbers have fallen to 2.6kg (5lb 10oz) and 5.2kg (11lb 9oz) - reductions of 20%.

Between 2002 and 2003 there was also a marked fall in 'condition factor' (a measure of 'fatness') for both 1SW and 2SW fish on the Dee (Fig. 7c). This coincided with reports on other rivers (e.g. in Scotland) of 'skinny grilse' and a general concern that changes in the marine environment were adversely affecting the quantity and quality of prey items available to salmon in the North Atlantic.

Fig. 7 Changes in the size composition of Dee salmon, 1991-2015





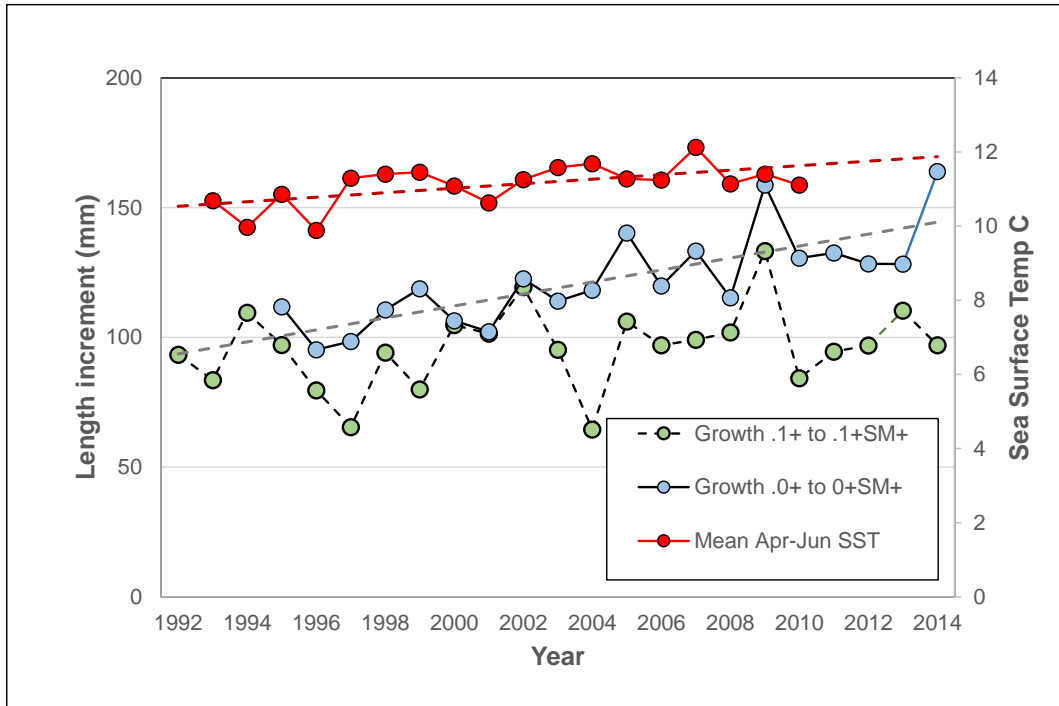
On the Dee, the condition of both sea age groups began to pick up around 2010 to levels similar to those at the start of the time-series; however, in the last few years, values have fallen back a little (the condition factor for 1SW fish in 2015 was the lowest recorded).

These reductions in the size of salmon are likely to be linked to the changes in abundance (and sea survival) seen in recent years. For example, changes in the marine environment may mean that fish have to remain at sea for longer to attain the size needed to mature and return (relating to the decline in grilse but increase in older sea age groups).

The return of fewer salmon to our rivers and fish which are smaller, on average, than they were 20 years ago is doubly problematic in terms of meeting the Conservation Limit, simply because larger (female) fish will carry more eggs and the more fish we have the better.

For Dee sea trout, the situation is different as fish appear to have been growing faster over the years. This is the case for post-spawning fish returning aged $.0+SM+$ and (to a lesser extent) $.1+SM+$ (Fig. 8); as well as post-smolts returning for the first time as whitling (not shown on Fig. 8). This period of improved growth corresponds to a gradual increase sea surface temperatures (SSTs) at relevant time of year and in off-shore areas where these fish are likely to be found (Fig. 8). While temperature, as such may not be the main cause of this increase in growth rate, related factors (e.g. food availability) could be.

Fig. 8 Dee sea trout growth rates and local sea temperatures, 1992-2014



6. Developments: Alternative Mitigation Project

Over the next 5 years Natural Resources Wales have committed to spend £110K per annum on improving the number of smolts produced in the upper Dee catchments through improving access to spawning areas and increasing habitat availability. This work will be delivered by NRW and external partners and a steering group of interested partners have been set up.



One project which was delivered in Autumn 2015, was on the Afon Mynach in the upper Tryweryn. This section of river was chosen because it had been over widened and was lacking in-river structure. Woody in-river structures and rocks were introduced to create parr habitat and the channel was narrowed in places to speed up the water, giving more depth & to create pools. This work will increase the holding capacity of this section of the river for salmon parr and will improve smolt output from the Afon Mynach.