



**Cyfoeth
Naturiol
Cymru**
**Natural
Resources
Wales**

Technical case supporting a public consultation on proposals for new fishing controls to protect salmon and sea trout stocks in Wales.

About Natural Resources Wales

Natural Resources Wales' purpose is to pursue sustainable management of natural resources. This means looking after air, land, water, wildlife, plants and soil to improve Wales' well-being, and provide a better future for everyone.

Evidence at Natural Resources Wales

Natural Resources Wales is an evidence based organisation. We seek to ensure that our strategy, decisions, operations and advice to Welsh Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well-resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

This document is the Technical Case produced by Natural Resources Wales to support decisions on new fishing regulations. It contains background, evidence and an appraisal to identify the preferred option to secure the future for our important salmon and sea trout stocks. It forms part of a collection of documents supporting a public consultation: please see:-

<https://naturalresources.wales/catchcontrols2017>

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EXECUTIVE SUMMARY

This technical document sets out the case for amendment of fishing controls to protect stocks of salmon and sea trout in Welsh rivers, and presents the concluding proposals for new byelaws to regulate fishing and the keeping of captured fish.

The technical case describes:-

- a. The application for a renewed 'all Wales' 2017 Net Limitation Order
- b. Proposals for new net and rod fishing byelaws across the whole of Wales (with the exception of the cross-border rivers dee, Severn and Wye)
- c. Proposals for new 'Cross Borders (Wales) Byelaws' to address matters in those three rivers.

The NLO ('a' above) and the Wales net and rod byelaws ('b' above) are both being progressed now with the NLO advertisement and the byelaw consultation being launched simultaneously. The border rivers byelaws ('c' above) will be launched later in the year.

It is the intention to seek agreement and approval by Welsh Government ('a' and 'b') and, in due course, Welsh Government and DEFRA ('c' above) to implement new measures prior to the 2018 fishing seasons.

There has been considerable investment in the science of salmon stock management throughout the countries where they exist. This is a result of the iconic nature of the Atlantic salmon and its extraordinary life cycle and requirements for high quality environmental conditions. But it is also because of the high value placed upon them for recreational purposes and as a sought-after food item.

Pressures on the salmon resource in England and Wales led to a Ministerial Direction in 1998 requiring the development of a scientific basis for their management and the production of Salmon Action Plans for 62 rivers designated as 'principal salmon rivers' and one estuary.

In Wales the sewin, or sea trout has a similar reputation and traditions. Its life cycle is very similar to that of salmon and in many of our rivers it is the primary migratory salmonid. However evidence for management of the species is constrained by its life cycle, which is inter-twined with the non-migratory brown trout in most rivers. This makes management on the basis of biological reference points challenging, however NRW has developed and is commending a new methodology to do this on our 33 main sea trout rivers.

Natural Resources Wales is now seeking views on its proposals to reduce the exploitation of salmon and sea trout in the rod and net fisheries in Wales.

This follows our review of evidence of stock status derived from catch statistics, and the emerging concerns of the status of juvenile fish populations across Wales.

The proposals would, if confirmed and implemented, see byelaws requiring statutory catch-and-release (C&R) fishing for salmon and some sea trout stocks, by rods and nets across most of Wales. We are also proposing byelaws to ensure that angling methods used are commensurate with the highest rate of survival after release. Finally we are proposing amendments to net fishing seasons to protect important stock components of sea trout whilst also saving more salmon.

Our overall objective for salmon and sea trout is:-

“To protect, through the application of best-practice science and management, the sustainability of our natural resource of wild salmon and sea trout stocks in Wales.”

This paper sets out the technical case for our proposals by describing the status of stocks across Wales and considering issues around the exploitation of salmon and sea trout and the options to reduce this.

Over the past 20 years or so the status of most of our stocks of migratory salmonids has declined. Catches have reduced and the uptake of fishing has generally mirrored this. There is a complicated range of factors that has contributed to this, including the survival of fish at sea, the pressures on freshwater habitats, and past unsustainable fishing effort in high seas and other interceptory fisheries including some fisheries in home waters. Where feasible some of these pressures have been addressed or removed, however with few exceptions stocks have not returned to levels of historical abundance.

Although it seems clear that no stocks are at risk of extirpation, it is also clear that re-building to a position of sustainability is essential if exploitation is to be allowed. Our position is that stocks may be exploited when they are sustainable but until they are we must ensure that pressures are moderated or excluded in order to achieve this goal.

Salmon is a species listed under Annex 2 of the EC Habitats Directive and currently supports the designation of 6 *Natura 2000* sites across Wales. Both salmon and sea trout are listed as UK BAP (Biodiversity Action Plan) priority species. Both are therefore regarded as most threatened and requiring conservation action.

Under the Environment (Wales) Act 2016, there is a duty on public authorities to:-

“seek to maintain and enhance biodiversity so far as it is consistent with the proper exercise of those functions. In so doing, public authorities must also seek to ‘promote the resilience of ecosystems’”.

Both species are included in the list of the living organisms of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales.

Evidence

We have considered 3 principal sources of evidence in concluding our preferred option for management change:-

Salmon

The most recent assessment of our stocks indicates that compliance with conservation limits and management targets across the whole of Wales is very poor.

20 of our 23 principal salmon rivers are either 'At Risk' or 'Probably at Risk' of failing to achieve their management objectives in 5 years' time. All but 2 of these are continuing to decline.

The only exceptions to this are the rivers Wye, Usk and Severn but only the Wye has a near statistically significant trend of improvement.

The status of salmon in 4 of the 6 *Natura 2000* sites is unfavourable.

Sea trout

Management of sea trout stocks has been constrained due to the lack of a system based on biological reference points. Such a system has been used for the management of salmon stocks for many years. NRW has now developed a similar process for sea trout, and this is described here together with the results.

21 of our 33 main sea trout rivers are 'At Risk' or 'Probably at Risk' of failing to achieve their management targets. In many cases there are significant egg deficits

Juvenile Salmonids

The results of recent monitoring programmes for juvenile salmonids have given rise to very serious concern. Following the exceptionally wet and warm winter of 2015/2016 there was a broad-scale reduction across most of Wales in the numbers of 0+ fry in the majority of rivers, including near-absence in some.

This will result in shortfalls in adult salmon runs, and possibly some sea trout, in coming years, mainly in 2019 – 2020. We have also considered this and the general status of juvenile salmonids in concluding our options for management.

It is important to note that there is inevitable uncertainty around the predictions of both stock assessment assessments and caution is needed in triggering management control. However by whatever measure, the current status of most of our salmon stocks, and some of our sea trout stocks, gives increasing serious cause for concern.

Having considered the available evidence, and applied the National decision structure for salmon stock management and the complementary approach for sea trout stock management, it is concluded that further reduction towards zero exploitation of fish is urgently required in most of our rivers.

Options

The key sections of this document that have shaped our proposals are Chapters 5, 6, 7 and 8.

We have considered the following options:-

1. **do nothing further, continuing to manage fisheries as we do now** - this will not achieve the required reduction in exploitation,
2. **reduce exploitation by nets and rods through a combination of:
byelaw controls on rods and nets**

and / or

fishing method control by voluntary catch-and-release fishing

Despite good uptake of this by most anglers in many rivers, it is clear that the urgently required reduction in exploitation is not evident,

3. **a 'zero kill' policy for salmon and some identified sea trout stocks through statutory catch-and-release fishing with appropriate restrictions on fishing methods** – regulation of exploitation through new byelaws,
4. **closure of specified net and rod fisheries** - this would result in negative socio-economic impacts

We conclude that Option 3 is required and propose the following measures for a 10 year period.

Salmon Rod fisheries

A. 'All rivers in Wales byelaws'

Statutory C&R fishing at all times in all rivers in Wales

Method controls	imposing prohibition on:- bait (worm, prawn and shrimp) treble hooks barbed hooks (barbless acceptable)
Exceptions:	The three cross-border rivers.

B. 'Border rivers byelaws'

Statutory C&R fishing at all times on 2 of the 3 cross-border rivers

Detail:

Wye	no change to existing statutory C&R measures (expiring on 31.12.21) new method control prohibitions (to expire on 31.12.21)
-----	--

Severn	no new byelaws proposed (currently 'Probably Not At Risk'). The Environment Agency takes integrated lead for fisheries matters. The river falls within EA planning under their "5 Point Approach Programme".
Dee	statutory C&R fishing at all times new method control prohibitions

Method controls prohibition on:-

- bait (worm, prawn and shrimp)
- treble hooks
- barbed hooks (barbless acceptable)

Note: NRW is working with the Environment Agency on the technical case and rod fishing byelaws for the Wye and Dee ("Border Rivers byelaws").

Salmon Net fisheries

- Statutory C&R fishing at all times in all fisheries.
- Revised start and finish dates for seasons (see sea trout measures).

Exception: Wye (Blackrock heritage lave net fishery).
The supporting stock is 'Probably Not At Risk'. Fishery catch capped at <2 salmon per licence under terms of a lease.

Sea Trout Rod fisheries

A. 'All rivers in Wales byelaws'.

Statutory C&R fishing in rivers in the period when net fishing is also constrained.

Method controls imposing prohibition on :-
bait fishing before 1st May (targeted rivers)
treble hooks (all rivers)
barbed hooks (barb-removed acceptable)(all rivers)

Method control: single hook (<8mm gape) only for bait fishing

Slot length - 60cm (the maximum length of fish that may be retained)

B. 'Border rivers byelaws'.

Detail:

Wye	No change to existing statutory C&R measures (expiring on 31.12.21) New method control prohibitions (to expire on 31.12.21)
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Severn no new byelaws proposed. The Environment Agency takes integrated lead for fisheries matters.

Dee New method control prohibitions.

Method controls prohibition (Wye and Dee) on:-
treble hooks
barbed hooks (barb-removed acceptable)

Method control: single hook (<8mm gape) only for bait fishing

Slot length of 60cm (all larger fish to be returned).

Note: NRW is working with the Environment Agency on the technical case and rod fishing byelaws for the Wye and Dee (“Border Rivers byelaws”).

Sea Trout Net fisheries

- Single consistent start of net fishing season in Wales on 1st May (delaying start by 1 month on:-

NeVERN, Teifi, Dyfi and by 2 months on the Tywi and Taf).

Other rivers to retain existing start-date of 1st May.

- Single consistent end date to net fishing season in Wales (bringing forward end date to 31 July on:-

Cleddau, NeVERN, Teifi, Conwy, Dyfi, Dysinni, Mawddach).

Other rivers to retain existing end-date of 31st July.

5. Proposed new NLO

A renewed NLO is important in order to regulate the number of net fishing licences issued for fishing in the public net fisheries around the Welsh coastline and estuaries.

We are advertising a new NLO to maintain the existing cap on the numbers of licences available. We are doing this as our proposals for new byelaws will facilitate regulation of netting activity and catches.

Our proposals

We are proposing to seek confirmation of a new NLO and new byelaws for a period of ten years for rod and net fishing in Wales. Separately we will consult on and seek confirmation of new rod fishing byelaws for the border rivers Dee and Wye.

Your response

We would like your views on our proposals and invite you to submit these using the form designed for the purpose which is available on our website here: <https://naturalresources.wales/catchcontrols2017>

Respondents on matters for the rivers Wye and Dee should note carefully where representations for either Wales or England are to be sent.

1. INTRODUCTION

This document is the technical case supporting our proposals for the further regulation of fishing, by rods and nets, for salmon and sea trout in Wales.

Natural Resources Wales (NRW) undertakes annual assessments of the status of stocks of these two species in most of our rivers. We report these locally to stakeholders and nationally to Non-Governmental Bodies (NGOs including, for example, rivers trusts); to Welsh Government and the UK Government and; via these, to international bodies including ICES (International Council for the Exploration of the Sea) and NASCO (North Atlantic Salmon Conservation Organization). This evidence is used to determine the status of our stocks and to identify management action that might be required to ensure their sustainability and, where necessary, to restore them to sustainability. In doing so we have regard to the abundance of stocks, their genetic variability and resilience to environmental pressures, and to their capacity to support exploitation by rod and net fishing.

1.1. Mission Statement

Our objective for the management of our salmon and sea trout stocks in Wales is shaped by our general duty under Article 4 of The Natural Resources Body for Wales (Establishment) Order 2012 to pursue sustainable management of natural resources and apply the principles of sustainable management of natural resources, as contained in S4 of the Environment (Wales) Act 2016, in the exercise of its functions.

<https://naturalresources.wales/media/678317/introducing-smnr-booklet-english.pdf>

and our duties to “..maintain, improve and develop fisheries...” placed upon us under the Environment Act (1995):-

<http://www.legislation.gov.uk/ukpga/1995/25/contents>

From this we draw our mission statement for the management of salmon and sea trout in Wales:

“To protect, through the application of best-practice science and management, the sustainability of our natural resource of wild salmon and sea trout stocks in Wales.”

1.2. Objectives

Our objectives for the management of our natural resource of salmon and sea trout are therefore:-

- To secure the health and sustainability of **Wild stocks**
- To manage fish stocks through the setting of **Quantitative Targets** and to seek sufficient **Abundance** to support sustainable rod and net fishing

- To manage fish stocks in a precautionary way to ensure the maintenance of **Diversity and Resilience**
- In securing the above objectives we aspire to deliver **Benefits for All**

Salmon and Sea Trout Stocks in Wales

Salmon and trout are widely distributed around Wales. There are 23 rivers designated as 'principal salmon rivers' following a Ministerial Directive in 1998 that required the derivation and initiation of a precautionary stock management system based on targets and annual compliance assessment (Annex 1). Many of these rivers are also significant for their sea trout stocks and fisheries and form an important part of our 33 main sea trout rivers and fisheries in Wales (Annex 2).

Six Welsh rivers are also designated under the Habitats Directive:-

[The Habitats Directive](#)

with salmon as one of the listed features, recognising their international significance and the need to conserve them.

All of these rivers have, at some point in the past, supported flourishing rod fisheries of local, national and, in some cases, international significance. Each has contributed significantly to the social and economic well-being of the areas in which they are located. Net fisheries have also been of considerable local value.

In most cases, stocks are currently performing poorly and are not in compliance with their conservation limits and management targets. Notably most salmon stocks are in poor condition ('At Risk' or 'Probably at Risk' of failing their management objective). Although this largely reflects an international reduction in stock abundance noted over the range of the species in the North Atlantic over the past two to three decades, it is important to note that there are also local constraints to the wellbeing of stocks.

Of major concern currently is the very poor status of the one-sea-winter salmon stock component (those fish that spend one winter at sea before returning to their natal river). These fish are commonly referred to as 1SW fish, or grilse. This stock component typically predominated in most of the smaller rivers in Wales and elsewhere, but are currently suffering high rates of mortality at sea. Larger salmon are typically 2SW fish (spending two winters at sea) with still older fish present in some rivers, notably the Wye. These are currently performing slightly better at sea, however in recent years their marine survival has also given cause for concern.

Sea trout stocks are depleted in some areas of Wales, mainly – but not wholly - in the south west of the country, whereas other populations in the north of Wales are performing better.

1.3. A shared vision

NRW is charged by WG with the implementation and discharge of relevant statutory duties for fisheries that require the sustainable management of populations of freshwater and migratory fish in Wales.

NRW notes that:-

- The fisheries of Wales are iconic, renowned, and highly valued contributing to viable, vibrant communities in Wales.
- Fish stocks are valued as an important natural resource and we seek to manage them within sustainable limits
- The status of Welsh fisheries is an indicator of the health and resilience of the natural resources of Wales. Several species support designations in 8 *Natura 2000* sites in Wales.
- Our vision is for sustainable wild populations of fish in Wales.
- We work towards the sustainable management of our wild fish resource – seeking to ensure that measures to regulate the fisheries provide the necessary protection to vulnerable stocks.
- In doing this, we broadly seek to achieve relative and appropriate equity between rod and net components of the fisheries.

1.4. Sustainable management

Sustainable Management of Natural Resources

The Environment (Wales) Act (2016) and the Well-being of Future Generations (Wales) Act (2015) together create modern legislation for managing the natural resources of Wales and improving the social, economic, environmental and cultural well-being of Wales. They will help us tackle the challenges we face and to take better advantage of the potential opportunities for Wales. The Environment Act focuses on building resilience into our ecosystems and recognising the benefits that they provide if we manage them in a smarter way.

Sustainable Management of Natural Resources (SMNR) is defined in the Environment (Wales) Act (2016) as:

“using natural resources in a way and at a rate that maintains and enhances the resilience of ecosystems and the benefits they provide. In doing so, meeting the needs of present generations of people without compromising the ability of future generations to meet their needs, and contributing to the achievement of the well-being goals in the Well-being of Future Generations Act.”

The new legislation will mean that, for the first time, public bodies must do what they do in a sustainable way. Public bodies in Wales need to make sure that, when making their decisions, they take into account the impact they could have on people living their lives in Wales in the future.

It will expect them to:

- work together better
- involve people reflecting the diversity of our communities
- look to the long term as well as focusing on now
- take action to try and stop problems getting worse - or even stop them happening in the first place.

The legislation establishes a statutory Future Generations Commissioner for Wales, whose role is to act as a guardian for the interests of future generations in Wales, and to support the public bodies listed in the Act to work towards achieving the well-being goals. It also establishes Public Services Boards (PSBs) for each local authority area in Wales. Each PSB must improve the economic, social, environmental and cultural well-being of its area by working to achieve the well-being goals.

Sustainability in salmon and sea trout stocks

Our fisheries duties are set out in the boxes below. The new Welsh legislation supports core duties for fisheries set out in national legislation (Environment Act, 1995; Marine and Coastal Access Act, 2009) to define a legal framework for the way in which NRW manages inland and diadromous fisheries resources. As set out in our mission statement above, we will manage the sustainability of our wild fisheries resource through the deployment of best practice science and management. We do so through the use of best available evidence, and we will seek to expand on this wherever possible, within the confines of the resources available to us.

1. Our statutory fisheries duties

We have a statutory duty to operate a licensing system for fishing under Section 25 of the Salmon and Freshwater Fisheries Act.

1. Natural Resources Wales has a duty under section 6(6) of the Environment Act 1995 “to maintain, improve and develop fisheries of salmon, trout, eels, lampreys, smelt and freshwater fish”.
2. Government guidance on this duty is:
 - to ensure the conservation and maintain the diversity of freshwater and migratory fish, and to conserve their aquatic environment
 - to enhance the contribution migratory and freshwater fisheries make to the economy, particularly in remote rural areas and in areas with low levels of income
 - to enhance the social value of fishing as a widely available and healthy form of recreation
 - Our role for fisheries encompasses protection of fish stocks and their environment and a service to anglers paid for from the rod licence duty to manage fisheries.

3. The powers to meet these duties are contained primarily in the Salmon and Freshwater Fisheries Act 1975 (including licensing of angling and net fishing), the Water Resources Act 1991 (including making of byelaws to regulate fishing), the Eels (England and Wales) Regulations 2009 (including powers to facilitate eel passage) and the Keeping and Introduction of Fish Regulations 2015 (including regulating the movement and introduction of fish).
4. There are specific powers relating to licensing of angling by rod and line and netting of fish in section 25 Salmon and Freshwater Fisheries Act 1975, which includes provisions for operating a licensing system for rods and nets and setting licence duties (fees) for them, and to authorising of other fishing methods in section 27A.
5. The duties and powers are imposed on Natural Resources Wales in relation to regulation of freshwater and migratory fisheries in Wales.
6. Natural Resources Wales also has a duty under section 6(1) of the Environment Act 1995 which requires us to promote the conservation and enhancement of the natural beauty and amenity of inland and coastal waters and of land associated with such waters; the conservation of flora and fauna which are dependent on an aquatic environment; and the use of such waters and land for recreational purposes.

1.5. International commitments

NASCO

The UK subscribes to NASCO (the North Atlantic Salmon Conservation Organisation), an international organisation established by an inter-governmental convention in 1984, and is a member of one of 6 parties represented by the European Union. The objective of NASCO is to conserve, restore, enhance and rationally manage Atlantic salmon through international cooperation.

NASCO and its parties have adopted and are applying a precautionary approach (NASCO, 1999) which is applied to the Atlantic salmon resource and the environment in which it lives.

The agreed approach requires that:-

“..... more caution is exercised when information is uncertain, unreliable or inadequate. The absence of adequate scientific information should not be used as

a reason for postponing conservation and management measures. The Precautionary Approach requires *inter alia*:

- consideration of the needs of future generations;
- avoidance of changes that are not potentially reversible;
- prior identification of undesirable outcomes;
- initiation of corrective measures without delay;
- priority to be given to conserving the productive capacity of the resource;
- appropriate placement of the burden of proof.”

NASCO has developed specific agreements in relation to:-

- management of fisheries;
- habitat protection and restoration;
- impacts of aquaculture, introductions and transfers and transgenics;
- stock rebuilding programmes;
- use of socio-economic factors in management decisions.

NRW, to which the fisheries duties and powers of Welsh Government are devolved, will follow the principles and guidance developed by NASCO in carrying out its statutory duties.

<http://www.nasco.int/>

The International Council for the Exploration of the Sea (ICES)

The ICES Working Group on North Atlantic salmon (WGNAS) provides scientific advice to NASCO on the status of stocks in the North Atlantic to inform management decisions and also provides catch advice for the mixed stock fisheries at West Greenland and the Faroes. Eastern Atlantic salmon stocks are assessed within the North-East Atlantic Commission (NEAC); stocks are divided between a northern stock complex and a southern stock complex. Wild salmon stocks in UK (England & Wales) are included as part of the southern stock complex, along with stocks in rivers in UK (Northern Ireland), UK (Scotland), Ireland, France and the south and west of Iceland.

In 2013 ICES provided assessments of NEAC stock status for 2013 to 2016 and advised that:

“on the basis of the MSY [maximum sustainable yield] approach, fishing should only take place on salmon from rivers where stocks have been shown to be at full reproductive capacity. Furthermore, because of the different status of individual stocks within stock complexes, mixed-stock fisheries present particular threats. The management of a fishery should ideally be based upon the individual status of all stocks exploited in the fishery” (CNL (13)8).

The assessments include model forecasts for the southern stock complex and its constituent countries, including England and Wales, of maturing and non-maturing Pre-Fisheries Abundance (PFA), 1SW and MSW Lagged Eggs, and the proportion of PFA maturing. The latest (2017) assessment for the southern stock complex notes:

- *“The abundance (PFA) of both maturing and non-maturing 1SW salmon show a general decline over the time period for both Northern and Southern NEAC.*
- *For Southern NEAC, both age groups were at full reproductive capacity prior to the commencement of distant water fisheries throughout the early part of the time-series. Since the mid-1990s, however, the non-maturing 1SW stock has been at risk of suffering reduced reproductive capacity in approximately 50% of the assessment years. The maturing 1SW stock, on the other hand, was first assessed as being at risk of suffering reduced reproductive capacity in 2009. For most years thereafter, the stock has either been at risk of suffering reduced reproductive capacity or suffering reduced reproductive capacity.*
- *In the latest assessment year, the Southern NEAC maturing 1SW and non-maturing 1SW stocks were both considered to be at risk of suffering reduced reproductive capacity in the latest PFA years (i.e. 2016 for the maturing fish and 2015 for the non-maturing salmon).”*

ICES is not asked to develop catch advice for homewater fisheries, but has previously noted that while the abundance of stocks remains low, particular care should be taken to ensure that fisheries in homewaters are managed to protect stocks that are below their CLs.

The EU Habitats Directive

The Council Directive 92/43/EEC (on the conservation of natural habitats and of wild flora and fauna) states that:

"If a species is included under this directive, it requires measures to be taken by individual member states to maintain or restore them to favourable conservation status in their natural range”.

The Atlantic salmon (*Salmo salar* L.) is a species listed in Annex 2 of the Directive. From a Welsh perspective, there are currently 6 rivers (or tributaries of rivers) designated as SAC's where salmon are a qualifying interest:–

Wye	UK0012642
Usk	UK0013007
Teifi	UK0012670
Eden Cors Goch Trawysfenydd	UK0030075 *
Gwyrfai and Llyn Cwellyn	UK0030046
Dee and Bala Lake	UK0030252

* Salmon is a primary reason for selection of each site except the Eden where it is present as a qualifying feature, but not a primary reason for site selection

The sea trout is not designated under the HD, however some populations support other designations, for example as features in SSSIs (Sites of Special Scientific Interest - designated under the Wildlife and Countryside Act, 1981, as amended by the Countryside Rights of Way Act, 2000).

In applying the HD, consideration must be given to all of the populations and not just specifically to these 6 rivers.

The conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within its territory. This *conservation status* will be taken as ‘favourable’ when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis...”

The HD specifically allows for provision to be made for management measures for salmon, if their conservation status so warrants, including the prohibition of certain means of capture or killing, whilst providing for the possibility of derogations on certain conditions.

Under the terms of the HD, every 6 years member states are obliged to submit a report detailing the conservation status of their salmon stocks. At the last report by the UK in 2013, the status of Atlantic salmon was reported as Unfavourable-Inadequate, because both population and future prospects were assessed as inadequate, especially in Wales and England:-

http://jncc.defra.gov.uk/pdf/Article17Consult_20131010/S1106_UK.pdf

Fishery management measures have been identified as instrumental in maintaining the number of spawning adult salmon over the long term, despite substantial reduction in marine survival.

Common standard monitoring guidance ‘*Condition assessment*’ for freshwater fauna (JNCC, 2015) sets out the protocol for monitoring and assessing Atlantic salmon populations in sites designated as SACs and SSSIs.

The population distribution, juvenile density and adult run size for the SAC river is assessed using electrofishing surveys, rod catch returns and, where available, fish counter and trap data. Compliance with Conservation Limits, set as egg deposition targets, are used to assess the status of spawning stocks at whole catchment scales. These analyses in conjunction with an assessment of environmental attributes such as river flow, habitat and water quality (JNCC, 2016) are used to classify the Atlantic salmon feature as either “Favourable” or Unfavourable” for each SAC river (JNCC, 2017).

Other international commitments for salmon and sea trout management

Other international agreements and conventions are also of relevance for the management of salmon and their environment:-

The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) (ETS No.104)

This convention, adopted in Bern Switzerland in 1979, came into force in 1982. The principal aims of the Convention are to ensure conservation and protection of wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention), to increase cooperation between contracting parties, and to regulate the exploitation of those species (including migratory species) listed in Appendix III:.

<http://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/104>

The Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention, EC Decision 82/461/EEC of 24 June 1982).

This convention deals specifically with the conservation of migratory species of wild animals.

<http://www.cms.int/>

The OSPAR Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic convention, 1992).

OSPAR is the mechanism by which 15 Governments and the EU cooperate to protect the marine environment of the North-East Atlantic.

<https://www.ospar.org/convention/text>

2. Assessing and managing stocks of salmon and sea trout in Wales

2.1. Monitoring stocks and fisheries

Monitoring programmes for salmon and trout/sea trout - targeting various life stages – have been long established by NRW and predecessor organisations and provide the evidence base to evaluate stock status and inform management decision making.

Key monitoring activities include:

- a) The collection, collation and reporting of rod and net catch statistics. These are available for most rivers and coastal fisheries in Wales since 1951 and for much longer for some rivers. Rod catches were recorded more consistently from 1975 when regional licence-based catch return and reminder systems were introduced. These were replaced in the early 1990s with a single, national (England and Wales) rod licence and catch return system which has collected catch and release, and fishing effort data in a broadly consistent way since that time.
- b) Annual monitoring of the abundance and distribution of juvenile salmon and trout populations since 1986 using electrofishing (EF) methods. The frequency and extent of annual EF surveys have been variable, however most rivers have core annual programmes which have remained largely consistent since 2002.
- c) Use of fish traps and fish counters – primarily to enumerate numbers of returning adult salmon and sea trout. This includes:
 - (i) the ‘index’ river monitoring programme for salmon and sea trout on the River Dee which began in 1991 (one of the longest running and most comprehensive programmes of its type in the North Atlantic region – see e.g. Davidson and Cove, 2017);
 - (ii) operation of an acoustic fish counter on the River Teifi - producing salmon run estimates since 2010 and
 - (iii) Cardiff Bay Barrage programme on the River Taff/Ely where NRW has operated a fish counter/trap (on behalf of the harbour authority) to provide salmon and sea trout run estimates since 2008.

Data from these sources is analysed and presented in Annex 3.

2.2. Management of mixed species

Most rivers in Wales support notable stocks and fisheries for both salmon and sea trout with relatively few rivers overwhelmingly dominated by just one of these species. The species are commonly targeted by fisheries at the same time and this can pose a number of dilemmas for management – particularly where marked differences exist in the status of the two species in any one system, and hence different degrees of management intervention may be appropriate. In such circumstances various ‘principles for management’ should apply:

- the weakest stock should take priority for management intervention
- the risk of a by-catch (incidental or intentional) damaging the weaker stock must be thoroughly assessed and addressed if a fishery is to persist
- the harvest (kill/take) of fish should only be permissible where the status of the stock allows (e.g. not on stocks classified as 'at risk')
- Rod and net fisheries should have equal access and opportunity to fish.

2.3. Salmon

Adult stock assessment procedures

Following the advice of ICES and NASCO, Conservation Limits (CLs) and associated Management Targets have been used to assess the status of salmon stocks in England and Wales (E&W) since the early 1990s. This approach was enshrined in a Ministerial Direction in 1998 which, among a number of actions, required Conservation Limits to be set and used to assess stocks annually on 64 principal salmon rivers in E&W.

The Conservation Limits derived for all 'principal salmon rivers' have been based on modelled stock and recruitment (SR) curves which relate spawner or egg numbers to smolt output (Figure 1). SR curves have been developed from river specific measures of the extent and quality of freshwater habitat. They also incorporate information from a SR relationship produced from long-term monitoring data collected on the River Bush, N. Ireland. See Annex 4.

Additional information on sea survival (the 'replacement line' in Figure 1) and the average sea age and size composition of returning stocks is also required to set the CL (again based on observations from index monitored rivers as well as river specific data).

CLs serve as a 'limit' reference point below which further reductions in spawner numbers are likely to result in a significant fall-off in smolt production.

Compliance procedures require that spawning levels are above the CL in four years out of five, on average, (i.e. 80% of the time) for a stock to formally 'pass' its CL. This is the 'Management Objective' and the associated 'Management Target' or MT (a 'target' reference point) defines the average stock level required to achieve this.

The CL and MT reference points are both indicated on the SR curve shown in Figure 1. A further reference point – 'Maximum Smolt' - is also shown to identify the maximum smolt output that may be expected from a catchment.

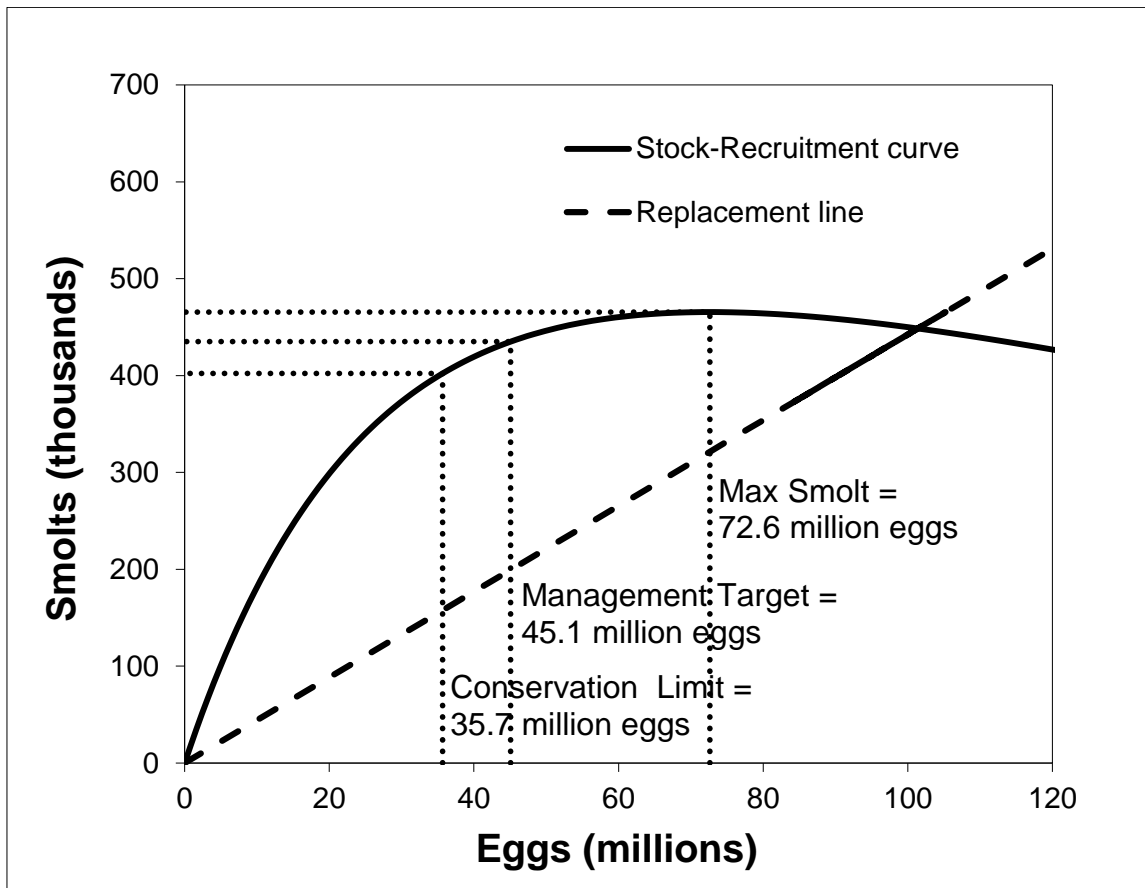


Figure 1 Conservation Limit and other reference points defined by the stock-recruitment curve and replacement line

For each river salmon stock, estimates of spawner numbers and egg deposition are produced annually. In most cases (except for rivers with counters or traps) these estimates are derived from rod catches and assumed angling exploitation rates (the latter based on observations from counted rivers). Other information, for example relating to the size and sea age composition of returning salmon, catch declaration rates and the egg contribution of rod-released fish is also built into the spawner/egg estimates.

Compliance with the Conservation Limit is tested each year using a statistical procedure which fits a trend line to the latest 10-year time-series of egg deposition estimates for each river and examines the position of that trend line (and confidence limits around that line) relative to the Conservation Limit. This procedure includes extrapolation of the trend line to assess the possible status of the stock in 5-years' time (Figure 2).

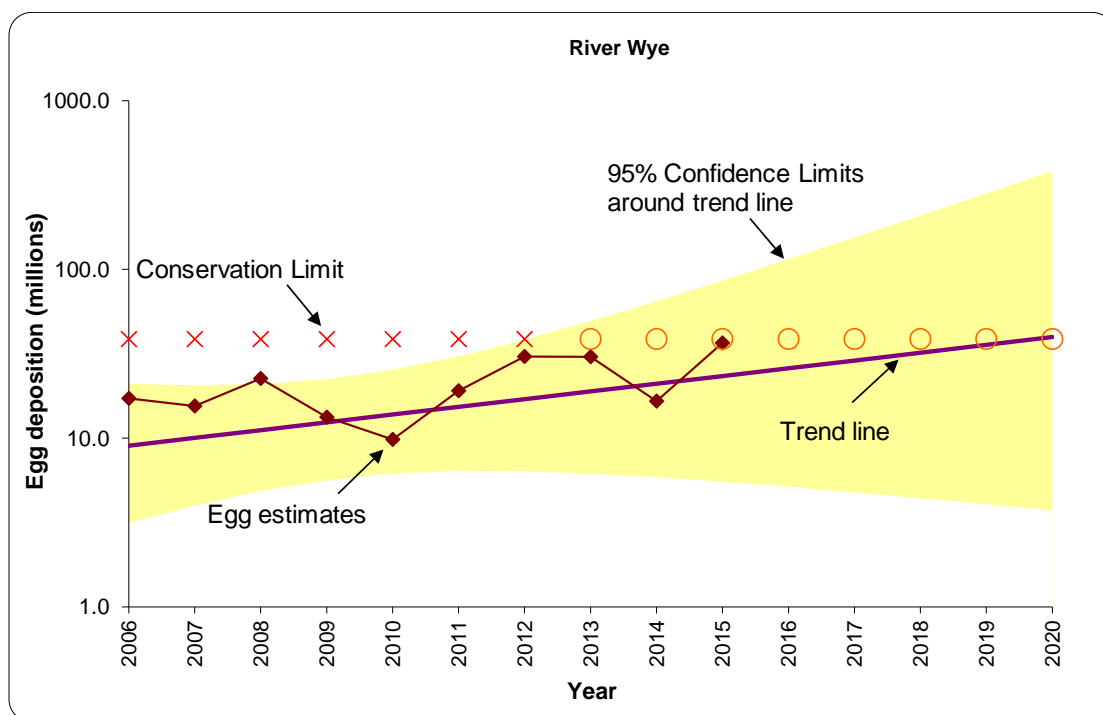


Figure 2 Compliance with Conservation Limits: Example graphical assessment for the River Wye, 2015

The resulting compliance status for each river is examined annually against a 'Decision Structure' (DS) (Annex 4) which provides a standard and consistent decision framework to identify management actions for the regulation of exploitation of stocks in both the rod and net fisheries. This recognises that exploitation control is the most immediate remedy to shortfalls in spawning stocks, however it is also the case that longer term initiatives, for example the protection and restoration of river habitats, are fundamental to the protection and future health of our salmon populations.

Annex 4 provides further information on the derivation and use of Conservation Limits in salmon management in E&W – including additional details relating to compliance assessment and the application of the Decision Structure.

2.4. Sea Trout

Sea trout stock assessment procedures:

In contrast to salmon, no established methods of setting Conservation Limits or similar 'Biological Reference Points' (BRPs) for sea trout have been available in E&W (or elsewhere). The need to develop such methods has been widely recognised by fisheries biologists and managers, and to address this, an ICES Working Group – drawing on pan-European expertise - has recently been established with this aim. This group is set to report by 2019.

In the absence of stock-based reference points for sea trout – NRW and the Environment Agency have, for a number of years, routinely applied a fishery based

assessment to the principal sea trout rivers in E&W (Aprahamian, pers com). This assessment, which utilises time-series' of angling catch per unit effort (CPUE) data ('catch per day') - collected via the national licence return since 1994 - is detailed below and is one approach used in this Technical Case to examine sea trout performance on a river-by-river basis.

More recently, however, an alternative stock-based assessment method has been developed by NRW which is applied (for the first time) in this Technical Case. This utilises angling catch data to derive run and egg deposition estimates for sea trout in much the same way that the similar data sets are used in Conservation Limit compliance procedures for salmon assessment in E&W. For example, applying assumed angling exploitation rates to catch data to derive run estimates; adopting standard sex ratios and weight-fecundity relationships to generate egg deposition figures.

These data sets are used to generate stock and recruitment (SR) relationships for individual river stocks of sea trout, deriving from these relationships reference points that are broadly equivalent to the Conservation Limits and Management Targets used in salmon assessment, and which allow use of the same trend-based statistical compliance procedures to assess the 'risk' status of the stock.

The details of this method are also set out below (and in Davidson *et al.* in prep), with procedures for estimating adult returns from rod catches, spawner numbers and levels of egg deposition summarised in Annex 5.

CPUE based assessment

This assessment utilises time-series' of angling CPUE data – expressed as catch per day – collected via the national licence return since 1994. The assessment is undertaken annually on each river and includes (i) comparison of the most recent 3-year mean CPUE value to the 50th and 80th percentile values calculated from the previous 10-years of data ('reference period'), as well as (ii) an examination of the most recent 10 year trend in CPUE values . A graphical example of this assessment is shown below for the River Teifi.

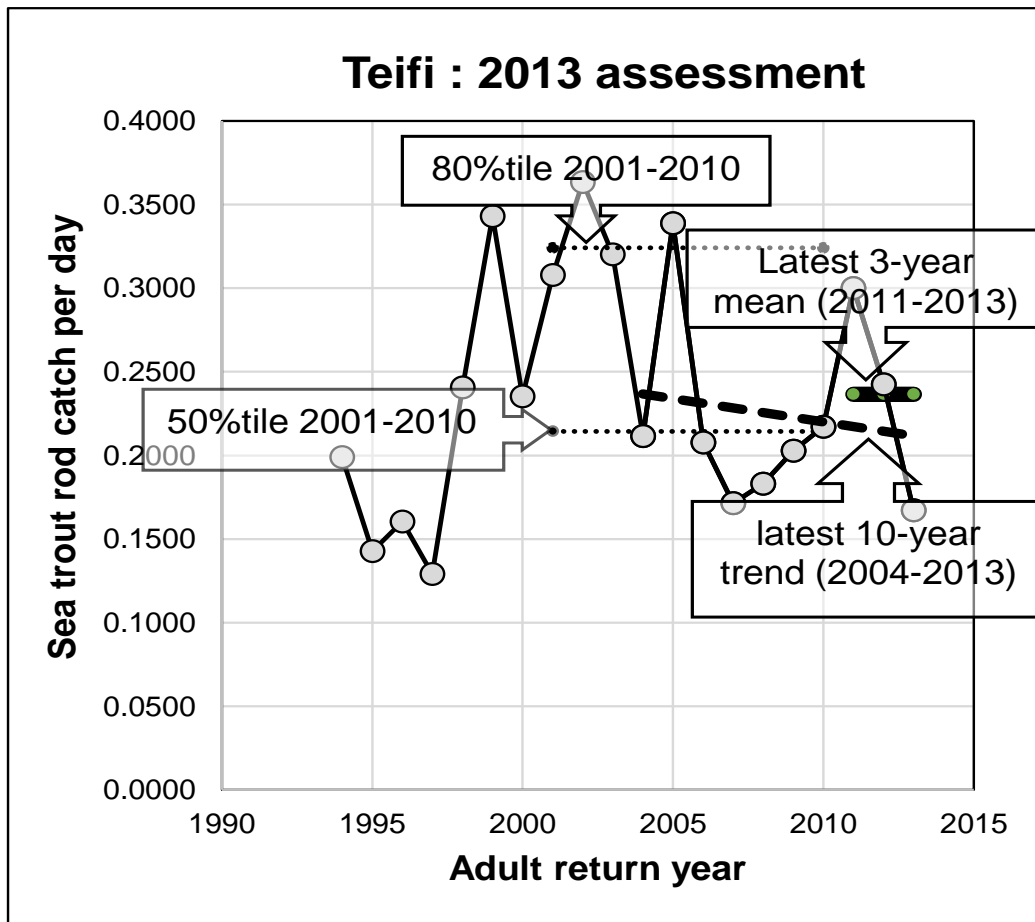


Figure 3 Sea trout CPUE assessment: Example for the River Teifi, 2013

'Risk' categories are assigned depending on the above measures of fishery performance and are set out in the table below (Aprahamian pers com). While these risk categories appear similar to those applied in salmon assessment (Annex 4) they are not directly comparable. Their primary purpose is to provide an early warning about potential problems and so prompt further investigation into sea trout stock status and the need for remedial management action.

Table 1 Risk Status Categories

Status	Category	Score
Trend in CPUE significantly up or stable & current stock >80% of reference period	Not at risk	4
Trend in CPUE stable & current stock between 50 and 80% of reference period	Probably not at risk	3
Trend in CPUE stable & current stock <50% of reference period	Probably at risk	2
Trend in CPUE significantly down & current stock <50% of reference period	At risk	1

A weakness with this method is that the shifting 10-year reference period built into the assessment approach will not necessarily reflect a biological optimum e.g. carrying capacity, and could, for example, in a prolonged period of low stock levels/poor fishery performance result in a favourable assessment of stocks well below carrying capacity.

'Stock-recruitment' based assessment

As described above, the starting point in this assessment is the generation of rod catch derived estimates of run and egg deposition - procedures which mirror those well established in assessing the status of salmon stocks in E&W (e.g. applying assumed angling exploitation rates to catch data to derive run estimates, etc) This procedure is summarised in Annex 5.

Resulting run and egg deposition estimates are then used to generate time-series of stock and recruitment data to which Ricker SR relationships are fitted using non-linear regression methods. In this process, the 'stock' variable is defined as the number of eggs laid in any one year and the 'recruit' variable as the number of whitling (or .0+ fish) that arise from those eggs three years later (calculated on the basis that the great majority of sea trout from rivers in E&W appear to emigrate as 2-year old smolts).

Whitling abundance is used as an indicator of recruitment because that sea age group (i) dominates the return (>50%) on most west coast rivers and all the main sea trout rivers in Wales (ii) is readily identified in the catch data on the basis of weight (trapping data from the Welsh Dee indicates that all fish <1.5lbs are likely to be whitling to the virtual exclusion of all other sea age groups). Whitling are also only lightly exploited by net fisheries because mesh dimensions and their small size mean they largely avoid capture (i.e. as an index of recruitment their abundance at return will not be unduly influenced by netting activity). Whitling are also closely associated with the smolt stage – the stage that marks freshwater carrying capacity – as the whitling and smolt stages are separated by just a few months at sea. Consequently, it is likely that a SR relationship defined in terms of whitling recruitment will be similar in form to the equivalent relationship for smolt recruitment, as will the values of associated stock related BRPs.

The Ricker SR relationship derived for the Teifi is shown in Figure 4 with the reference point considered equivalent to maximum smolt output ('Max Smolt') identified at the top of the fitted SR curve. This relationship has been fitted to stock and recruitment data sets generated from rod catch returns for the years 1994-2015 (the period since the introduction of the national catch-return and reminder system).

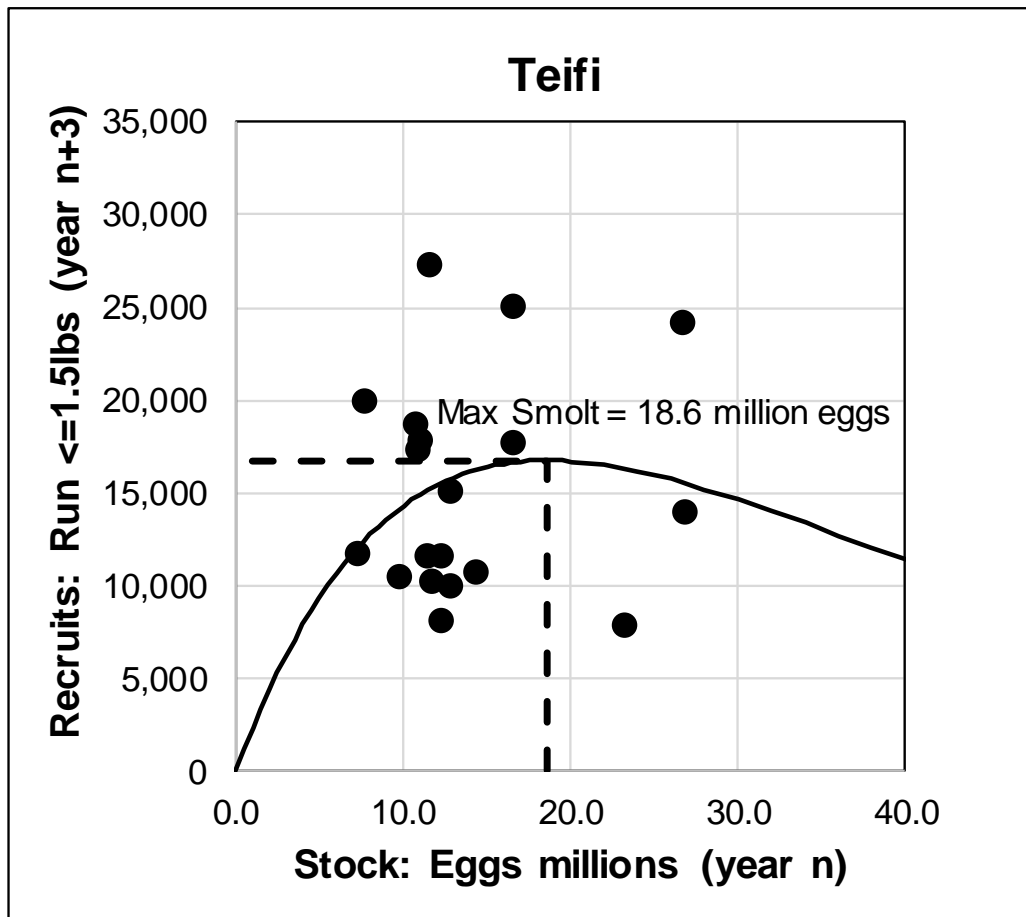


Figure 4 Sea trout Ricker stock-recruitment curve for the River Teifi (year classes 1995-2013).

In the case of salmon, the Conservation Limit (CL) is set at a point termed 'Maximum Sustainable Yield' - somewhat below Max Smolt. For the SR curves derived for sea trout, the equivalent point to the CL on the stock axis (based on observations from SR curves and reference points for salmon) would occur at around 70% of Max Smolt; this equates to ~13.0 million eggs in the Teifi example.

An indicative Management Target (reflecting the Management Objective that stocks should be at or above the CL four years out of five, on average) can be calculated from the CL by taking into account year-to-year variation in estimates of egg deposition. The resulting Management Target (MT) value in the case of the Teifi is ~16.5 million eggs.

Compliance assessment using the same statistical trend procedure applied to salmon classifies the Teifi as 'probably at risk' in 2016 and (just) 'probably not at risk' in 2021 (Figure 5).

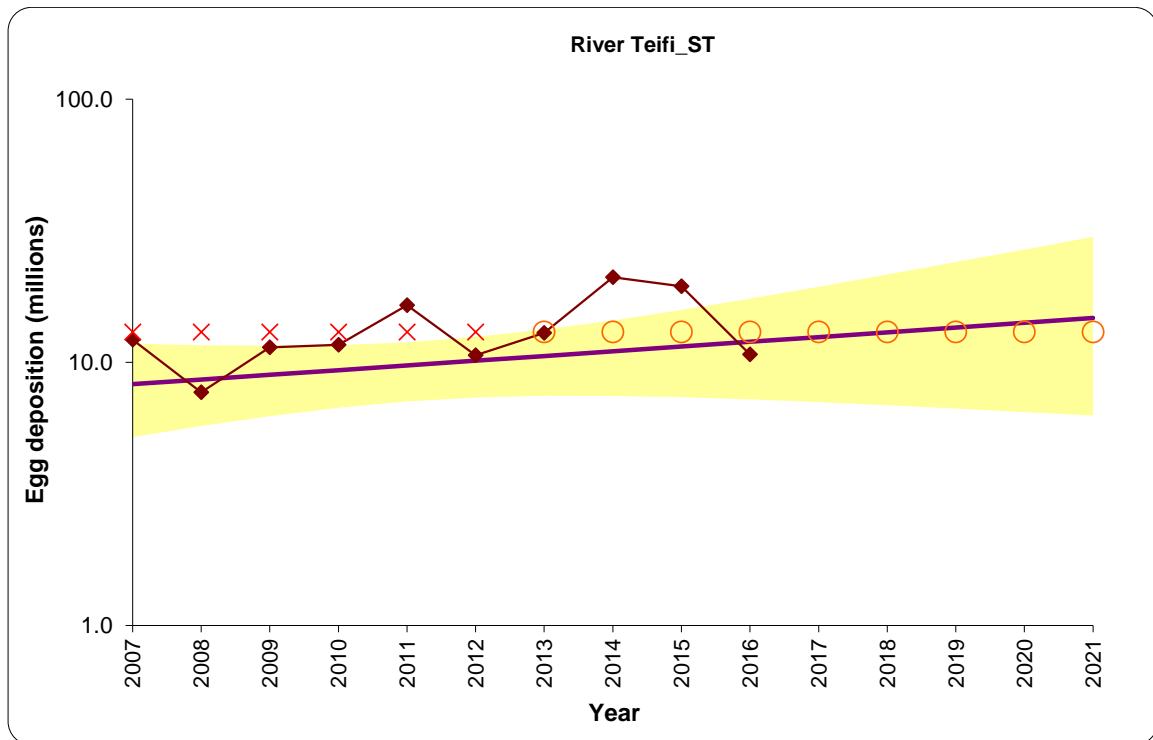


Figure 5 Compliance with Conservation Limits: Example graphical assessment for Teifi sea trout, 2016

2.5. Juvenile population assessments

Electrofishing (EF) surveys to assess the distribution and abundance of juvenile salmon and trout have been undertaken on most catchments in Wales - with the earliest data sets extending back about 30 years. The current EF monitoring programme comprises a temporal element, where a number of fixed sites are surveyed annually, and a spatial element where considerably more sites spread across the whole catchment are surveyed every 6 years as a “snapshot” of catchment fish populations. The number of sites in the temporal and spatial programmes vary between catchments and relate to the size of the catchment. The monitoring programmes were reviewed in 2001 and have remained largely consistent since.

The data collected in these surveys are used for various purposes, including WFD and other assessments which identify environmental constraints and prompt remedial measures. An important further use, however, has been to examine annual trends in salmonid fry and parr numbers (see Figure 6) and to explore causative factors. Long-term trends reflect a range of factors affecting juvenile populations, from spawner abundance to the quality of freshwater habitat. Trends are usually examined using time-series from 2001 onward – a period in which the EF monitoring programme has remained relatively consistent.

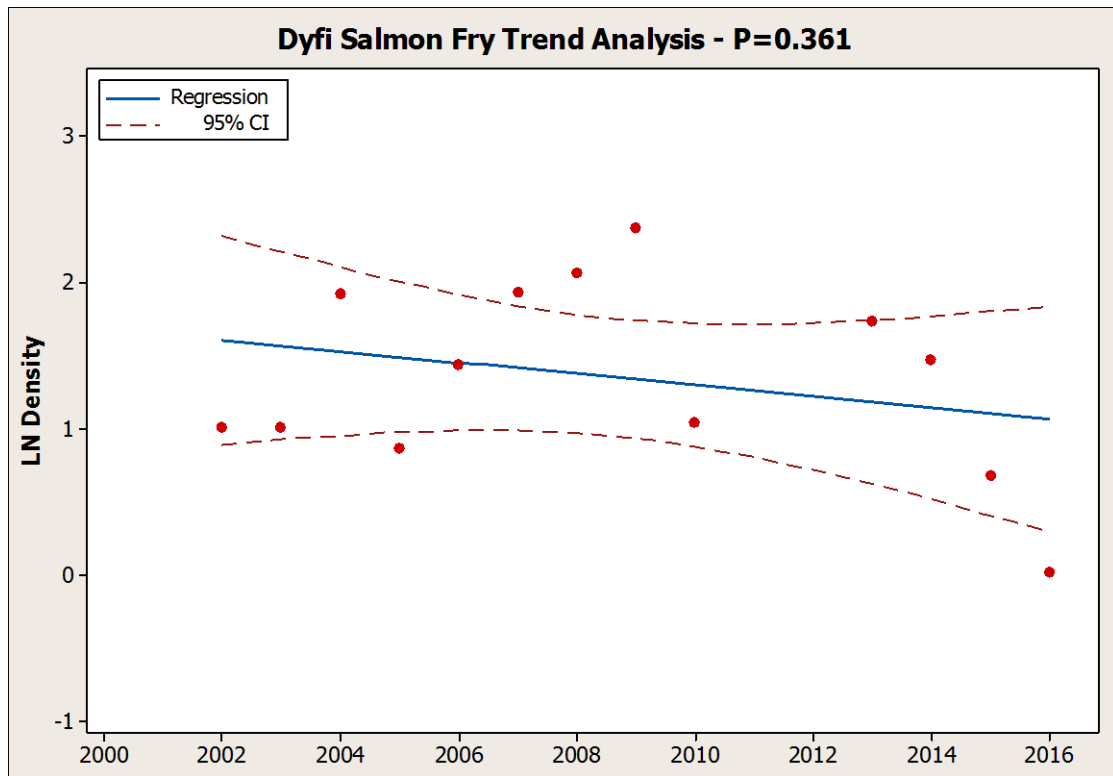


Figure 6 Statistical analysis of long term trends in Dyfi salmon fry (0+), 2002 to 2016

Spatial data, and to some extent temporal data (if sufficient sites are surveyed) are used to look at differences in fish populations within catchments. As an example, the 2016 salmon data for the Dyfi temporal and spatial surveys, and the salmon and trout data for the Dyfi 2015 temporal surveys are shown below (Figure 7).

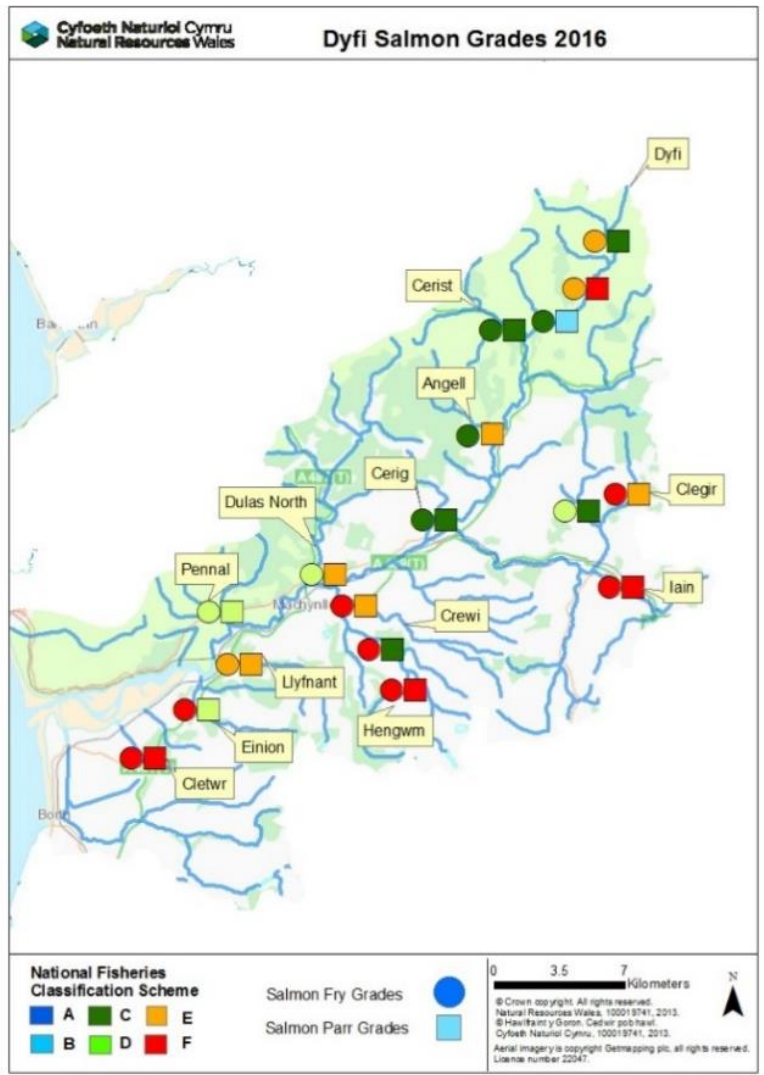
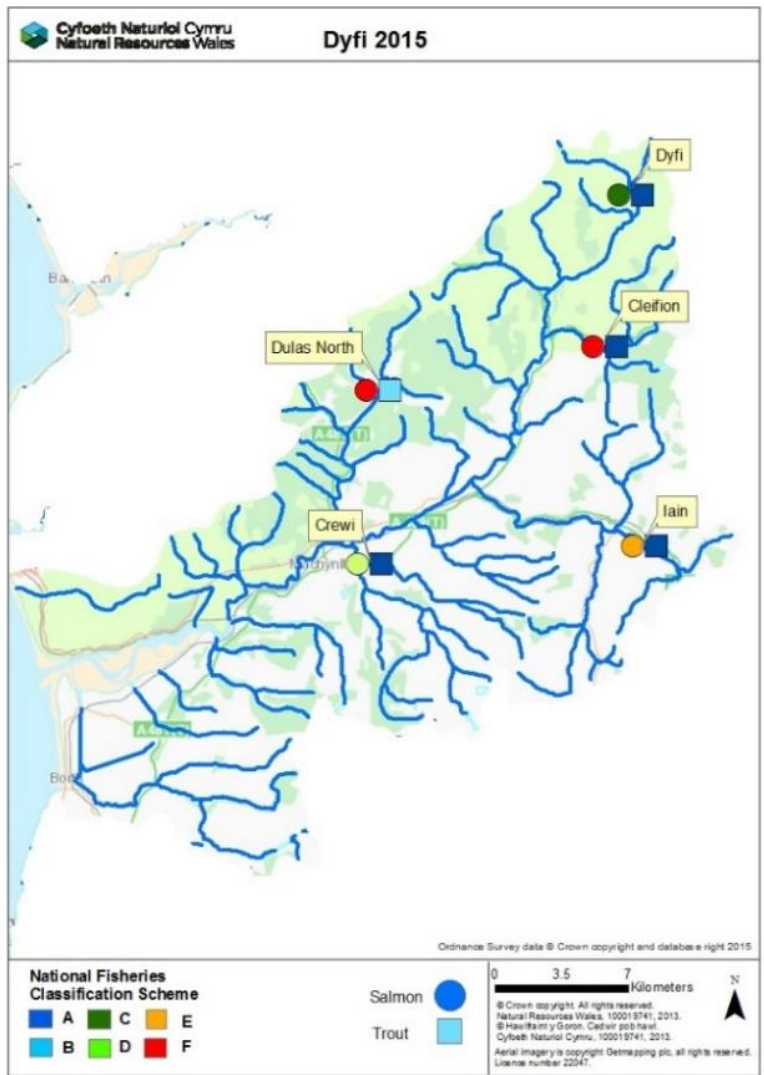


Figure 7 Dyfi salmon fry and trout classification (National Fisheries Classification System, NFCS) from the 2016 spatial and temporal programmes; and the salmon and trout classifications for the 2015 temporal programme.

Additional monitoring is carried out across Wales which does not target salmon or trout, e.g. eel index river surveys and lamprey surveys. These surveys can provide further information on the distribution of salmon and trout within a catchment.

The data for each of the catchments assessed for juvenile salmon and trout are presented in Annex 3.

2.6 Implementation Plans and Reporting

NRW produces annual reports - 'Know your Rivers': ([know-your-rivers](#)) which describe the status of the salmon and sea trout populations for each of the principal salmon and sea trout catchments in Wales. They bring together data from catches, stock assessments and juvenile monitoring; describing the factors limiting the populations and setting out the challenges faced in the catchments.

Actions to restore freshwater productivity of salmon and sea trout populations are set out in action tables. These tables include joint project proposals in which work will be carried out by our partner organisations, not just Natural Resources Wales (NRW).

Fisheries statistics reports for commercial and recreational fisheries in England and Wales. Including declared catches for salmon, sea trout, by rods, nets and other instruments are available annually.

<https://www.gov.uk/government/collections/salmonid-and-freshwater-fisheries-statistics>

In addition annual reports by CEFAS, EA and NRW on the status of salmon stocks and fisheries in England and Wales have been produced since 1997. These reports present a preliminary assessment for the latest year to assist ICES in providing scientific advice to NASCO and to provide early feedback to fishery managers and anglers.

[England and Wales Annual Salmon Stock Status Report 2015](#)

To improve commitment to the NASCO commitments, joint agreements and Implementation Plans have been developed detailing the measures taken in relation to management of salmon fisheries. Annual reports on progress against these plans provide detail on action taken including habitat protection and restoration, and minimising the adverse impacts of aquaculture, introductions and transfers.

The primary purposes of the annual progress reports are to provide details of: any changes to the management regime for salmon and consequent changes to the Implementation Plan:

- actions that have been taken under the Implementation Plan in the previous year;
- significant changes to the status of stocks, and a report on catches; and
- actions taken in accordance with the provisions of the Convention

The reports can be found on the NASCO web site (see links below)

UK - England & Wales	2013 2014 (IP rev.1)	2014	2015	2016	2017 (revised)
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3. Description of Fisheries

The majority of streams, rivers and estuaries in Wales support valuable salmonid fisheries.

There are 31 rivers in Wales for which salmon rod catches are reported although some of the stocks are very small and support minimal catches. Of these, 23 including three cross border rivers (the Wye, Severn and Dee) have been designated 'principal salmon rivers'. Conservation limits (CLs) and Management Targets (MTs) have been set for the principal salmon rivers in Wales and are used to assess the status of stocks against a common framework and to indicate the requirement for intervention measures to improve stocks (Section 2). Management action includes the control of fishing to maximise spawning escapement, but should also be interpreted as triggering the need for other initiatives such as river improvement initiatives.

The 23 principal salmon rivers are:-

- Severn*, Wye*, Usk, Taff & Ely, Ogmore, Tawe, Tywi, Taf, Eastern & Western Cleddau, Nevern, Teifi, Rheidol, Dyfi, Dysynni, Mawddach, Dwyryd, Glaslyn, Dwyfawr, Seiont, Ogwen, Conwy, Clwyd, Dee*.

Six rivers have been designated Special Areas of Conservation (SACs), under the EU Habitats Directive, with salmon as a named qualifying species. This places additional requirements to maintain the habitats in these rivers in a favourable condition for salmon.

- Wye*, Usk, Teifi, Eden, Gwyrfai, Dee*
* indicates cross-border rivers

In comparison, sea trout are distributed more widely and are generally more abundant than salmon in Welsh rivers. There are 33 sea trout fisheries that are assessed each year:

- Severn*, Wye*, Usk, Rhymney, Taff, Ogmore, Afan, Neath, Tawe, Loughor, Gwendraeth Fawr & Fach, Tywi, Taf, Eastern & Western Cleddau, Nevern, Teifi, Aeron, Ystwyth, Rheidol, Dyfi, Dysynni, Mawddach & Wnion, Artro, Dwyryd, Glaslyn, Dwyfach & Dwyfawr, Llyfni, Gwyrfai, Seiont, Ogwen, Conwy, Clwyd, Dee*.
* indicates cross-border rivers

3.1. Salmon and sea trout net fisheries in Wales

Salmon and sea trout are caught in a variety of nets and instruments in the estuaries of Wales, comprising coracle, compass, seine, wade and hand held lave nets. Some of these are believed to be unique to Wales and, as such, are regarded by some as having cultural and heritage significance.

All of the fisheries, with just two exceptions, operate in areas within public ownership and are subject to a licensing system managed by NRW. Fishing is regulated partly

by statutory instruments that control and limit the number of licences that may be issued. These Net Limitation Orders (NLOs) are set under the Salmon and Freshwater Fisheries Act (1975) and typically last for a period of 10 years. Two net limitation orders control net fisheries in Wales:-

- The 'All Wales NLO (Annex 6) in which 13 different fisheries fish in 10 river estuaries is capped at a total of 45 licences
- Dee NLO = 0. This NLO was most recently established in 2015.

In addition there are two further net fisheries:-

- Lledr trap Conwy, 1 licence may be issued to this 'Historic Installation' (identified as a 'Certificate of Privilege' fishery)
- Blackrock heritage lave net fishery. This is located within the Wye Fishery which is owned by NRW. Fishing is managed through a lease offered to the Blackrock Heritage Lave net Fishery' and is regulated through the terms of that lease, currently with 8 annual licences (one of which is for a trainee) and an annual catch limit of 15 salmon.

Net licence duties range from £79 per season for a wade net licence to £582 for some seine nets. These duties have not changed since 2010.

Table 2 Welsh net fisheries

Fishery	Instrument Type	Duty per net (£)	Number of licences available
Teifi*	Draft	582	3
Teifi*	Coracle	248	12
Towy*	Draft	582	3
Towy*	Coracle	555	8
Taf*	Coracle	248	1
NeVERN*	Draft	261	1
Taf*	Wade	79	1
Cleddau*	Compass	96	6
Dyfi*	Draft	582	3
Mawddach*	Draft	261	3
Dysynni*	Draft	372	1
Conwy*	Draft	372	3
Glaslyn*	Draft		0
Conwy**	Lledr Trap	131	1
Wye***	Blackrock Lave	79	8
Dee***	Trammel and draft		0

Note - does not include the net and fixed engine fisheries licensed on the Severn

* Net fisheries included in 'All Wales' NLO

** Lledr trap (historic instrument)

*** Lave net fishery is a private fishery not controlled by the All Wales NLO

The total income from net licences each year is currently approximately £16,600.

The number of salmon and sea trout net licences issued in Wales has decreased by 60% over the past 30 years from 141 licences in 1989 to 54 in 2016, although the number of licences issued has remained steady at around 54-55 over the past 10 years.

A total of 129 endorsees were involved with the fisheries in 2016, a reduction since 2008 when some 171 were involved in the fishery. Endorsees assist the licensee with fishing operations.

Catches of salmon (Figure. 8) have remained relatively low over the past 20 years compared to historic levels. The 5 year average (2011-2016) = 192.

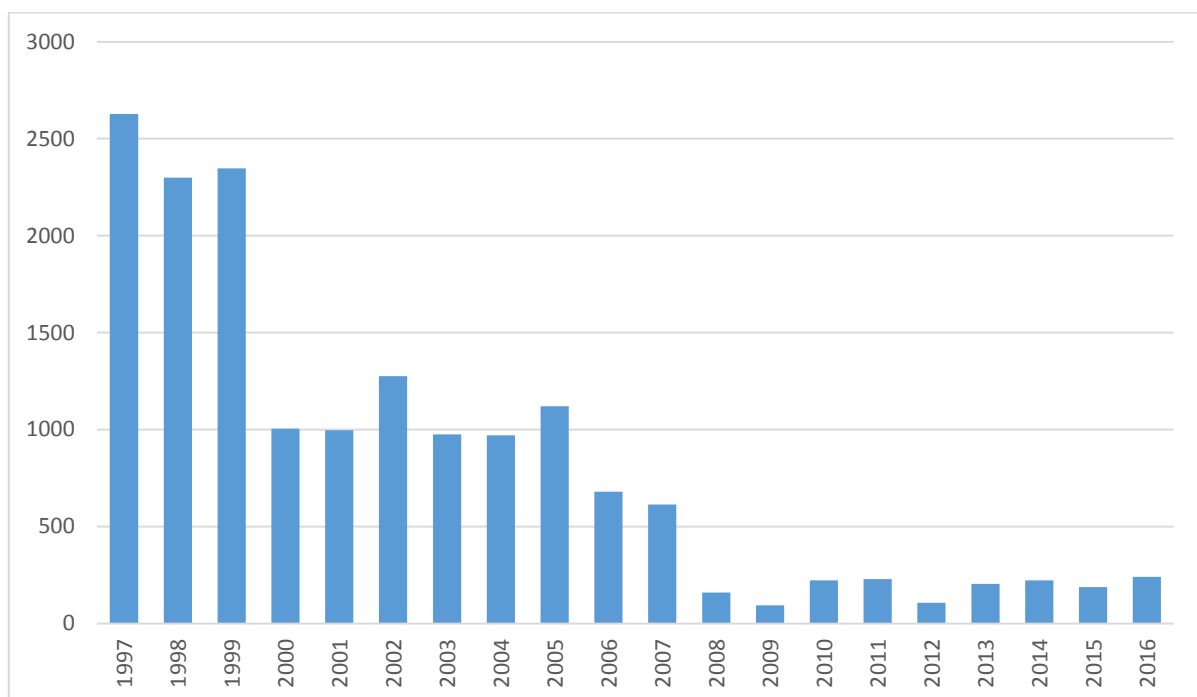


Figure 8 Total Wales declared salmon net catch 1997-2016

In contrast, sea trout net catches (Figure 9) have increased over recent years since lows in 2006, although they have not reached the declared highest catches observed in the late 1990s. The 5 year average catch currently (2011-2016) is 1,644.

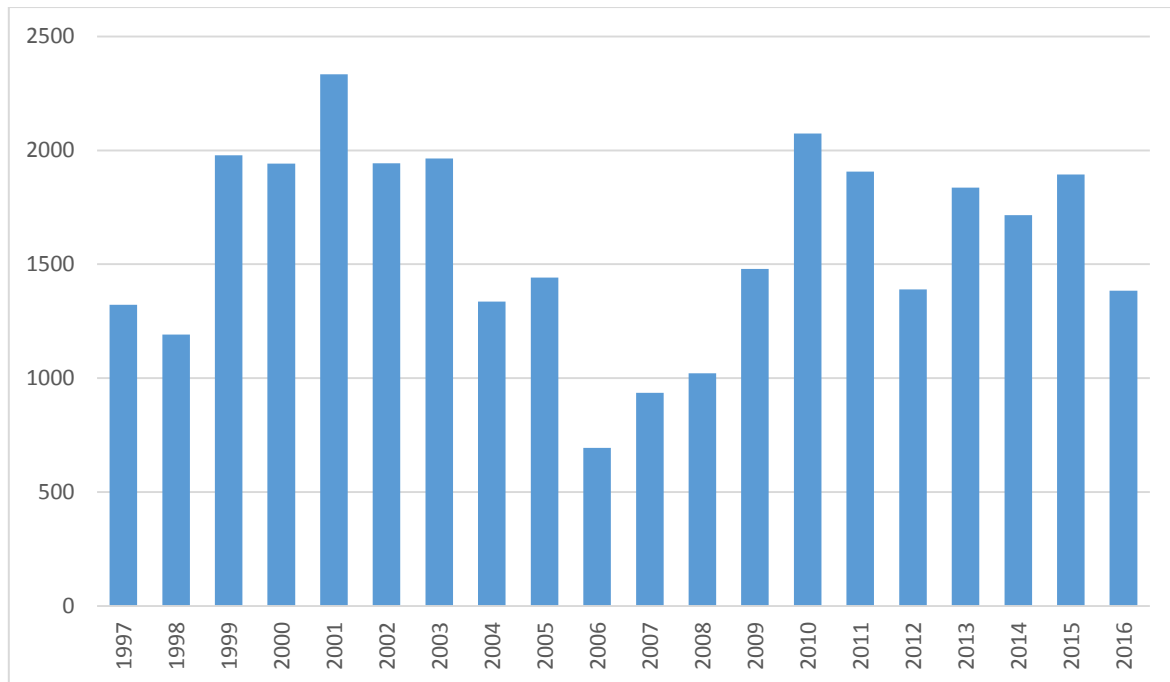


Figure 9 Total Wales declared sea trout net catch, 1997-2016

The latest published declared catches (for 2015) can be found at:-

[salmonid fisheries-statistics for england and wales-2015](#)

In order to effectively regulate and control net fishing, through the reduction in risk of an illegal catch, carcass tagging and logbook byelaws were introduced in 2009. Since then there has been a statutory requirement for all salmon and sea trout caught by nets to have a carcass tag affixed as soon as possible after capture.

The number of carcass tags allocated to each licensed netsmen is set at the previous year's declared catch plus 25%. Each tag is individually identifiable and catches are promptly recorded in a logbook which must be kept with the netsman. Logbooks and any unused tags are returned to NRW at the end of the season.

In the six seasons since coming into force, there has been a high level of compliance (100%) with the scheme, with all tags accounted for. We believe that this has led to more accurate reporting of catches.

3.2. Salmon and sea trout rod fisheries in Wales

The main indicators of the state of salmon and sea trout stocks are the catches taken and reported by rod fisheries. Total catches for Wales over the past 23 years are presented for salmon (Figure 10) and sea trout (Figure 11).

Over the past 20 years annual catches of salmon have varied between 2,124-7,707. Following increased catches in the period 2004-2012 catches have declined to around 2,750 over the past 4 years. This has principally been through the decline in grilse catches noted throughout Wales. Catches of MSW fish have in many cases increased.

The sea trout catch has varied over the past 20 years from 10,574-25,681. There appears to be two identifiable periods, one of relatively high catch (1998 – 2005) when an average catch of 22,000 was reported, and secondly a period of low catches (2006 - 2016) with a markedly lower average annual catch of 14,000.

Figures depicting the catches of individual catchments are set out in Annex 3.

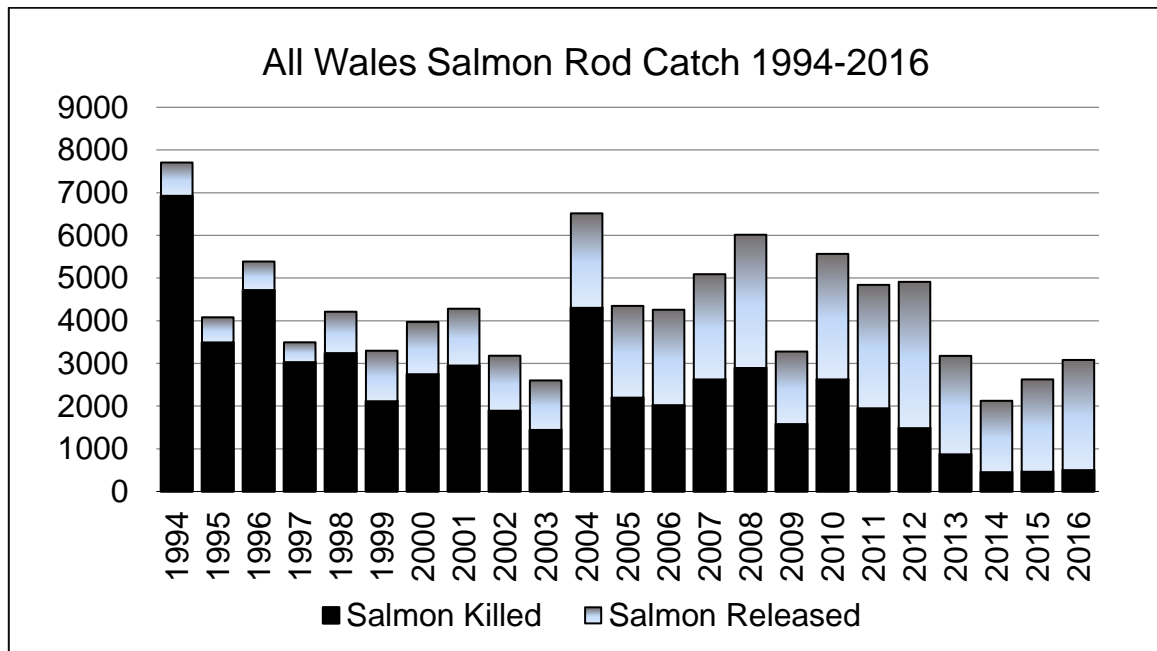


Figure 10 Total Wales declared salmon rod catch, 1994-2016

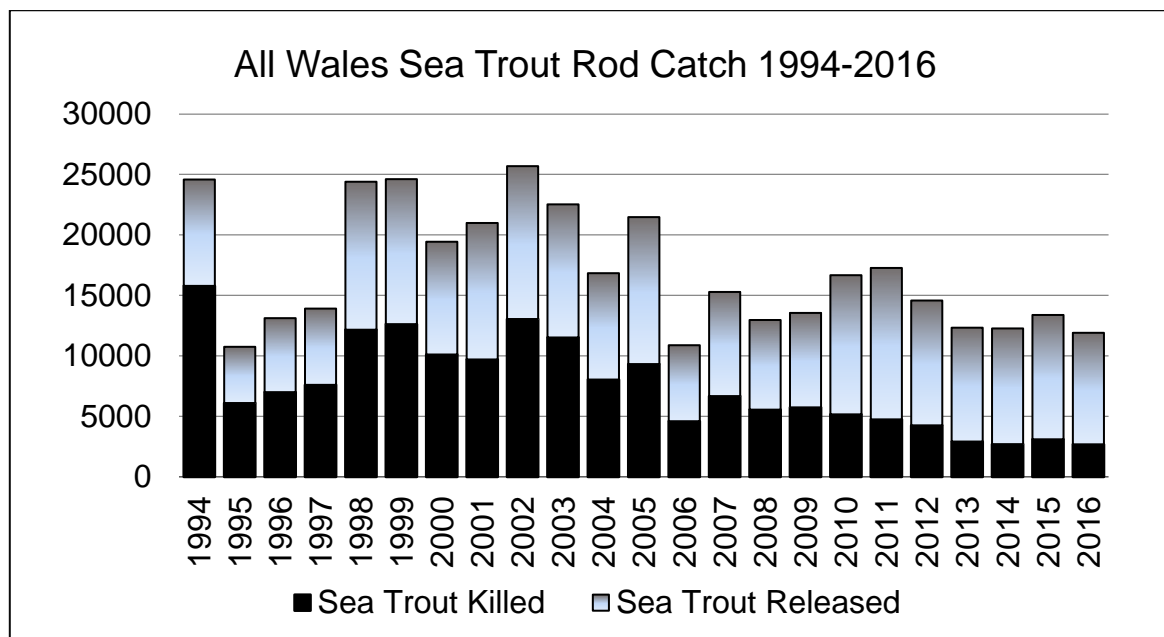


Figure 11 Total Wales declared sea trout rod catch, 1994-2016

3.2.1. Participation

Rod licence sales

The rod licence sales and administration service in Wales is managed on our behalf by the Environment Agency under formal agreement. All income raised from sales in Wales is forwarded by the EA to NRW (minus standard administration charges).

Total licence sales (migratory salmonids, and coarse and trout licences) have been declining in recent years in Wales from just under 57,000 licences sold in 2012 to just over 53,000 in 2016, a reduction of 6% in numbers sold and a reduction in income of just over £120,000 (see tables 3 and 4). A similar rate of decline in sales has been recorded in England.

Table 3 Number of licences sold in Wales (2012-2016)

	2012	2013	2014	2015	2016
Trout & coarse	50,079	49,759	48,883	49,080	47,734
Salmon & sea trout	6,795	6,317	5,749	5,660	5,514
Total	56,874	56,076	54,632	54,740	53,248

Table 4 Income from sales of rod licences in Wales (2012-2016)

	2012	2013	2014	2015	2016
Trout & coarse	£817,078	£792,075	£773,258	£780,443	£760,165
Salmon & sea trout	£348,331	£324,487	£299,740	£292,383	£282,355
Total	£1,165,409	£1,116,562	£1,072,998	£1,072,826	£1,042,520

There are 11 different licence types available (table 5). Full season salmon licences 44% and senior season licences 30% represent the two main licence types sold.

Table 5 Rod Licence numbers and income from anglers in Wales

	Numbers	Percentage of sales number	Income
Licence Type	2016/17		2016/17
<i>Salmon</i>			
Disabled	311	6%	£14,928
1 day	580	11%	£4,640
8 day	125	2%	£2,875
Full	2,429	44%	£174,888
Junior	307	6%	£1,535
Senior	1,654	30%	£79,392
Upgrade Disabled	3	0%	£90
Upgrade Full	73	1%	£3,285
Upgrade Junior	2	0%	£0
Upgrade Senior	19	0%	£570
Total	5,503		£282,203

Following consultation and Cabinet Secretary approval, new rod licence duties have been introduced in 2017 and will remain unchanged until at least 2020. Duties were last increased in 2010. In addition, a free junior licence – previously £5, was introduced in 2017.

Table 6 New licence duties and structure (2017-2020)

	Type of licence	2017-2020
Salmon & sea trout	Full	£82
	Full (concessionary) senior and disabled	£54
	Short term 1 day	£12
	Short term 8 day	£27
	Junior (aged 12-16)	Free

The duty for a full migratory salmonid rod licence for the 2008/09 season was £68 (with concessions ranging from £5 to £45). Total income from migratory salmonid rod licences sold in Wales in 2008 was approximately £380,000, approximately 25% greater than current salmon and sea trout licence income.

Returns and Efforts

Salmon and sea trout licence holders are required to make a return declaring both catches and effort. Since 1994 Effort Figures have been collected in a relatively consistent manner. Between 2010-2015 approximately 5,000 – 6,000 catch returns were returned declaring that they had fished in Wales (Figure 12)

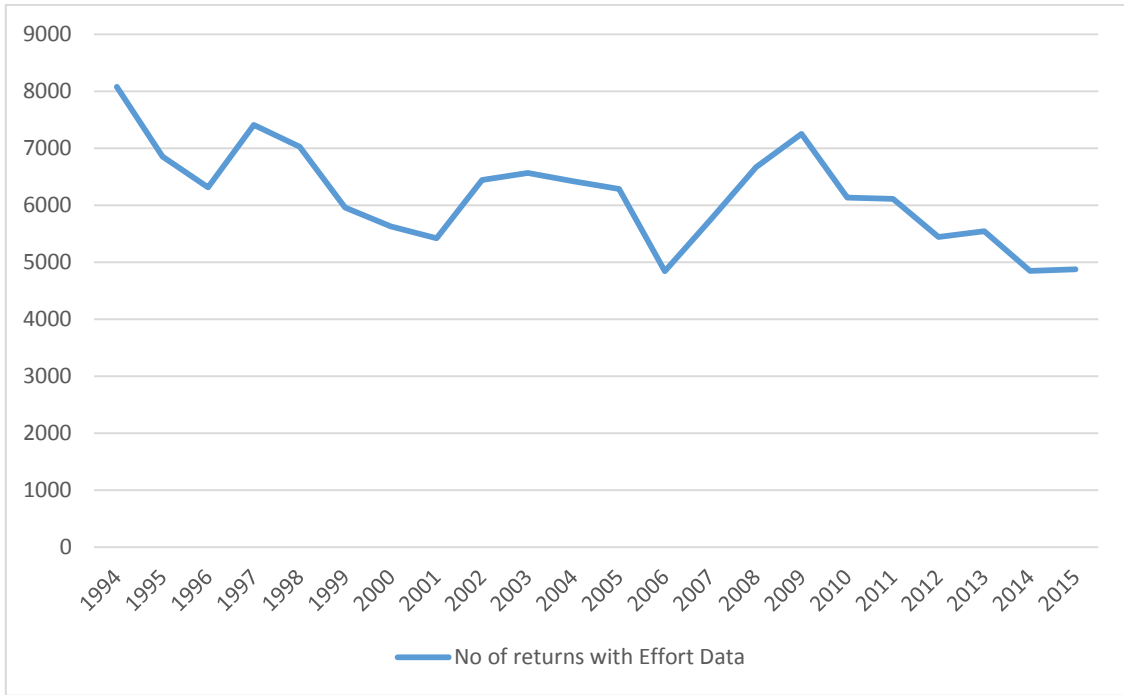


Figure 12 Rod effort Figures

Angling effort expressed as the number of days fished by migratory salmonid rod licence holders has fallen by some 60% over the past 25 years from 120,000 in 1994 to 52,000 in 2015, although from about 2000 onward declared angling effort has remained relatively stable. The trends in Wales follow broadly the trends and changes in the other main Environment Agency salmon and sea trout areas, namely; the North West (NW), South West (SW), and North East (NE) areas (Figure 13).

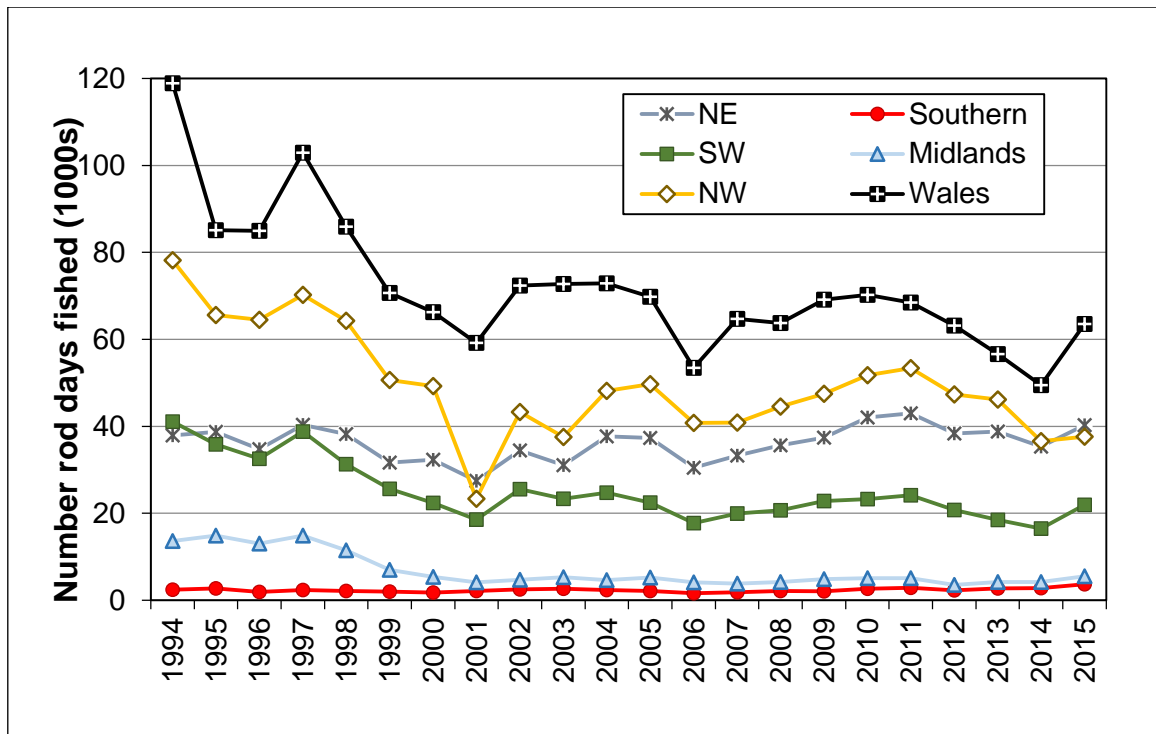


Figure 13 Declared Angling Effort for different regions in England and Wales

4. CURRENT STATUS OF WELSH SALMON AND SEA TROUT STOCKS

4.1. Adult stock status

4.1.1. Salmon assessment

The use of river specific Conservation Limits (CLs) to assess the status of salmon stocks across E&W has been described in Section 2 and Annex 4.

The latest set of assessment data (for 2016) are summarised in Table 7 and Fig. 14 and Fig. 15 below for the 23 principal salmon rivers in Wales (the equivalent data and assessments for 2015 are published in:

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

and

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

Three measures of performance are examined for each river stock:

- 'risk' status against the CL in the latest year (2016) and in 5 years' time (2021).
- the trend in egg deposition estimates over the latest 10-year period (the method by which 'risk' status is projected in 5-years' time).
- estimates of the egg shortfall/surplus against the Management Target based on the most recent (5-year average) levels of spawning escapement.

All except three of the 23 principal salmon rivers in Wales had a projected (2021) compliance status of 'probably at risk' or 'at risk' (the Ogmore, Tawe, E&W Cleddau, Rheidol, Dyfi, Seiont, Clwyd and Dee were all in the latter category). This is the assessment referred to in the Decision Structure (Section 2 and Annex 4).

In addition, none of the rivers in the 'probably at risk' or 'at risk' categories had (10-year) trends in egg deposition which were markedly positive ('+++'), indeed most had negative trends, significantly so ($P < 0.05$) in the case of the Tawe, Cleddau, Seiont and Clwyd (Table 7).

The Severn, Wye and Usk were the exceptions to this pattern with these three river stocks all projected to be 'probably not at risk' in 2021 with the Wye showing a strong upward ('+++') trend in egg deposition over the last decade.

Compared to the projected compliance status in 2021, compliance in 2016 was generally less favourable, with 11 rivers classified as 'at risk' (Taff and Ely, Ogmore, Tawe, Taf, E&W Cleddau, Rheidol, Dyfi, Dwyrhyd, Seiont, Clwyd and Dee).

For most of the 23 rivers, comparison of average egg deposition levels over the last 5 years with the Management Target indicated egg shortfalls (Table 7). On 13 of these rivers, egg shortfalls exceeded 50% of the Management Target.

Table 7 'Risk' Status and egg shortfall/surplus for the main salmon rivers in Wales 2016 assessment.

River	Accessible	Conservation Limit	Conservation Limit	Management Target	5-yr Geo. mean	Difference from Management Target:		At Risk' status:		Trend	
	wetted area (m2)	Eggs (millions)	Eggs per 100m ²	Eggs (millions)	Eggs (millions)	Eggs (millions)	Adults*	2016	2021		
Severn##	8,980,737	12.85	143.1	19.21	19.90	0.69	230	Prob not at risk	Prob not at risk	Uncertain	++
Wye	17,210,439	38.57	224.1	49.10	30.95	-18.15	-6,050	Prob at risk	Prob not at risk	Uncertain	+++
Usk	4,070,931	10.11	248.4	14.89	15.82	0.93	309	Prob not at risk	Prob not at risk	Uncertain	+
Taff & Ely	1,457,195	3.19	219.2	3.44	0.84	-2.60	-867	At risk	Prob at risk	Uncertain	+
Ogmore	612,070	1.10	180.5	1.35	0.33	-1.02	-339	At risk	At risk	Uncertain	--
Tawe	878,493	1.85	210.8	2.38	0.54	-1.84	-613	At risk	At risk	Down	---
Tywi#	5,000,722	11.30	226.0	15.60	7.30	-8.29	-2,764	Prob at risk	Prob at risk	Uncertain	--
Taf#	901,208	1.70	188.6	2.65	0.98	-1.67	-556	At risk	Prob at risk	Uncertain	--
E&W Cleddau#	866,130	1.55	179.4	1.81	0.59	-1.22	-406	At risk	At risk	Down	---
Teifi#	3,259,156	8.65	265.3	12.50	7.13	-5.36	-1,788	Prob at risk	Prob at risk	Uncertain	--
Rheidol	306,345	0.68	222.0	0.85	0.26	-0.59	-197	At risk	At risk	Uncertain	--
NeVERN#	185,530	0.48	259.4	0.59	0.40	-0.19	-63	Prob at risk	Prob at risk	Uncertain	-
Dyfi#	1,791,306	4.21	234.9	5.63	1.38	-4.25	-1,417	At risk	At risk	Uncertain	--
Dysinni#	314,883	0.68	216.3	0.73	0.12	-0.62	-206	Prob at risk	Prob at risk	Uncertain	+
Mawddach#	566,610	1.37	241.9	2.02	1.49	-0.53	-178	Prob at risk	Prob at risk	Uncertain	-
Dwryd#	92,400	0.19	201.4	0.33	0.11	-0.22	-75	At risk	Prob at risk	Uncertain	--
Glaslyn#	250,122	0.48	191.5	0.63	0.56	-0.07	-23	Prob at risk	Prob at risk	Uncertain	-
Dwyfawr	333,101	0.86	257.6	1.00	0.21	-0.79	-264	Prob at risk	Prob at risk	Uncertain	-
Seiont	210,534	0.48	226.1	0.83	0.16	-0.66	-221	At risk	At risk	Down	---
Ogwen	239,027	0.87	362.3	1.67	0.92	-0.74	-248	Prob at risk	Prob at risk	Uncertain	--
Conwy#	630,101	1.17	185.1	1.89	1.31	-0.58	-193	Prob at risk	Prob at risk	Uncertain	--
Clwyd	839,231	1.99	237.1	3.44	0.55	-2.89	-962	At risk	At risk	Down	---
Dee	6,170,351	15.30	247.9	16.78	11.57	-5.21	-1,737	At risk	At risk	Uncertain	---

*Expressed as 8lb fish equivalents where average fecundity = 3,000 eggs per fish

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Trend:	
p<0.05	---
p<0.10	---
0.10<=p<0.30	--
0.30<=p<0.50	-
0.70=>p>0.50	+
0.90=>p>0.70	++
p>0.90	+++
p>0.95	+++

For Wales as a whole, the shortfall in egg deposition based on the 5-year averages was around 56 million eggs. This equates to over 19,000 ~8lb adult fish equivalents (assumed mean fecundity of 3,000 eggs).

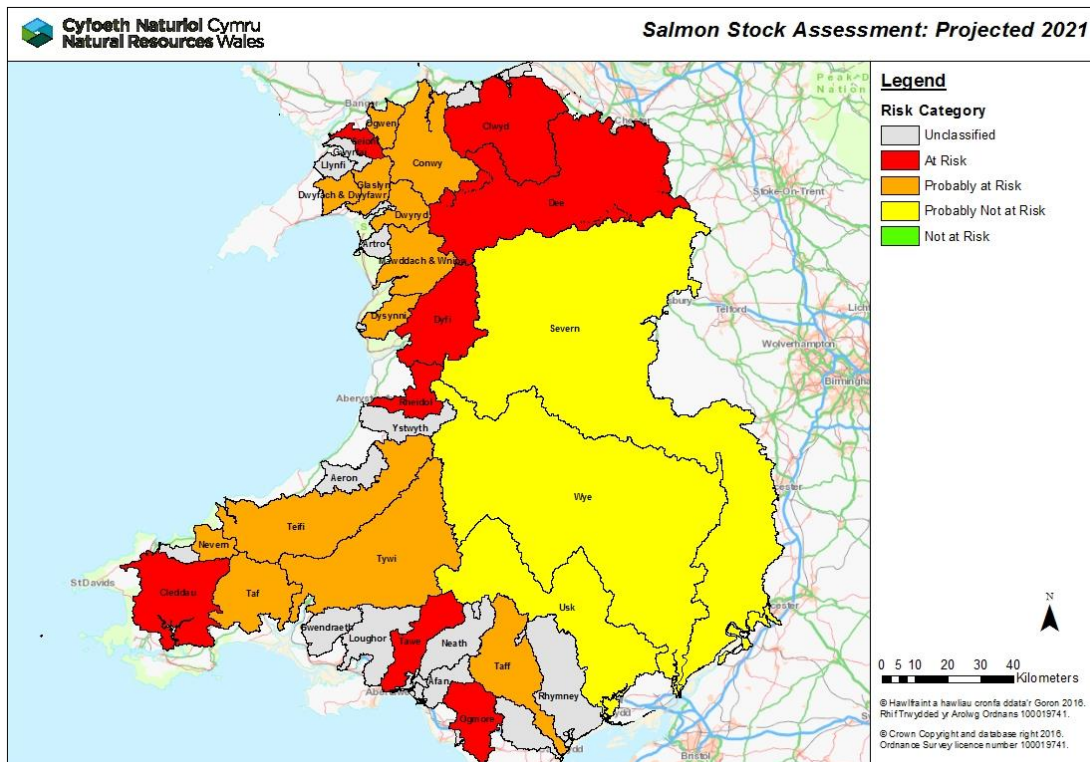


Figure 14 'Risk' status for the principal salmon rivers in Wales: current year 2016

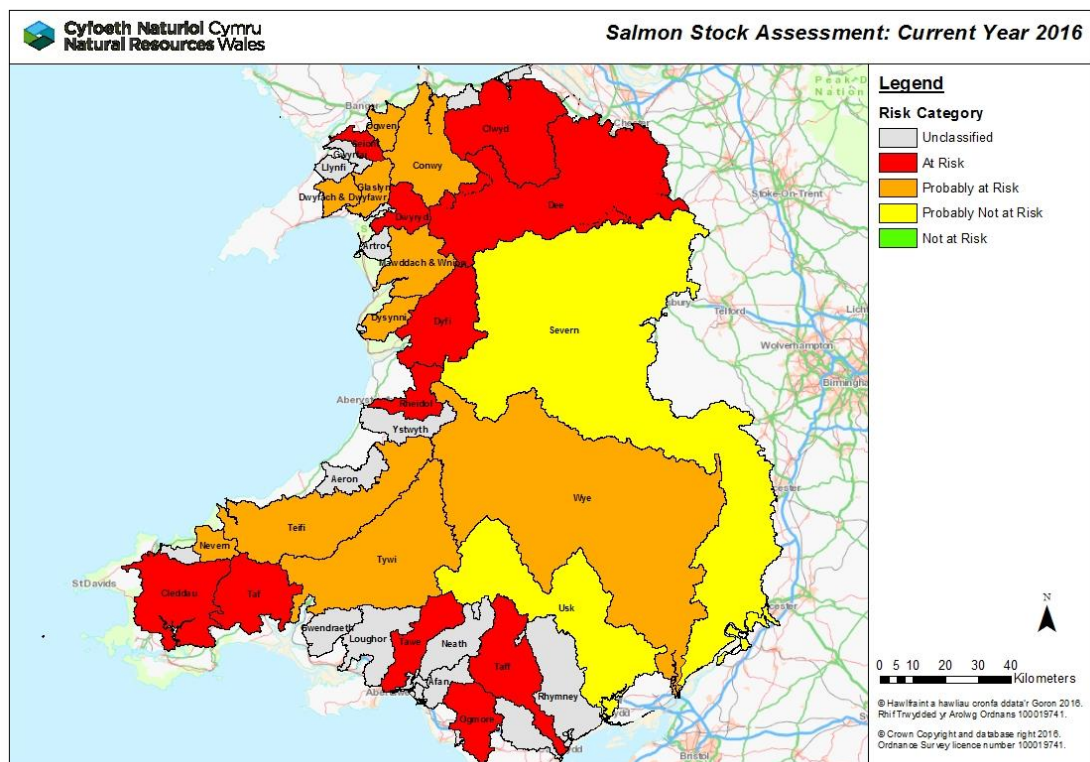


Figure 15 'Risk' status for the principal salmon rivers in Wales: projected 2021

4.2. Sea trout assessment

Angling CPUE and SR based assessments for sea trout (Section 2I) are shown in Tables 8 and 9 and Figs 16, 17 and 18 for the 33 main sea trout rivers in Wales.

While these two types of assessment are not directly comparable, either in methodology or 'risk' classification, they both indicate broadly similar geographical patterns in the performance of sea trout stocks across Wales (Figs 16, 17 and 18), with stocks in mid and north Wales generally faring better than those in the south and southwest. The reasons for this geographical contrast are unclear.

Table 8 CPUE based assessment of 'risk' status for the main sea trout rivers in Wales; 2016

River	2016
Severn	Prob not at risk
Wye	Prob at risk
Usk	At risk
Rhymney	At risk
Taff and Ely	Prob not at risk
Ogmore	Prob not at risk
Afan	Prob not at risk
Neath	Not at risk
Tawe	Prob at risk
Loughor	Prob at risk
Gwendraeth	Prob at risk
Tywi	Not at risk
Taf	At risk
E&W Cleddau	Prob at risk
NeVERN	Prob not at risk
Teifi	Not at risk
Aeron	Prob at risk
Ystwyth	Prob at risk
Rheidol	Not at risk
Dyfi	Not at risk
Dysynni	Prob not at risk
Mawddach	Not at risk
Artro	Not at risk
Dwryd	Not at risk
Glaslyn	Prob not at risk
Dwyfawr	Not at risk
Llyfni	Not at risk
Gwyrfai	Prob at risk
Seiont	Not at risk
Ogwen	Not at risk
Conwy	Not at risk
Clwyd	Not at risk
Dee	Not at risk

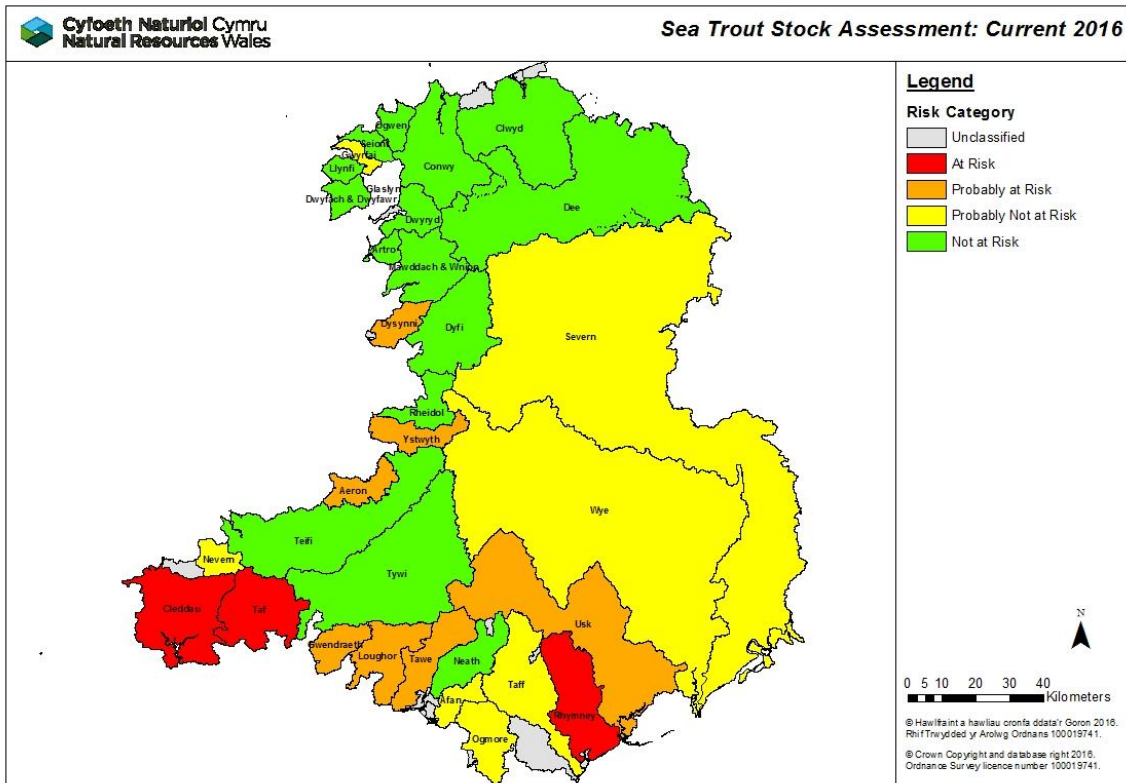


Figure 16. CPUE based assessment of risk status for the main sea trout rivers in Wales: 2016

The SR based assessment is likely to be the most biologically meaningful of the two sea trout assessment methods in that it aims to (i) provide an estimate of carrying capacity or related reference point (e.g. the CL) and (ii) evaluate stock performance against that reference point. The strong similarities between this approach and that applied to salmon also means that the same statistical trend-based compliance procedures can be used to classify risk status. In addition, the units of assessment – as spawners or eggs – have direct relevance to fishery management.

For these reasons, results from the SR based assessment are referred to throughout the remainder of this report to evaluate stock status and determine appropriate management responses.

In doing so it should be noted that the SR based method, like all fisheries assessment methods, is not an 'exact science'. Outputs are subject to errors and uncertainty which have not been quantified. In particular, as this is the first broad scale application of the SR based method, outputs should be closely scrutinised and interpreted carefully.

Table 9 Stock-recruitment (SR) based assessment of 'risk' status and egg shortfall/surplus for the main sea trout rivers in Wales: 2016

River	Accessible wetted area (m2)	Conservation Limit Eggs (millions)	Conservation Limit Eggs per 100m ²	Management Target Eggs (millions)	5-yr Geo. mean Eggs (millions)	Difference from Management Target: Eggs (millions)	At Risk' status: 2016	2021	Trend
Severn##	8,980,737	0.42	4.6	0.76	0.64	-0.12	Prob at risk	Prob at risk	Uncertain
Wye	17,210,439	0.97	5.6	1.55	1.34	-0.21	Prob not at risk	Prob not at risk	Uncertain
Usk	4,070,931	9.90	243.1	10.94	2.26	-8.68	At risk	At risk	Down
Rhymney		0.40		0.70	0.08	-0.61	At risk	At risk	Uncertain
Taff & Ely	1,457,195	4.42	303.5	5.23	0.69	-4.55	At risk	At risk	Uncertain
Ogmore	612,070	4.94	807.2	6.20	6.73	0.54	Prob not at risk	Prob not at risk	Uncertain
Afan	296,047	1.34	453.8	1.56	1.49	-0.07	Prob at risk	Prob at risk	Uncertain
Neath	556,110	2.61	468.6	3.48	3.50	0.02	Prob at risk	Prob at risk	Uncertain
Tawe	878,493	4.46	507.4	4.92	1.50	-3.42	At risk	At risk	Uncertain
Loughor	597,847	2.98	498.7	3.66	1.71	-1.95	At risk	At risk	Uncertain
Gwendraeth		1.77		2.46	0.54	-1.92	At risk	At risk	Down
Tywi#	5,000,722	20.80	416.0	23.96	18.79	-5.17	At risk	Prob at risk	Uncertain
Taf#	901,208	3.63	403.2	4.80	2.15	-2.65	At risk	At risk	Down
E&W Cleddau#	866,130	4.23	488.2	4.86	2.21	-2.64	At risk	At risk	Uncertain
NeVERN#	185,530	1.06	569.6	1.47	1.76	0.29	Prob not at risk	Prob not at risk	Uncertain
Teifi#	3,259,156	13.01	399.3	16.57	14.32	-2.25	Prob at risk	Prob not at risk	Uncertain
Aeron	201,733	0.77	384.0	1.01	0.41	-0.60	At risk	At risk	Uncertain
Ystwyth	461,156	2.32	503.2	3.20	2.38	-0.83	Prob at risk	At risk	Uncertain
Rheidol	306,345	3.19	1039.8	4.17	3.99	-0.18	Prob not at risk	Prob not at risk	Up
Dyfi#	1,791,306	28.79	1607.4	41.26	52.97	11.71	Not at risk	Not at risk	Up
Dysinn#	314,883	3.51	1113.2	4.76	6.03	1.26	Not at risk	Not at risk	Uncertain
Mawddach#	566,610	3.72	656.4	5.45	9.20	3.75	Not at risk	Not at risk	Up
Arro		0.32		0.42	0.30	-0.12	Prob at risk	Prob at risk	Uncertain
Dwyrhyd#	92,400	1.72	1864.1	2.51	1.22	-1.29	At risk	Prob at risk	Uncertain
Glaslyn#	250,122	6.77	2705.3	8.62	6.59	-2.03	Prob at risk	Prob at risk	Uncertain
Dwyfawr	333,101	4.84	1452.3	6.73	6.36	-0.37	Prob not at risk	Prob not at risk	Uncertain
Llyfni		2.76		3.58	2.46	-1.11	Prob at risk	Prob not at risk	Uncertain
Gwyrfai		0.15		0.19	0.18	-0.01	Prob at risk	Prob not at risk	Uncertain
Seiont	210,534	0.17	82.2	0.59	0.38	-0.21	Prob not at risk	Prob not at risk	Uncertain
Ogwen	239,027	2.02	846.1	2.88	3.44	0.55	Prob not at risk	Prob not at risk	Uncertain
Conwy#	630,101	4.53	719.6	7.56	9.43	1.87	Not at risk	Not at risk	Up
Clwyd	839,231	21.67	2582.5	25.53	17.28	-8.25	Prob at risk	Prob not at risk	Up
Dee	6,170,351	7.25	117.5	10.61	11.23	0.62	Not at risk	Not at risk	Up

*Expressed as 3lb fish equivalents where average fecundity = 2,000 eggs per fish

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Trend:	
p<0.05	---
p<0.10	---
0.10<=p<0.30	--
0.30<=p<0.50	-
0.70=>p>0.50	+
0.90=>p>0.70	++
p>0.90	+++
p>0.95	+++

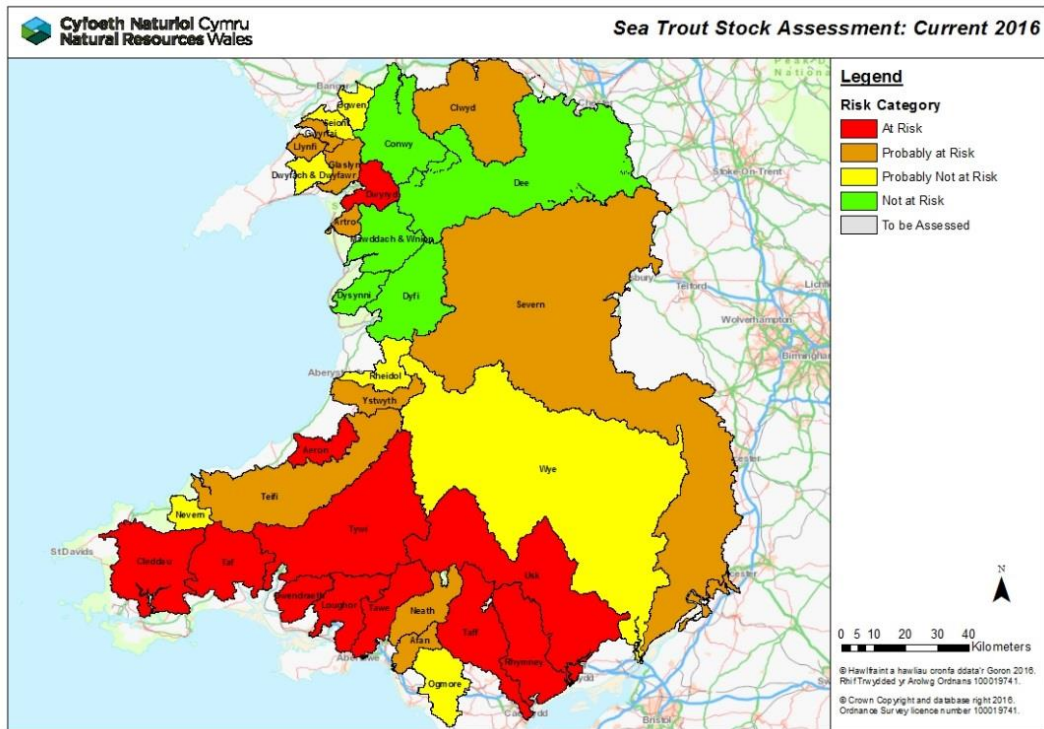


Figure 17. SR based assessment of 'risk' status for the main sea trout rivers in Wales: current year 2016

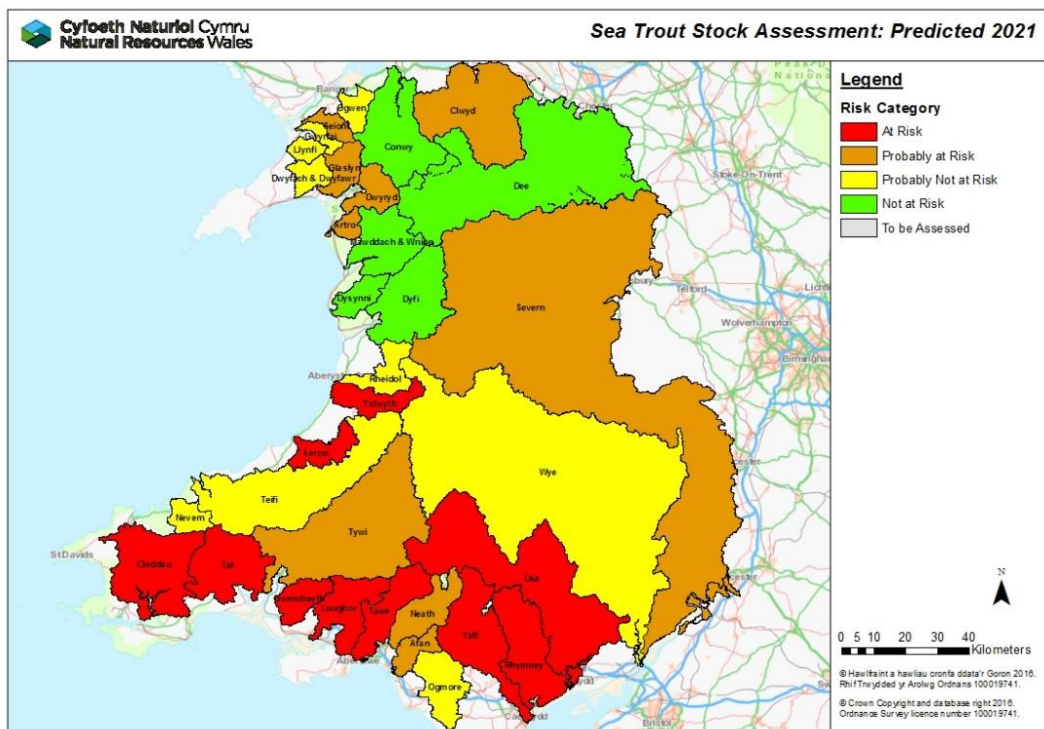


Figure 18. SR based assessment of 'risk' status for the main sea trout rivers in Wales: projected 2021

4.3. Juvenile salmon and trout stock status

The temporal electrofishing (EF) monitoring programme provides a largely consistent dataset across 32 catchments in Wales. Two analyses have been done on these data to examine long and short term patterns of abundance; the latter to assess the extent of the sharp decline in juvenile salmon and trout abundance evident across Wales and elsewhere in 2016:

- **Long term:** Ten of the larger catchments were selected for examination and statistical assessment of trends in juvenile salmon and trout densities (2002 to 2016, 15 years). Only catchments with in excess of 4 survey sites were selected with the aim of minimising the influence of any unusual sites or years on the analysis (i.e. to help ensure any one site does not disproportionately distort the results).
- **Short term:** To examine recent concerns about poor recruitment of juvenile salmon and trout following the 2015 spawning season, densities in 2016 were compared to average densities for the previous 5-years. This has been done on all 32 catchments, however, many of these catchments only have 1 or 2 survey sites, and so conclusions should be drawn with some caution.

Long Term

The table below (Table 10) summarises the long term trend analyses of salmon and trout densities in our larger catchments. The supporting data and graphs for these trends are shown in Annex 3.

The trends in juvenile salmon and trout abundance across Wales since 2002 ('All Wales') are mixed. Salmon fry show a declining trend and parr show no marked trend; however trout fry and parr both show an upward trend (albeit none of these trends are statistically significant).

Of the ten separate catchments assessed for trends over the 15 years from 2002 to 2016:

Salmon

- Eight have declining trends in salmon fry abundance, including two (Clwyd and Usk) which are statistically significant.
- The remaining two catchments (Wye and Conwy) showed no discernible trends in fry abundance estimates.
- There are very clear downward trends in both salmon fry and parr on the Tywi and Usk. This link between declining fry and parr numbers is evident for example on the Usk, where declining salmon fry numbers in 2014 and 2015 at the better parr sites have all been followed with poor results for parr in the subsequent years. Our continued investigations into the issue will seek to explore this further.
- The remaining rivers show either no trend or an upward trend for salmon parr.

Table 10. Long term trend analyses (2002 to 2016) for catchments with at least four survey sites. Statistically significant trends ($P < 0.05$ i.e. less than 5% probability that trends are due to chance) are highlighted in **bold**. The trend for 'All Wales' is derived

from all of the temporal monitoring sites across Wales, not just a summary of the ten larger catchments.

Catchment	0+ Salmon (fry)	>0+ Salmon (parr)	0+ Trout (fry)	>0+ Trout (parr and adults)
All Wales	Down P = 0.101	None P = 0.716	Up P = 0.442	Up P = 0.506
Cleddaus (East and West)	Down P = 0.616	Down P = 0.535	None P = 0.816	Up P = 0.127
Clwyd	Down P = 0.031	None P = 0.590	Up P = 0.241	Up P = 0.001
Conwy	None P = 0.680	Up P <0.001	Up P = 0.008	Up P = 0.069
Dee	Down P = 0.324	None P = 0.808	Up P = 0.004	Up P = 0.024
Dyfi	Down P = 0.361	Up P = 0.089	Up P = 0.066	Up P = 0.001
Taf	Down P = 0.216	Up P = 0.215	None P = 0.800	Down P = 0.697
Teifi	Down P = 0.263	None P = 0.827	None P = 0.794	Down P = 0.466
Tywi	Down P = 0.085	Down P = 0.016	Up P = 0.612	None P = 0.993
Usk	Down P = 0.033	Down P = 0.016	None P = 0.582	None P = 0.730
Wye	None P = 0.725	None P = 0.758	Up P = 0.027	None P = 0.521

Trout

The trout trends are more positive over this time period than are those of salmon

- Approximately half of the catchments show an increasing trend in trout fry and or parr
- Upward trends in trout fry in 6 catchments (3 statistically significant: Conwy, Dee and Wye)
- Upward trend in 5 catchments for trout parr (3 statistically significant: Clwyd, Dee and Dyfi)
- No declining trout fry trends (6 Up, 4 No Trend)
- Only two declining parr trends - the Taf and Teifi (5 up, 3 no change, 2 down)

Short Term

Routine monitoring in 2016 revealed fry numbers, especially young salmon hatched in the spring of 2016 at critically low levels on a number of principal catchments. These were rivers which previously produced consistent fry numbers.

The maps (Figures 19-22) show a comparison of these 2016 juvenile survey results as compared to the 5-year average.

Many of these catchments only have 1 or 2 survey sites, and so certainty around trends is reduced, especially for example on the Rhymney where any variation in the very low numbers of salmon caught may result in big percentage differences. Further detail on these data is shown in Annex 3.

When compared to the 5 year average, 29 of the 32 catchments surveyed in 2016 showed a decline in salmon fry (Figure 19), 28 of these were down by in excess of 40%. Included in this group are all of the ten larger catchments that were assessed for long term trends. Only the Rhymney, Seiont and Tawe, showed an increase in salmon fry.

A drop in salmon parr is also evident (Figure 20), with 27 of the 32 catchments having decreases in densities of between 1% and 100%; 12 of these had less than half the density of salmon parr than the 5 year average. Several of the larger catchments, with more sites and therefore more robust data show a large drop in both salmon fry and parr density against 2015 and the 5-year average - the Cleddaus, Clwyd, Dyfi, Teifi, Tywi, Usk and Wye catchments.

Of significance in the 2016 juvenile salmon results was the widespread absence of fry from sites where they have consistently been present; absent at 8 of the 13 Usk sites; 3 of the 6 Teifi sites; 6 of the 12 Tywi sites; and all 5 Clwyd sites.

There were no wide-scale absences of trout fry (Figure 21). Trout fry densities however were notably lower in all but 5 of the 32 catchments against the 5-year average. This is in stark contrast to the 15 year trend which showed no declining trends in the larger catchments. 14 catchments had less than half of the densities in 2016 as compared to the 5 year average. All of the catchments west from the Tawe to the Rheidol show a decrease in excess of 30% in trout fry density.

Trout parr appear more stable overall (Figure 22), with approximately half the catchments with declining densities and half with increasing densities. Of note from the larger catchments are the Clwyd with an 89% reduction in trout fry; the Tywi (-81% fry and -16% parr); the Usk (-67% fry and -22% parr) and the Cleddaus (combined -78% fry and -35% parr).

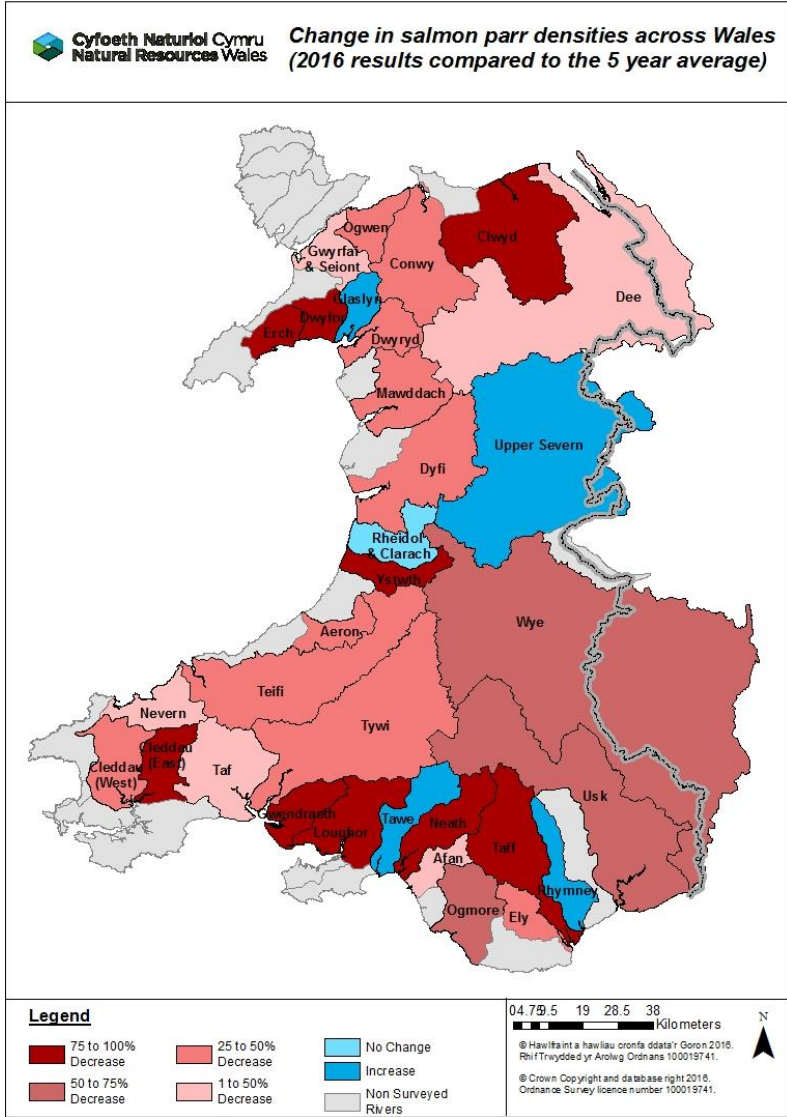


Figure 19 Change in salmon fry densities

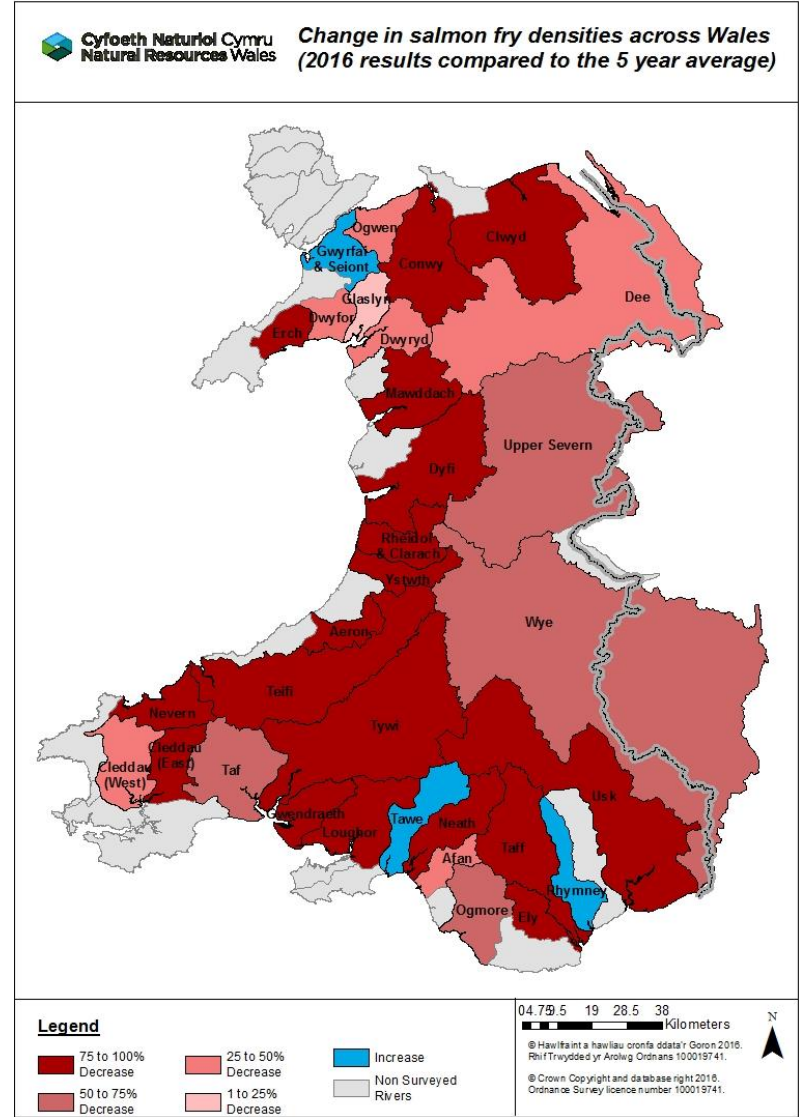


Figure 20 Changes in salmon parr densities

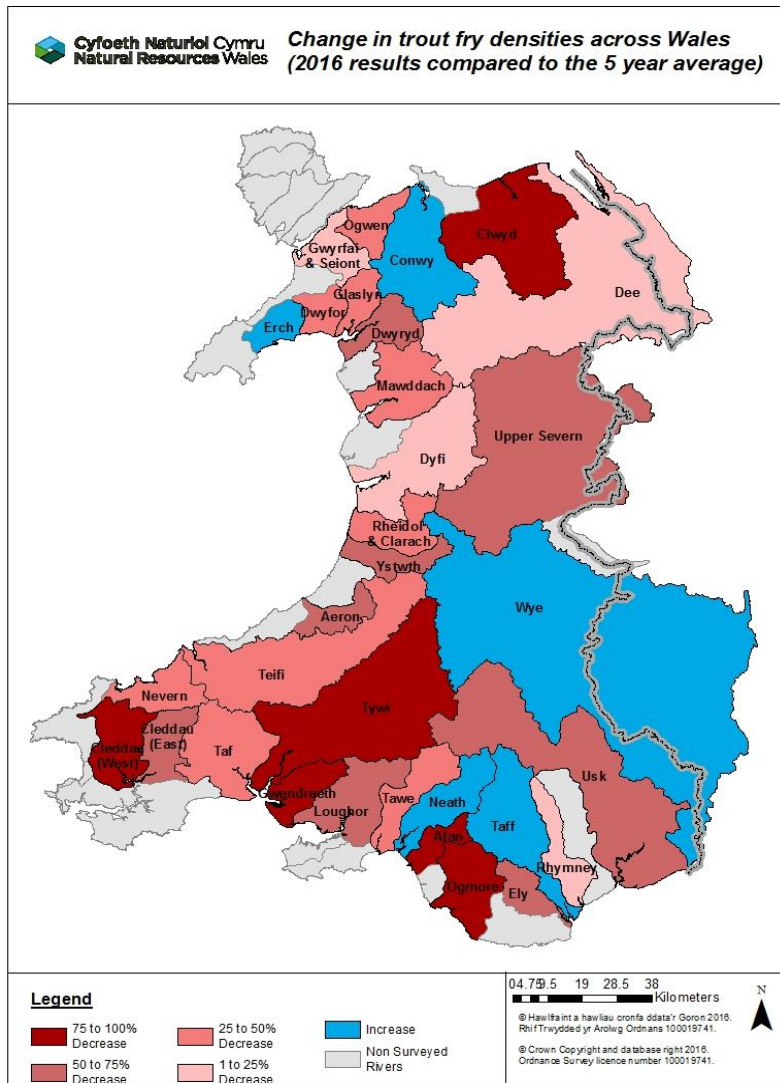


Figure 21 Changes in trout fry densities

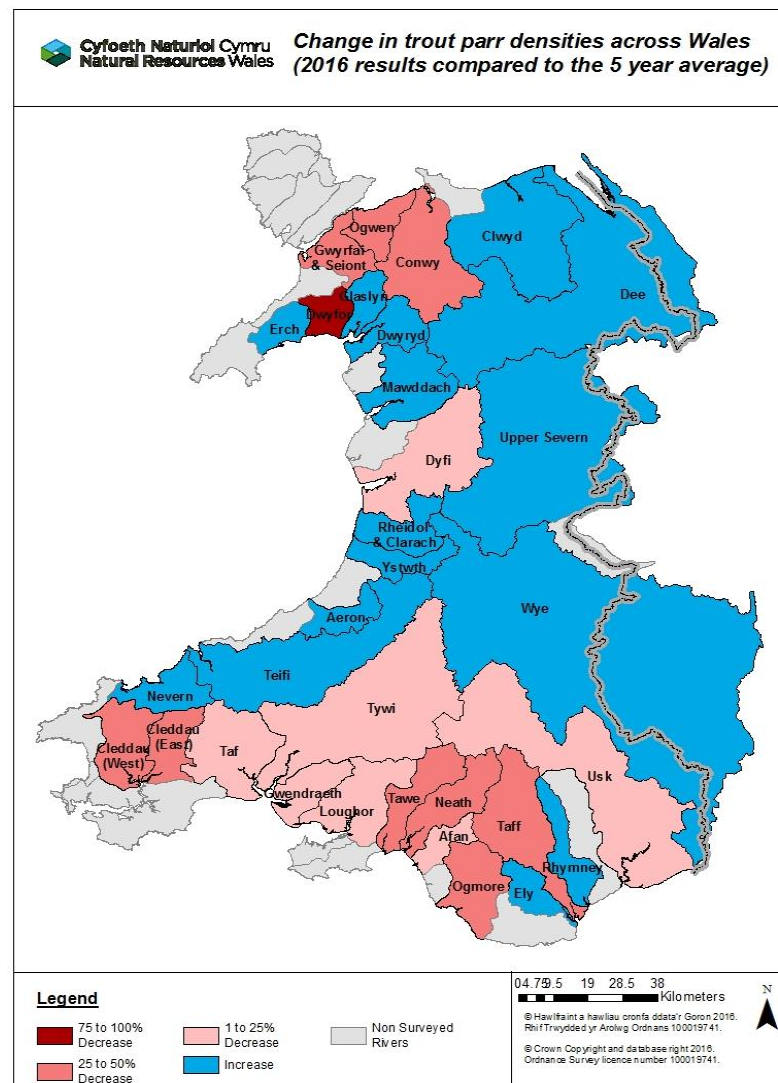


Figure 22 Changes in trout parr densities

There are three major factors that could have resulted in the decline in juvenile fish in this instance:

1. A shortfall in numbers of spawners (broodstock) in the 15/16 season,
2. Flow conditions and the impact of high flows on spawner distribution and damage to spawning sites.
3. Temperature - 2016 was the warmest year on record and it is likely that temperature effects in November and December would have impacted the final maturation of adults with a resultant impact on eggs. Temperatures in December were reported to be the warmest for both the UK and the Central England Temperature (CET) series, which dates back to 1659.

A shortfall in numbers of spawners has been considered by assessing the salmon rod catch over the same 15 year period as the trend analysis. Most salmon catches have declined since a peak in 2010. For example, the downwards trend (long and short term) in salmon fry noted on the Teifi is mirrored by a sharp decline in rod catch and in the run estimate from the Glanteifi fish counter. The numbers of adults in 2015, as estimated from the fish counter, were approximately a quarter of the estimate for 2010, decreasing from 6056 to 1298; and the rod catch decreased from 1013 to 298 (see Annex 3 for details). Indeed, of the ten rivers assessed for long term trends, the Wye is the only river with an increasing salmon rod catch, and whilst there is no long term trend up or down evident in the juvenile data, there has been a big drop in numbers of fry and parr in 2016 compared to the 5 year average.

General declines in rod catch however, do not adequately explain all of the salmon fry data. They do not for example explain the wide-scale absences of fry from several sites within the Usk and Tywi in 2016, where the rod catch was in fact slightly higher in 2015 than in 2014. It also does not address the fact that similar observations have been made in England, where, on some rivers at least, lack of spawners does not appear to be a key factor. This suggests a common effect, and, as a consequence, further investigations are underway into flows and flooding, and winter water temperatures.

To some extent it also follows that a decline in juveniles will mean fewer smolts and fewer returning adults. However with natural mortality between life stages playing such a significant role, as well as marine survival, this relationship is a complex one. In the long term analysis, declining salmon fry trends are not widely reflected in parr trends (except for the Cleddaus, Tywi and Usk); but the 2016 results as compared to the 5 year average do show a strong link with most of the rivers with fewer salmon fry also having fewer salmon parr.

The link between adult sea trout (or brown trout) rod catch and juvenile trout densities is likely to be more complex than in salmon. This is because it is not possible to distinguish whether trout fry are the progeny of sea trout, resident brown trout, or indeed both; or to tell at the juvenile stage whether they will migrate to sea or stay in the river. This plasticity of life history makes the sea trout potentially more flexible in its responses to stressors than salmon, but in turn, relationships between indicators of

adult abundance such as rod catch and numbers of juveniles may be difficult to discern.

5. CHALLENGES TO STOCKS

NRW is aware that a number of pressures is acting on our rivers and their ecology and that this is also having an effect on fish. The purpose of this section is to set out those pressures and to explain what NRW is currently doing to address them. We think that whilst these actions are agreed and implemented, it is essential to preserve the vital spawning stocks of fish.

Introduction

There is a wide range of factors that each, sometimes in combination, influence the quality of habitats in which salmon and sea trout exist. These factors therefore may act in a number of ways to suppress and threaten the wellbeing of stocks.

These factors are considered within the river basin plans that are produced as a requirement of the EU Water Framework Directive:-

http://ec.europa.eu/environment/water/water-framework/index_en.html).

The plans are concerned with the pressures facing Wales' water environment. Our rivers, lakes, wetlands, ground waters, estuaries and coastal waters, including those in protected areas all fall under these plans. They are updated on a six yearly cycle and are prepared in consultation with a wide range of organisations and individuals. The approved river basin management plans and supporting documents are available on our website:-

<https://naturalresources.wales/evidence-and-data/research-and-reports/water-reports/river-basin-management-plans-published/?lang=en>

Additionally, NRW has compiled and published a report on the state of the natural resources of Wales (SONAR). The report assesses the extent to which natural resources in Wales are being sustainably managed, and recommends a proactive approach to building resilience. And - for the first time – the report links the resilience of Welsh natural resources to the well-being of the people of Wales. The report considers how pressures on Wales' natural resources are resulting in risks and threats to long-term social, cultural, environmental and economic well-being, as set out in recent legislation:

<http://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en>

The SONAR report can be found here:-

<https://naturalresources.wales/evidence-and-data/research-and-reports/the-state-of-natural-resources-report-assessment-of-the-sustainable-management-of-natural-resources/?lang=en>

More specifically for salmon, local issues and constraints have previously been reviewed in specific catchment Salmon Action Plans, but more recently are considered in the set of 'Know Your Rivers' documents compiled by NRW with the support of stakeholder groups, most notably the Local Fisheries Groups. These reports set out

local issues and endeavours to identify partner organisations who can undertake these remedial works alone or in partnership with NRW or other bodies.

This section briefly considers principal factors that are known or are believed to be impacting on our stocks. These range from global factors such as marine survival of fish which is presumed to be a reflection of climate change, to local factors such as diffuse pollution and avian predation. We have included this to indicate clearly that there many issues that need to be addressed in order to restore our stocks to sustainability whilst action is taken through fishing control measures to ensure that we maximise our annual spawning stocks.

The factors we consider here are:-

- I. Marine survival of salmonids
- II. Water quantity
- III. Water quality
- IV. Predatory birds
- V. Disease and parasites
- VI. Illegal fishing and enforcement
- VII. By-catch in pelagic fisheries
- VIII. Freshwater survival – a changing climate
- IX. Fish introductions and hatcheries

5.1. Marine survival of salmonids

The catches of salmon have been declining across its range for the past 40 years, and populations that make up the southern European stocks have experienced the greatest declines in the NE Atlantic (Figure 23)

These reductions have occurred following extensive efforts in restricting exploitation, both in distant high seas fisheries (Faroes and Greenland Fisheries) as well as home waters, in both net and rod fisheries. The declines could equally be as a result of the reductions in exploitation as well as reductions in pre fishery abundance.

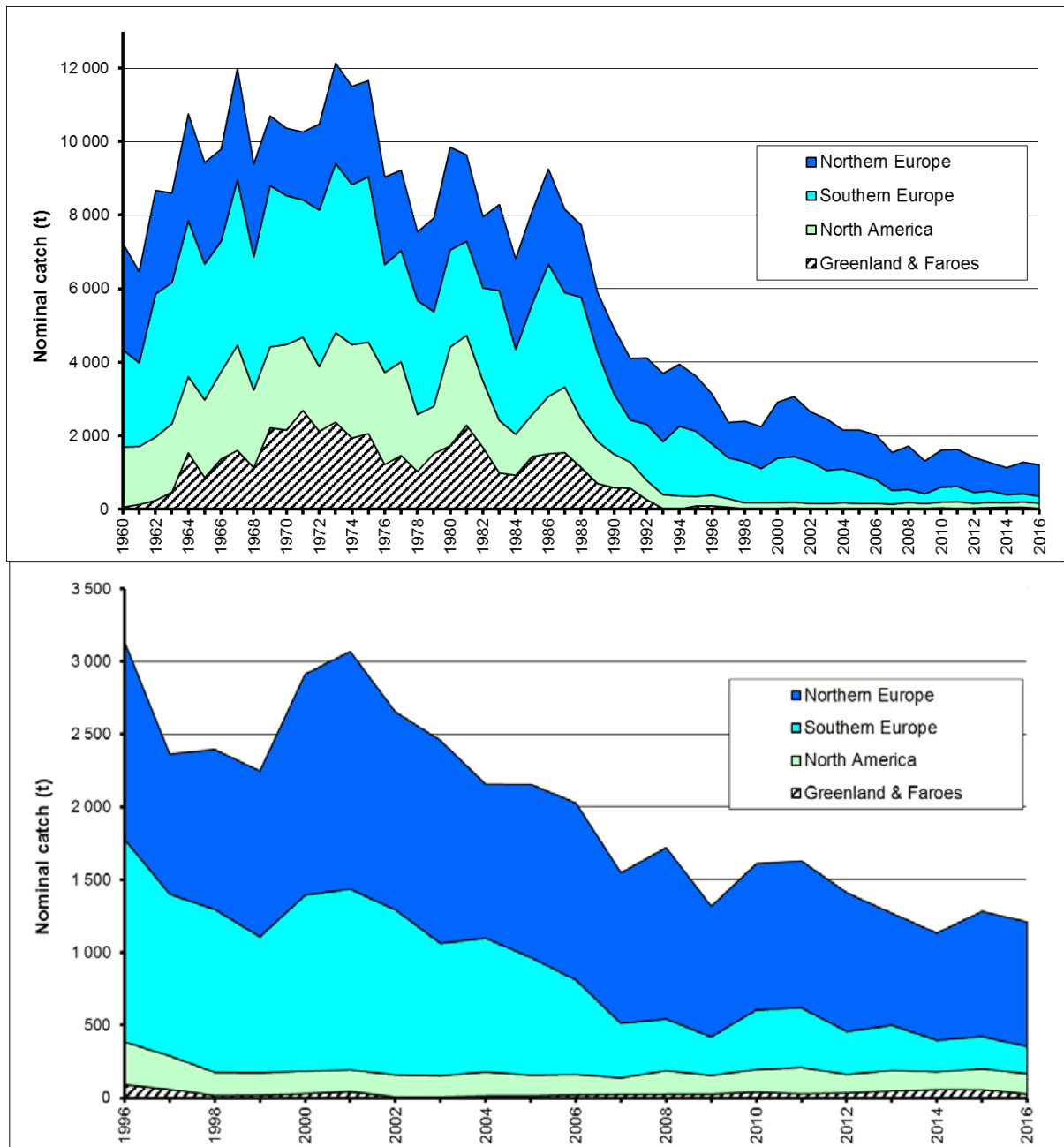


Figure 23 Total reported nominal catch of salmon (tonnes round fresh weight) in four North Atlantic regions, top: 1960–2016 and bottom 1995–2016. (ICES 2017).

The exact reasons for these declines are not fully understood, however they have been linked closely to climatic changes and environmental conditions in the north Atlantic.

The marine survival of salmon is typically expressed as the proportion of emigrating smolts that return to homewaters (to the coast) or to their river of origin as 1SW or 2SW adults. In reality, however, these ratios are return rates rather than survival rates since they reflect the effects of both mortality and maturation. Changes in the age at maturation may affect the relative proportions of a smolt cohort that return as 1SW or 2SW fish, but this can also result from changes in natural mortality in different areas

of the ocean. Numerous factors are thought to affect the survival of salmon in the sea, both biotic and abiotic, although their relative impact and the interactions between them are poorly understood. Nonetheless, there is clear evidence of a substantial downturn in the survival of fish at sea (ICES, 2017) and the extent and coherence of the observed declines in the abundance of salmon stocks have long been considered to indicate that broad-scale changes in the marine environment are the main cause of this. Such changes have been linked to large climate forcing mechanisms affecting trophic pathways and have been reported for both the Northwest and Northeast Atlantic.

The latest information, (Figure 24) on the return rates to stocks in Southern Europe over the past 35 years suggests that the proportion of smolts returning as 1SW fish has dropped, on average, to around 3.5%, although there is marked variability between stocks and between years. During the 1980's it was estimated that the return rate for 1SW fish was on average 15%, but since the 1990s the estimated survival has steadily declined, with 3 of the last 5 years significantly below 5%.

Survival of smolts returning as 2SW salmon has, on average, remained low throughout the past 35 years, and is currently estimated at approximately 2%.

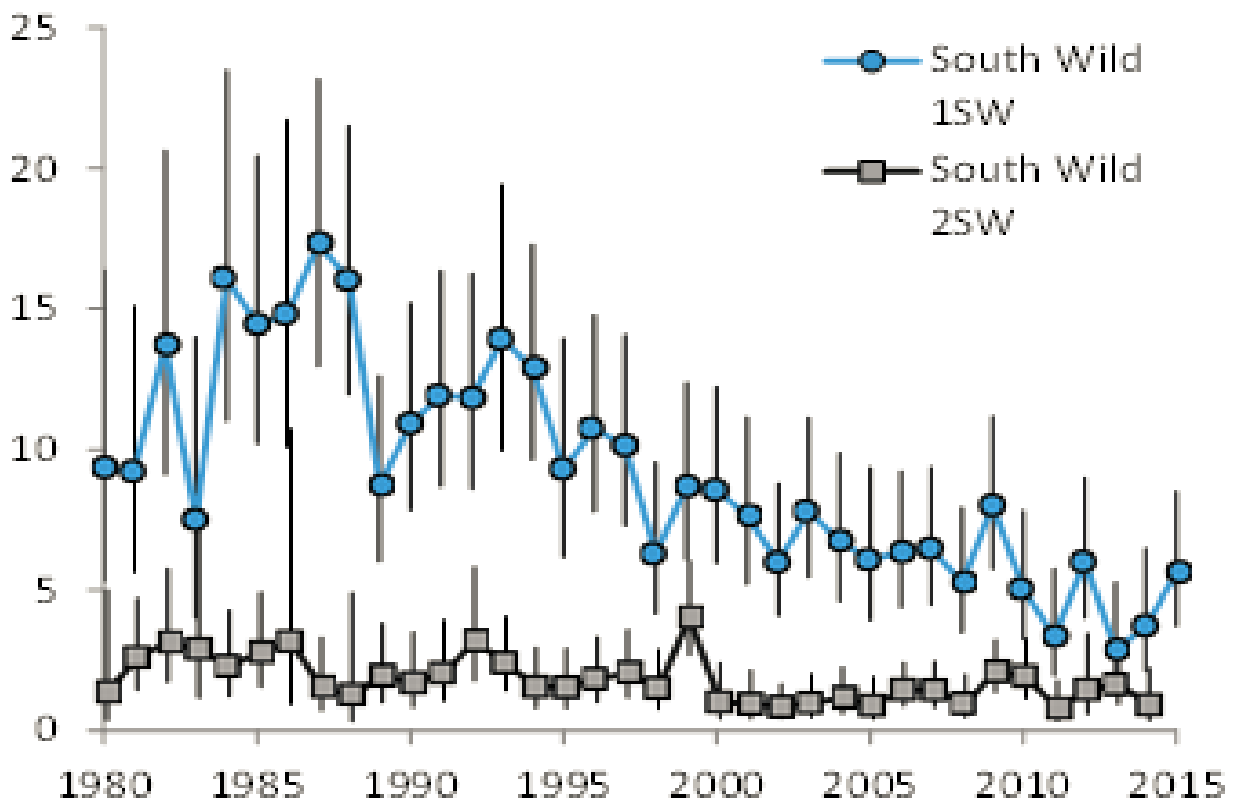


Figure 24 Percentage survival of smolts returning to Southern European stocks. (From ICES 2017)

Least squared (marginal mean) average annual survival indices (%) of wild southern areas. Annual means derived from a general linear model analysis of rivers in a region with a quasi-Poisson distribution (log-link function). Error values are 95% CLs the analyses included estimated survival (%) to 1SW and 2SW returns by smolt year with: Wild returns to: southern rivers (El-lidaar, Corrib, Burrishoole, North Esk, Bush, Dee, Tamar and Frome Bush 2+ smolts).

The continued low abundance of salmon stocks in many parts of the North Atlantic despite significant fishery reductions strengthens the views that factors acting on the survival in the first and second year years at sea are constraining the abundance of salmon. (ICES 2016)

It is therefore vitally important that we aim to maximise, spawning and freshwater production to protect vulnerable stocks.

5.2. Water quantity

Restoring damaged ecosystems is a long-term process and we will need to manage the expectations of those seeking instantaneous improvements. Additionally, where required, changes in business practices and culture, legislation and policy and the commitment of investment, may take time to secure particularly during economically challenging times. To minimise the risk of incurring high costs versus relatively low benefits, intervention on the ground will be undertaken only where there is good evidence of practices causing environmental harm, otherwise we will review and issue best practice guidance for high risk activities.

Water is the most essential of Wales' natural resources. NRW is the regulatory body responsible for managing water resources in Wales. We need to balance the water needs of the environment, society and the economy, both now and in the future. We face a number of challenges which will have an impact on our water resources and the ways we manage them. These include population growth, an increased demand for water and climate change

We manage the amount of water taken from the environment through a permitting system and by regulating existing licences. Where appropriate, we also grant new licences. We currently regulate some 1,160 abstraction licences and 627 impoundment licences across Wales.

The publication, '[Managing water abstraction](#)', sets out the approach and regulatory framework within which we will manage water resources:-

<https://naturalresources.wales/permits-and-permissions/water-abstraction-and-impoundment/information-about-water-abstraction-or-impoundment-licensing/?lang=en>

A water abstraction licence will be needed from NRW to remove (abstract) more than 20 cubic metres (4,400 gallons) of water a day from a surface or ground water source in Wales. Further information on abstraction and impoundment licensing is available in the '[Permitting](#)' section. To see how much water is available in your river catchment area and to understand the likelihood of your application being successful, please see your local [Abstraction Licensing Strategy \(ALS\)](#).

We also need to make sure that the amount of water being taken from rivers or out of the ground can be sustained without damage to the environment. In cases where water cannot be abstracted sustainably, we may need to amend existing licences, under the [Restoring Sustainable Abstraction \(RSA\) programme](#). Investigations under

the RSA programme have helped us identify improvements that will contribute to meeting the UK's objectives with regard to the European [Water Framework Directive \(WFD\)](#).

Under the Habitats Directive there is an obligation to ensure that our Special Areas of Conservation (SACs) are managed so as to secure favourable conservation status of the interest features (the habitats and species for which they are designated) and, where that conservation status is not favourable, to restore it to such a status (Article 6.1). In addition we must ensure that the habitats of the species for which the SAC is designated do not deteriorate, and that the species are not subject to significant disturbance (Article 6.2).

As a competent authority under the Habitats Regulations 1994, NRW and its predecessor body EAW have undertaken a review of our existing permissions, to determine whether we can ascertain no adverse effect, or risk of adverse effect on site integrity if these permissions are allowed to continue unmodified (affirmed).

The Review of Consents (RoC) process provides a vital contribution to the international obligations. It has led to many changes in permits and, in some cases, operational practices for both abstraction and discharges. Although these changes are based on the habitats and species (e.g. salmon) that are designated, there are also valuable benefits to other species including brown trout and sea trout. The review itself however, on its own, is unlikely to achieve the full requirements of these obligations to sustain and where necessary restore the favourable conservation status of every feature throughout the SACs.

5.3. Water quality

As our control of regulated discharges has become increasingly effective, the significance of other sources of pollution has become more evident. These sources, known as diffuse pollution, typically consist of discharges or contamination that, while relatively minor individually, collectively have a significant impact on water quality. The contamination is frequently associated with rainfall and its chemical and microbial composition can be extremely variable.

The Water Framework Directive required that we aim to achieve good status (or potential) in all water bodies by 2015. This improvement in status can be realised through future cycles of the WFD, ending in 2027. More information on the Water Environment and WFD can be found on the [waterwatchwales](#) site.

As our control of regulated discharges has become increasingly effective, the significance of other sources of pollution has become more evident. These sources, known as diffuse pollution, typically consist of discharges or contamination that, while commonly are of relatively minor significance individually, collectively have a significant impact on water quality. Some diffuse pollution pollutants can however have deleterious effects on their own. The contamination is frequently associated with rainfall and resulting run-off, and its chemical and microbial composition can be extremely variable.

Where water bodies are non-compliant for fish, we have conducted investigations to identify the reasons for not achieving good status or better. The full list of reasons for not achieving good status is presented in for national Significant Water Management Issue (SWMI), SWMI Activity and SWMI pressures, respectively. This information shows that significant pressures affecting fish populations including habitat alterations, barriers to fish passage and sediment inputs into our rivers (Figure 25), but it should be noted that these issues are not all directly related to water quality.

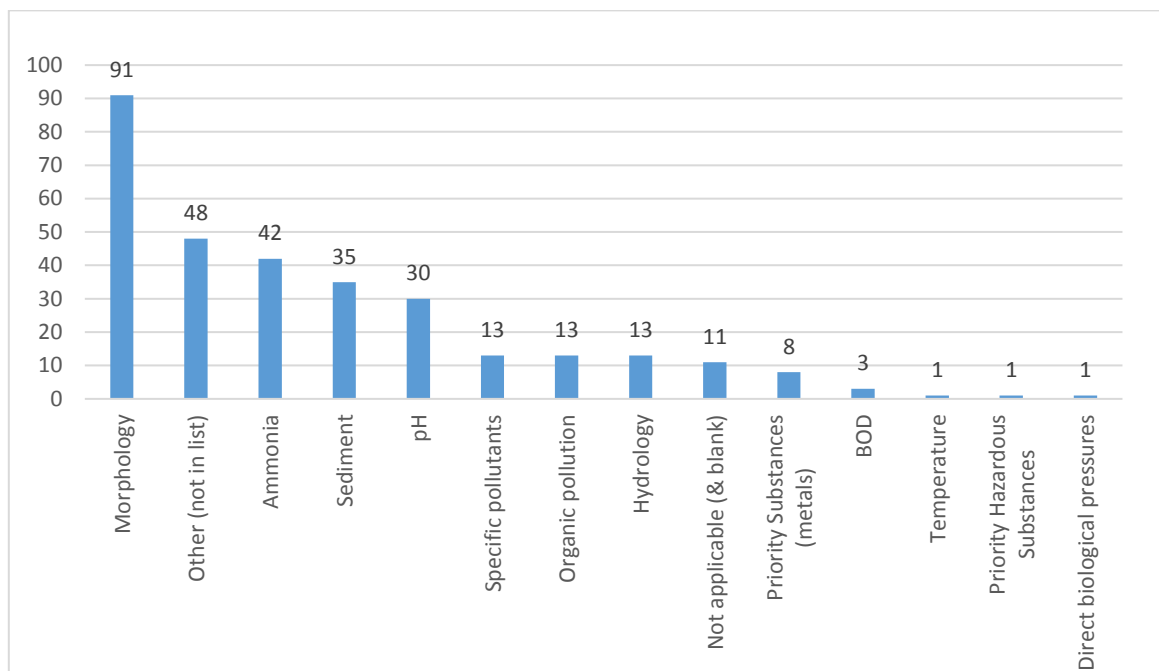


Figure 25 WFD Fish Classification in Welsh rivers (2015): Reasons for Not Achieving Good Status - Significant Water Management Issues pressure (confirmed and probable)

We continue to identify the technically feasible and cost beneficial measures that will be required to allow fish to achieve good status. We will continue to improve this information as we move through the next cycles of the WFD. Funding and delivery of these measures will be challenging. Catchment based partnership working will be an important part of achieving the benefits associated with achieving good status.

If a water body is not achieving 'Good status' we need to understand what is causing the failure, so appropriate actions can be taken to improve its status.

The 'reasons for failure' data is a record of what we believe the cause of the problem is (activity, source and sector) and is based on the results of our investigations, local knowledge and technical expertise. By identifying why a water body is failing we can consider what actions we or others can take to deal with the problem.

Figures 26 and 27 indicates the reasons for not achieving 'Good Status' - Significant Water Management Issues Activity, that are the most probable and confirmed reasons.

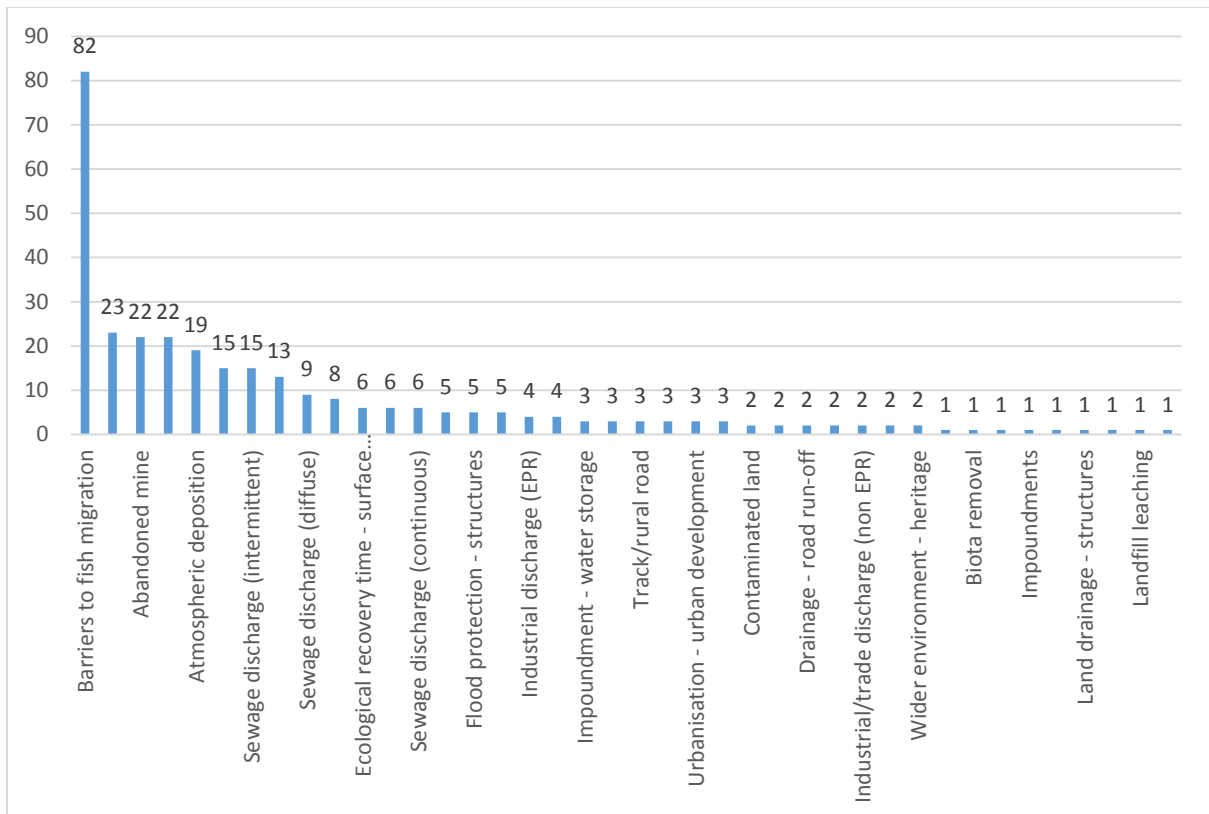


Figure 26 WFD Fish Classification in Welsh rivers (2015): Reasons for Not Achieving Good Status - Significant Water Management Issues Activity (confirmed & probable)

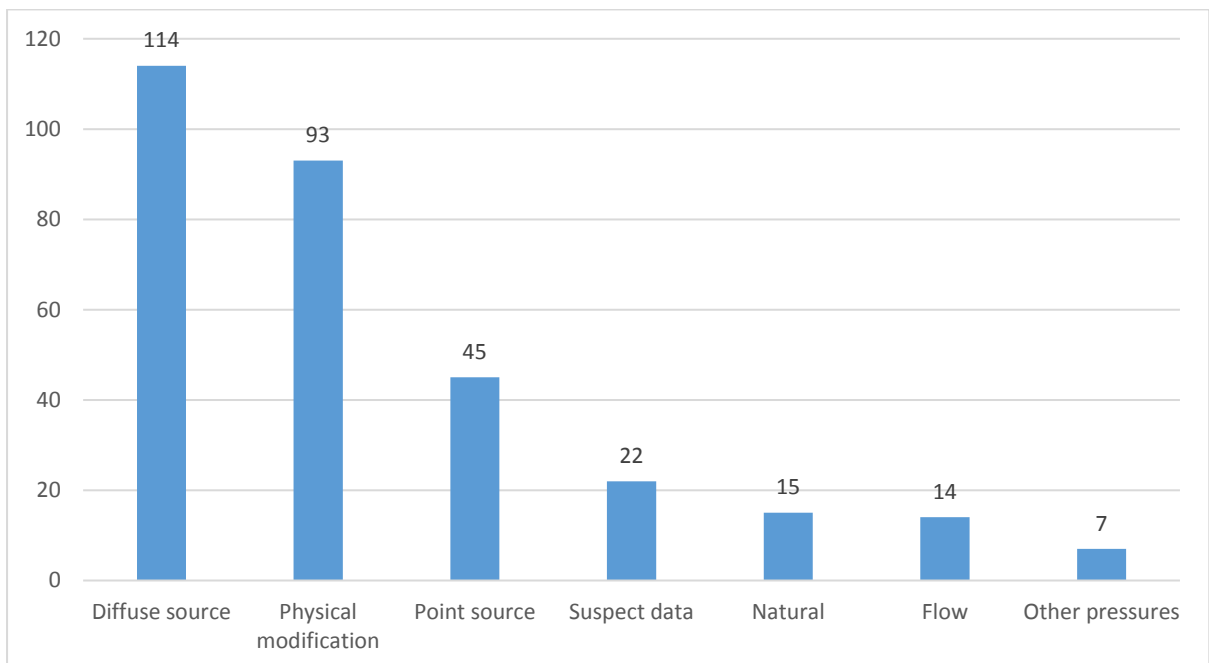


Figure 27 WFD Fish classification in Welsh rivers (2015): Reasons for Not Achieving Good Status - National Significant Water Management Issues (confirmed and probable)

Quantifying the extent and impact of ‘unseen’ diffuse pollutants, and raising awareness among those responsible, is difficult. However, in January 2013 we estimated that at least 35% of Water Framework Directive water-bodies in Wales are failing due to diffuse pollutants.

Building on previous work between Welsh Government and other organisations, we have identified eight areas on which to prioritise effort to tackle diffuse pollution, namely:

- industrial estates,
- small sewage discharges (private),
- drainage misconnections,
- surface water drainage from developed areas,
- livestock management,
- land management,
- storage – slurry, fuel, oils, chemicals,
- mine waters

We will learn from best practice, use alternative rather than additional solutions, and aim to deliver the plan within existing budgets. Where identifiable we will endeavour to apply the polluter pays principle.

5.4. Agricultural pollution

Analysis of the Water Framework Directive (WFD) investigations programme for 2015 shows that agricultural practices are contributing to the failure of 110 water bodies. One of the roles of NRW is to address these failures and to restore ecological status of the water bodies to at least ‘Good’.

Whilst uncertainty surrounds the future of the regulatory framework for agriculture and the level of available resources following UK’s decision to leave the EU, it is clear that diffuse and point source pollution both need to be addressed within Wales as soon as possible. More information is available within the recently published State of Natural Resources report (SoNaRR):-

<https://naturalresources.wales/evidence-and-data/research-and-reports/the-state-of-natural-resources-report-assessment-of-the-sustainable-management-of-natural-resources/?lang=en>

The Water Strategy for Wales sets out Welsh Government’s priorities for water management up to 2020. The accompanying action plan makes a commitment to review the regulatory framework for diffuse pollution by 2018.

Ongoing agricultural pollution arising from both point and diffuse sources is having a serious detrimental effect on the Welsh environment. This is reflected within SoNaRR as well as the ongoing Welsh Government consultation on Nitrate Vulnerable Zones (NVZ):-

<https://consultations.gov.wales/consultations/nitrate-vulnerable-zones-wales>

Both diffuse and point-source pollution from agriculture will impact on NRW's ability to meet WFD targets under the River Basin Management Programme.

Agricultural pollution is the third most frequent reason for not achieving good status in Wales, affecting some 180 individual waterbodies. The number of pollution incidents caused by dairy and beef farms across Wales has fluctuated between 85 and 120 for each of the last six years. Recent wet winters and a significant downturn in the dairy market have added to the pressure on the environment and on farmers, reducing their capacity to invest in improved slurry and silage store management.

Point source pollution incidents (such as those caused by overflowing slurry stores) are concentrated in particular parts of Wales. For example, over 60% of the incidents over the last three years took place within the milk field of Carmarthenshire and Pembrokeshire. These required significant input on the part of local NRW staff.

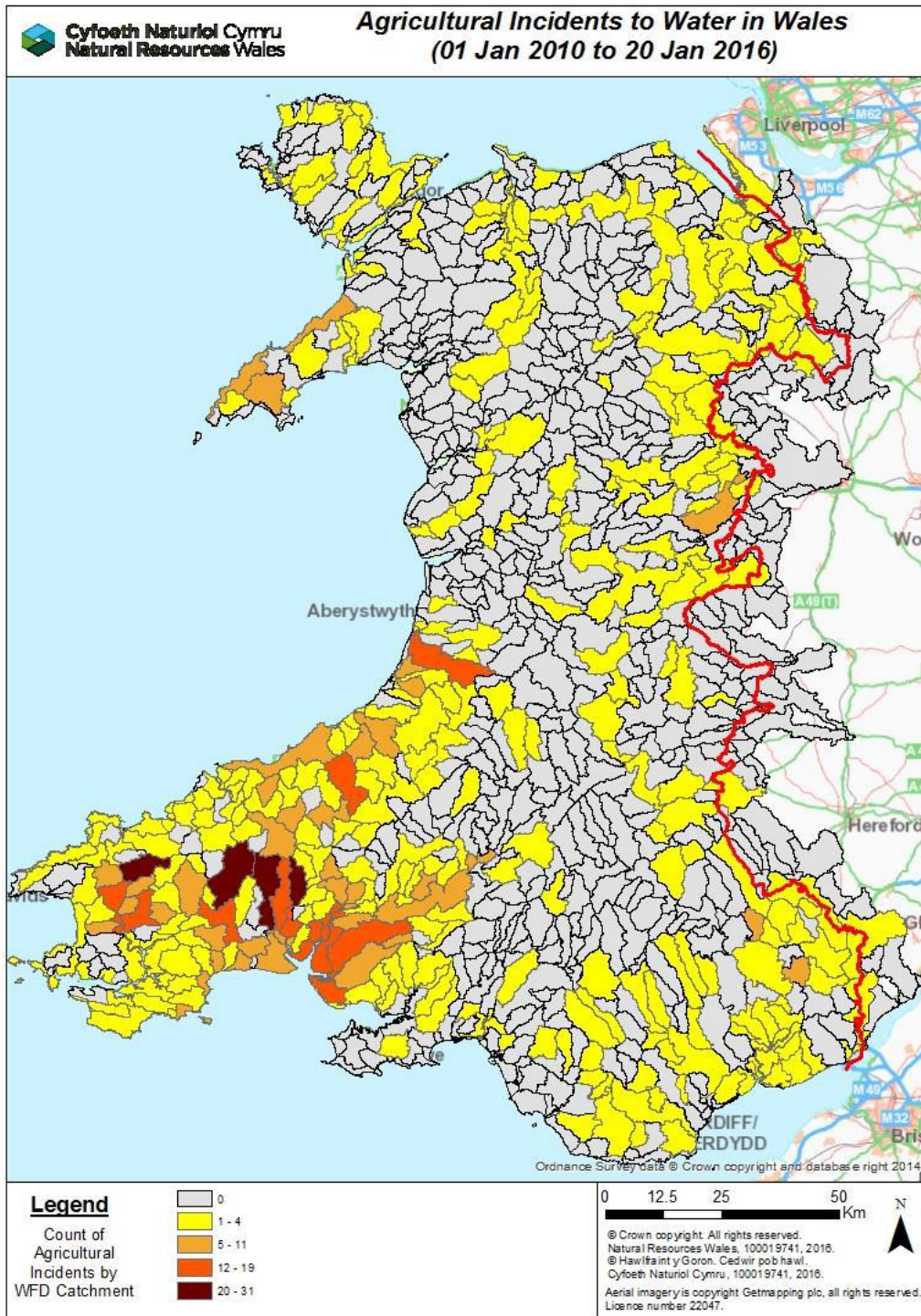


Figure 28 Location of Welsh agricultural pollution incidents impacting on water

Following several discussions with Welsh Ministers over the period 2015-2016, NRW and Welsh Government have now established a working group under the auspices of the Wales Land Management Forum (WLMF). The WLMF is the mechanism through which Board Members from NRW, the Farming Unions and the Forestry Sector are able to liaise on a regular basis.

The membership of the WLMF working group on agri-pollution includes:-

- the Welsh Government (WG),
- the National Farmers Union Cymru (NFU Cymru),
- the Farmers Union of Wales (FUW),
- the Country Landowners Association (CLA),
- Tenant Farmers Association (TFA),
- Dwr Cymru Welsh Water (DWCC),
- Hybu Cig Cymru (HCC),
- AHDB Dairy and
- Natural Resources Wales (NRW).

Other organisations can be invited to attend meetings and join the Group at the discretion of the Chair. All meetings are chaired by an NRW Board Member and NRW also provides the secretariat.

The primary purpose of the WLMF working group is to investigate, agree, report and deliver on potential solutions for tackling both diffuse and point source agricultural pollution in Wales. The group also aims to achieve a more integrated approach to tackling agri-pollution issues on the part of all participating organisations whilst building links with related forums such as the River Basin Management Liaison Panels.

As set out in the terms of reference, the specific objectives of the WLMF working group are to:

- Undertake root cause analysis in order to achieve common understanding of the causes of agricultural pollution and the ways in which these are currently addressed;
- Identify potential options for legislative and non-legislative measures designed to address agricultural pollution;
- Estimate the resources required to deliver the changes required and appraise each option in terms of a cost benefit analysis as far as possible;
- Select a smaller number of priority options for further development, taking into account those likely to be the most beneficial in the context of other sources of diffuse and point source pollution;
- Adopt a partnership approach to identifying and bidding for the resources required to develop specific initiatives, and when appropriate act as the Steering Group during the implementation phase.
- Address the requirement to establish measurable targets for reducing the number of point source agricultural pollution incidents, tackling the extent of diffuse pollution and improving water quality over a specific timeframe;
- Raise awareness and commitment of key stakeholders within the WLMF, the Agricultural Strategy Partnership Group (Amaeth Cymru), relevant sector bodies such as AHDB Dairy and Hybu Cig Cymru (HCC), agricultural advisors within the banking sector and the River Basin Management Liaison Panels.

The group has met several times since inception in January 2017, thus ensuring that members could rapidly gain a greater understanding of some of the issues and root causes underlying individual pollution cases. A series of case studies from NRW's work across South West Wales has been presented, and representatives from NFU Cymru and FUW presented the farmer's side of the story, placing particular emphasis on the need to take a new approach to raising farmers' awareness through demonstrating the impact of pollution incidents and developing a range of targeted messages for farmers facing specific problems whilst making it easier for the sector to develop a culture of self-reporting.

A significant tranche of work has concerned the nature and extent of the advice now being provided to farmers. This discussion has since been used to complete a Farming Connect Concept Document for submission to Welsh Government. The purpose of the Concept is to ensure that Farming Connect activities can be more directly focussed on the prevention of agricultural pollution in those areas at the greatest risk, whilst at the same time ensuring a co-ordinated approach alongside the work of NRW's local staff.

The most recent meeting of the working group in May 2017 featured discussions on:

- the draft Farming & Forestry Connect Concept Document;
- the nature and accessibility of the advice provided to farmers on both the NRW and Welsh Government websites;
- the role of the Rural Development Plan (RDP) investment measures in addressing agricultural pollution and the extent to which the use of these measures can be maximised in the period running up to 2020.

Following this meeting, there is commitment to continue with regular discussions to ensure that the sub-group is able to provide a comprehensive suite of recommendations to the Cabinet Secretary, NRW Board, Amaeth Cymru and the Boards of all participating organisations.

Regulation of the sector is another significant area of work in addition to advice and incentives. NRW is currently analysing additional statistical information on recent Category 1 & Category 2 incidents (now described as "High Impact" under the recently revised NRW incident categorisation system) with a particular emphasis on the kinds of enforcement action arising in each case. The nature of the enforcement action can vary from written warnings, formal cautions and prosecutions, but also incorporates the use of Enforcement Undertakings under which the polluter agrees to undertake some form of compensatory remediation.

A further major area that the working-group is considering is that of innovation, including the prototype slurry separator at Coleg Sir Gaer in Carmarthenshire. Other areas of innovation concern Anaerobic Digestion (AD) projects. One particular difficulty with the latter is that the products of all AD plants are required to be treated as waste and there are also some significant technical issues that can arise in the running of such plants.

The major challenges around land management and in particular agriculture are currently a significant challenge.

5.4.1. The Wales Land Management Forum

Recent incidents of pollution arising from the agricultural sector have triggered substantial work in order to address the impact on our rivers.

The Water Strategy for Wales sets out Welsh Government's priorities for water management up to 2020. The accompanying action plan makes a commitment to review the regulatory framework for diffuse pollution by 2018. Earlier this year a new working group, the Wales Land Management Forum (WLMF), a development sub-group on Tackling Diffuse & Point Source Agricultural Pollution was established. The group comprises representatives from Welsh Government (WG), the National Farmers Union Cymru (NFU Cymru), the Farmers Union of Wales (FUW), the Country Landowners Association (CLA), Tenant Farmers Association (TFA), Dwr Cymru Welsh Water (DWCC) and Natural Resources Wales (NRW). Other agricultural sector bodies may be invited to attend meetings and/or join the Group at the discretion of the Chair.

The Group aims to take a Wales-wide approach to understanding and resolving the issue of agricultural pollution. It will engage with the River Basin Management Liaison Panels on progress in order that a coordinated approach is taken.

The primary purpose of the Group is to investigate, agree, report and deliver on potential solutions for tackling both diffuse and point source agricultural pollution in Wales. The group will also aim to achieve a more integrated approach to tackling agri-pollution issues on the part of all participating organisations whilst building links with related forums such as the River Basin Management Liaison Panels. Celebrating and communicating success will be a key part of this process.

We will learn from best practice, use alternative rather than additional solutions, and aim to deliver our work within existing budgets. Where identifiable we will endeavour to apply the polluter pays principle.

5.5. Forestry

Much of the uplands in the source areas of our rivers are areas of managed forestry. Natural forestation has largely been replaced by managed coniferous plantations, and although there have been many benefits, such plantations can give rise to some challenges for the environmental quality of our rivers (e.g. related to acidification and drainage). The merger of forestry management with the previous remit of Environment Agency Wales brings significant benefit for holistic management of the uplands in order to protect and, where necessary, restore ecological functioning including realisation of benefit for our fish stocks.

The current policy for woodland management in Wales is set out in the "Woodlands for Wales Action Plan":-

<http://gov.wales/docs/drah/publications/160223-woodlands-for-wales-action-plan-en.pdf>

<http://gov.wales/topics/environmentcountryside/forestry/our-strategy/?lang=en>

The overlying strategy “*Woodlands for Wales*” is the Welsh Government’s fifty-year strategy for woodlands and trees in Wales. The action plan sets out the Welsh Government’s policy aims and objectives for *all* woodlands and trees in Wales, including both those in public and private ownership.

It sets out the WG vision for woodlands in Wales:-

“Wales will be known for its high-quality woodlands that enhance the landscape, are appropriate to local conditions and have a diverse mixture of species and habitats.”

Forests and woodlands cover approximately 15% of the land area of Wales and inevitably have an effect on our water resources. Although sustainable forest management is important for the supply of good-quality fresh water and can provide protection from natural hazards such as flooding or soil erosion, inappropriate forestry management can also lead to environmental harm. In order to ensure that forests contribute to the WG wellbeing objectives and protect the needs of aquatic species, the government has endorsed the UK Forestry Standards ‘Forests and Water Guidelines’ – one of seven guidelines that supports the standard:-

[https://www.forestry.gov.uk/pdf/FCGL007.pdf/\\$FILE/FCGL007.pdf](https://www.forestry.gov.uk/pdf/FCGL007.pdf/$FILE/FCGL007.pdf)

The guidelines seek to ensure that appropriate standards are maintained in the forestry sector, so that factors that have previously been considered to harm fish stocks, such as drainage and acidification, are progressively eliminated as new and improved standards increasingly feature in forestry plans.

Previous project work undertaken by NRW and partner bodies, notably the rivers trusts, has sought to bring about more rapid improvement in water quality in order to sustain fish life. Liming programmes are very common throughout Scandinavia, and seek to elevate the pH and suppress episodic low pH flushes that would otherwise be lethal to fish and other biota. NRW’s predecessor bodies implemented, and NRW continues to operate, a liming programme in the upper Tywi catchment, whilst the Wye and Usk Foundation and the West Wales Rivers Trust also carry out consented discharges of lime (often limestone sand) to upper river catchments.

NRW will consider applications to treat river catchments with lime under the normal [Environmental Protection Regulations discharge-permitting process](#) with applications being made using a stand-alone water discharge activity bespoke permit.

5.6. Predatory birds

We recognise that there is considerable concern by many anglers and fisheries interests that both cormorants and goosanders are damaging our fish stocks through direct and un-sustainable predation.

We have a duty under section 6(6) of the Environment Act 1995 to maintain, improve and develop fisheries for salmon, trout, eels, lampreys, smelt and freshwater fish and, in particular:-

- to ensure the conservation and maintain the diversity of freshwater and migratory fish, and to conserve their aquatic environment
- to enhance the contribution migratory and freshwater fisheries make to the economy, particularly in remote rural areas and in areas with low levels of income
- to enhance the social value of fishing as a widely available and healthy form of recreation

We are also the species licensing authority in Wales, and therefore we determine applications received from fisheries interests for licences to shoot birds which damage fisheries under the Wildlife and Countryside Act 1981 (Section 16 (1) (k)).

As NRW is an evidence based organisation. We seek to ensure that our strategies, decisions, operations and advice are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

Our procedures for dealing with licence applications is set out on our website ([Bird licencing](#)) where all appropriate documentation may be found. The application form requires evidence from the applicant on the number of birds present, the non-lethal deterrent methods in use and some estimate of the economic impact on the fishery in question (e.g. fish losses, lost income from permit sales, etc.).

Our position is that licences to shoot piscivorous birds are granted as an aid to scaring in order to ensure that birds are deterred from feeding at the fishery in question. We have encouraged, where possible, applications to be made on a large geographic scale, such as whole river catchments, to maximise the effect of deterrent measures at a broader scale. Our fisheries officers work with fisheries interests to help advise on how to conduct surveys to collect evidence of bird numbers, how to help protect fish from predation by habitat manipulation, the range of methods available for deterring birds, and the application process itself.

5.7. Disease and Parasites

Gyrodactylus salaris

Gyrodactylus salaris is a non-native ectoparasite of salmonids. It does not seriously affect its natural host, the Baltic strain of Atlantic salmon, but the Atlantic stocks (like the UK and Norwegian populations) have no natural immunity and the parasite can

cause death in juveniles and dramatic reductions in wild populations. In Norway, the parasite has resulted in reductions in Atlantic salmon stocks of up to 98%. There is no treatment for the parasite, and currently the only control measure is total eradication of affected fish populations followed by carefully managed re-introduction of stocks.

The parasite is absent from the UK, but remains probably the most important exotic fish health threat to our salmon rivers.

Cefas routinely monitor for *G. salaris* in wild salmonid stocks of England and Wales, and contingency plans are in place detailing the roles and responsibilities of those agencies, including NRW, involved in responding to an outbreak of a notifiable or emerging fish disease.

Fungal infections

Fungal infections are natural and often affect low numbers of salmon and sea trout as they return to our rivers to spawn. Infections are usually of a secondary nature and typically follow physical damage or times of stress, and are often seen during dry cold springs. The fungal infection causes pale, cotton-wool like growths on the head, body or fins, and during heavy infections large areas of the body may be covered. Badly affected fish become lethargic and may die as a result of the infection, but often the fish recover and can go on to spawn.

Fungal infections in salmonids are often confused or misreported as Ulcerative Dermal Necrosis (UDN), however, confirmed cases of this disease remain very rare.

Over the past four years, we have received a number of reports in the spring of wild salmon and sea trout, and sometimes brown trout, with fungal infections. We are monitoring the situation on all our major salmon rivers and working with partner organisations to progress our understanding of these occurrences and their implications for stocks.

Red Vent Syndrome and other disease issues

Red Vent Syndrome (RVS) presents as swollen and/or bleeding vents in returning adult salmon. It has been observed in some of our rivers since it was first reported in 2004 and can occasionally be prevalent whilst in following years appearing to be virtually absent. Fish affected by RVS generally show a degree of recovery in freshwater and appear to be able to spawn successfully. Monitoring programmes on salmon 'Index' rivers provide the most consistent measure of the incidence of RVS and these results are published annually in the ICES Salmon Stock Status reports.

NRW also maintains a watching brief regarding other possible diseases on all major salmon rivers.

Biosecurity – Check, Clean and Dry

There is a real risk of harm to the environment from invasive, non-native species and diseases with the greatest concern related to the potential transfer of *G. salaris* between Norwegian rivers and the UK. All those engaged in water sports need to be aware of these risks and make sure they avoid moving water or material (e.g. kit, tackle or equipment) between rivers and to follow the [Check, Clean Dry](#) guidance:-

- Check your equipment and clothing for live organisms
- Clean and wash all equipment, footwear and clothes thoroughly, leaving any organisms at the water body where you found them.
- Dry all equipment and clothing. Make sure you don't transfer water elsewhere.

5.8. Illegal fishing

Fisheries enforcement is a specialist area of work that is required to enforce fisheries legislation in order to ensure that illegal activities do not threaten the wellbeing of our stocks. This work requires a resource of dedicated and specially trained officers.

Our activities vary, ranging from overt patrols, deterring would-be offenders and achieving compliance through our presence on the river banks, to covert operations in problem hotspots aimed at catching those committing offences.

NRW is responsible for enforcement in all inland fisheries in Wales and, for diadromous fish, our remit extends out to sea for a distance of 6 miles from the coast.

Many of the key priorities in our Fisheries Enforcement Strategy for 2017-19 are focussed on migratory fish:-

- A targeted approach to illegal fixed and drift netting;
- A targeted approach to the protection of spawning beds;
- A targeted approach to ensuring compliance with relevant legislation, including byelaws, in our licenced net and rod and line fisheries.

These key priorities are identified following assessment of evidence on historical, recent and current activities and reports in the form of past cases, incident reports and intelligence. It includes an assessment of the impact and risk to vulnerable stocks. This does not constrain us from diverting resource to emerging threats or other forms of illegal activity which come to our attention such as the illegal sale of untagged fish.

The work priorities are delivered through Area plans using local knowledge and intelligence to analyse patterns of activity and identify areas of high risk, therefore enabling us to carefully target our enforcement effort.

NRW has had to modify operations and adapt to a targeted enforcement approach in response to a gradual reduction in the number of Fishery Enforcement officers over a period of time as Government funding has reduced. The present resource in Wales is 16.4 FTE fully warranted staff.

The reporting of illegal activity, and suspected illegal activity by anglers and the wider public is of great importance. This is most commonly captured as incident reports in the first instance, and over time analysis of the information can identify important trends and hot-spots of activity. Figure 29 shows the location of illegal fishing incidents reported to NRW over a 12 month period commencing March 2016. Almost 200

reports were received with 25% of these being substantiated with the remainder not confirmed by NRW Officers but captured as intelligence where appropriate.

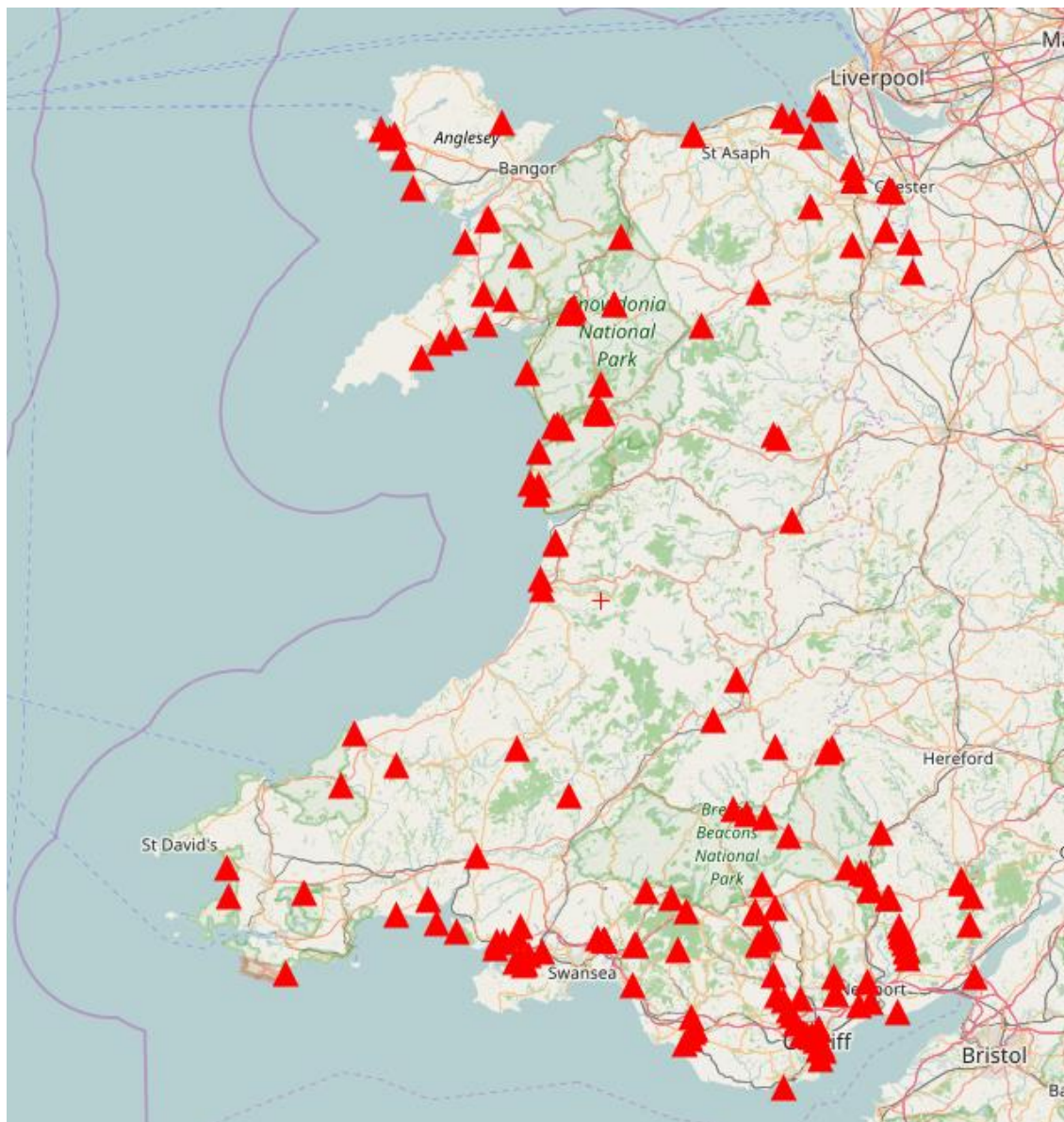


Figure 29. Incident reports of illegal fishing March 2016 – February 2017. *Note that clusters around the Dee estuary and Burry Inlet include reports relating to the cockle fisheries whilst some inland reports relate to stillwater fisheries.

Illegal activity that poses a risk to salmon and sea trout varies seasonally and geographically across Wales. Coastal netting accounts for the largest number of reports in the North and South-West and poses the highest risk to vulnerable stocks, whereas in South-East, illegal rod and line fishing is the most common issue. There is little intelligence to suggest non-compliance with byelaws in our rod fishing communities or net fisheries. Any new controls will be regulated equally between the two interests.

We are prepared to use the full range of our powers to tackle illegal fishing but must also consider and balance our actions with our responsibility as a proportionate and accountable regulator. It is essential that we review and adapt our priorities as required and will review these annually to take account of intelligence and new legislation, for instance new exploitation control measures.

5.9. Pelagic fisheries bycatch

Concern has been raised about the potential impact of high seas fisheries and potential bycatch of salmon. The issue is regularly brought up as a concern by angling groups during our stakeholder engagements. With unknown high seas fisheries and the expansion of mackerel stocks and fishery in the North East Atlantic the issue has increasingly highlighted by stakeholders.

There is a bycatch of salmon in fisheries for pelagic species in the Northeast Atlantic but with widely varying estimates. In the Norwegian Sea, the distribution of post-smolts overlaps with the mackerel fishery in international waters. In the late 1990s, post-smolts and mackerel were caught together in June and July in research surveys. There were also reports of adult salmon being caught in fisheries targeting herring in the northern most part of the Norwegian Sea. Estimates in 2004/2005 of the bycatch in the mackerel fishery ranged from 0.0002 to 5.93 post-smolts per tonne of mackerel. This resulted in very large variation in the estimated number of post-smolts caught (from a few individuals to 1.8 million fish).

Information from Iceland indicated bycatches of 4.8 and 7.0 salmon per 1,000 tonnes of mackerel and herring in 2010 and 2011 respectively, or approximately 169 and 200 salmon in total for the fishery. In the case of the Faroese mackerel fishery, bycatches of up to 180 salmon in 2011. While some fisheries for pelagic species do not appear to result in significant bycatch of salmon, there is a great deal of uncertainty in the estimates. NASCO CNL(12)60.

Due to the methods used, many of the estimates represent minimum figures and the real extent of the bycatch may be higher. The quantification of bycatch remains challenging. We support NASCO in its actions to further efforts to quantify the extent of bycatch and explore the opportunities for mitigation measures which may need to be explored with the bodies regulating these fisheries.

5.10. Impact of a changing climate

Atlantic Salmon have evolved to live in the variable climate that we have experienced up until the last few years. However climate change is projected to bring changes to both the underlying patterns of temperature and rainfall, and the frequency and severity of extreme events. Taken together these changes can place stress on the species and have a critical effect on particularly sensitive stages of their lifecycle. We are already observing these impacts.

The Atlantic salmon is fundamentally a cold water species, and this governs its geographical distribution in the North Atlantic region.

Global temperatures are predicted to increase over the coming decades as a result of anthropogenic climate warming:-

(<http://www.ipcc.ch/>)

and the specific issues for Wales have been reviewed:-

<http://ccra.hrwallingford.com/CCRAREports/downloads/CCRA%20for%20Wales%2016%20July%202012.pdf>

The overall projection for Wales is for warmer and drier summers, and warmer and wetter winters. There is much uncertainty, however key issues based on fundamental principles are emerging. Increasing air temperatures will lead to increases in surface water temperature, and as this occurs a number of negative effects on salmon may arise. Direct biological impacts on salmon include physiological stress, increased depletion of energy reserves, increased susceptibility and exposure to disease and disruptions to breeding efforts. Temperature regimes during the winter may have significant effect as various features of sexual maturation and the early survival of eggs are known to be highly sensitive to temperatures above the range to which salmon are adapted.

Such direct impacts on the biology of salmon may potentially lead on to further, less direct impacts. For example, as the developmental rate of salmon is directly related to water temperature, it is possible that increasing temperatures could cause the more rapidly developing juveniles to enter the ocean before their planktonic food source has reached sufficiently high levels. There is also already evidence from the River Bush in N. Ireland of changes in smolt run-timing being linked to at-sea survival.

Additional indirect effects to salmon, associated with increasing air and water temperatures, relate to negative changes to their habitat. It has been noted that areas of particularly warm freshwater can present a thermal barrier to migrating salmon. Such barriers can also delay or even prevent spawning.

A reduction in summer flow levels will serve to increase water temperatures further and is likely to reduce the overall habitat available to salmon. Increased winter flows are likely to scour the river beds, disturbing nests and causing physical damage to both salmon eggs and juveniles.

A reduction in flows during the spring and summer may impact on the success of smolt emigration and the entry and ascent of rivers by adult fish. The adjusted run timing of adult fish would be likely to significantly change angling practices and success.

An increase in freshwater discharge may result in increased sedimentation of river and stream beds. Such sedimentation is likely to reduce the amount of gravel substrate available for spawning, and to smother both eggs and juveniles.

At the request of NASCO a workshop on Climate Change Impact on Salmon (WKCCISAL) for advice on the potential Climate Change Impacts on Atlantic Salmon stock dynamics has recently convened:-

<http://www.ices.dk/community/groups/Pages/WKCCISAL.aspx>

With changing climatic and oceanic conditions there is potential for effects to be reflected in salmon feeding, growth and migratory routes. WKCCISAL aim to review predicted climatic changes over the range of wild Atlantic salmon, literature and research on biological and environmental drivers affecting stock dynamics and describe potential impacts.

The IUCN (International Union for Conservation of Nature) has published a report: “Salmon and Climate Change, Fish in hot water” that summarises the situation:

- Salmon have a long historical association with human society and make a large contribution to economies. They also have important ecological roles.
- Some salmon populations have declined significantly in recent decades. While human activities are largely responsible, climate change could now exacerbate or even supersede these threats, particularly in the southern part of their natural range.
- Physical changes to freshwater ecosystems resulting from climate change will degrade and diminish available habitat, reduce reproductive success and jeopardise migration.
- Although not well understood, impacts on salmon’s marine habitat could lead to temporal and spatial shifts in both their prey and predators. Possible changes to the timing of migration represents an important new threat.
- These species highlight the effects of rising temperatures on both freshwater and marine ecosystems, and illustrate how climate change impacts

[IUCN Red List - Salmon and climate change](#)

In 2016, we observed significant reductions in juvenile salmon and trout throughout Wales. This was particularly evident in the 0+ salmon group with wide spread and dramatic declines (see section?). Whilst spawner numbers and winter flow events may have been additional contributory factors in some cases, it is considered more likely that record high water and air temperatures during the main spawning period (November - December) disrupted spawning, either affecting development and maturation of the adults and/or affecting the fertilisation and development of eggs and fry.

5.11. Fish introductions and hatcheries

NRW concluded in 2014, after a technical review and public consultation and taking account of expert advice, that it would not carry-out or permit to be carried out stocking of salmon and sea trout in Wales.

The review concluded:

- That there had been no new evidence brought to our attention that might amend the conclusions set out in our initial review.
- That there is an increasing resource of publications and new evidence to substantiate our position that the stocking of salmon and sea trout poses a threat to wild populations.
- That stocking is potentially damaging to populations, as removing adults from the wild for hatchery broodstock depletes the resource of potential wild spawners, leading to the depletion of the resource of fit and adapted juveniles.
- That stocking represents a risk to the maintenance of local populations and their adaptations to existing and future conditions. This is because, in hatcheries, adult fish are selected for mating crosses that would not otherwise occur in the wild leading to potential loss of specific adaptations and fitness. Contribution to wild spawning by hatchery-derived adults represents a similar risk to population fitness.

The principle under which we manage migratory salmonids in Wales must be to protect, through best-practice scientific management and the ecosystem approach, the sustainability and productivity of wild salmon and sea trout stocks. It is apparent that this an emerging policy position in many North Atlantic countries.

6. OPTIONS FOR SUSTAINABLE MANAGEMENT

6.1. Analysing stock status and the need for additional regulations

Salmon and sea trout stocks have been ranked by measures of their status using the data from Section 4 in order to identify those which appear most vulnerable and require protection through more stringent regulation of the fisheries (Tables 11 and 12).

For both species the ranking process has been applied in the following order:

- i. Ranking on the basis of 'risk' status in 5-year's time (2021) (i.e. application of the formal Conservation Limit compliance process for salmon and the equivalent for sea trout using the new SR based assessment method).
- ii. Ranking on the basis of the latest 10-year trend in egg deposition estimates (i.e. a measure of whether the stock is showing any strong tendency toward recovery).
- iii. Ranking on the basis of the (most recent 5-year) average (%) egg shortfall/surplus against the Management Target (i.e. a measure of the average performance of the stock in recent years).

Fisheries operating on river stocks falling into the following categories are considered to require additional protective regulatory measures:

- A. River stocks classified as 'At risk' or 'Probably at risk' in 5 years time (2021) i.e. in-line with the management response identified in the Decision Structure (Section 2 and Annex 4).
- B. River stocks classified as 'Probably not at risk' but with a downward or weak ('+' or '++') upward trend and where the (most recent 5-year) average egg deposition has been below the Management Target.

This analysis of the stock assessment results places 20 of the 23 principal salmon rivers and 21 of the 33 main sea trout rivers in categories 'A' or 'B', above. For salmon, for example, this leaves just 3 rivers: the Usk, Severn and Wye which fall outside of these categories.

Additional regulatory measures on net and rod fisheries to protect and promote recovery of category 'A' and 'B' stocks are explored below. These are considered along with other options – including the introduction of common regulations on all salmon and sea trout rod and net fisheries in Wales. Use of both NLOs (nets) and byelaws (nets and rods) are examined as regulatory mechanisms. We additionally take account of recent concern for juvenile fish populations.

Table 11 Overview of salmon stock status and requirement for additional regulatory measures

River	Risk' status: 2021	Trend	Egg deficit/surplus on Management Target (%)
Clwyd	At risk	---	-83.9
Seiont	At risk	---	-80.4
Tawe	At risk	---	-77.2
E&W Cleddau#	At risk	---	-67.4
Dee	At risk	---	-31.1
Dyfi#	At risk	--	-75.5
Ogmore	At risk	--	-75.2
Rheidol	At risk	--	-69.6
Dwryd#	Prob at risk	--	-67.0
Taf#	Prob at risk	--	-63.0
Tywi#	Prob at risk	--	-53.2
Ogwen	Prob at risk	--	-44.6
Teifi#	Prob at risk	--	-42.9
Conwy#	Prob at risk	--	-30.6
Dwyfawr	Prob at risk	-	-79.0
Nevern#	Prob at risk	-	-32.1
Mawddach#	Prob at risk	-	-26.4
Glaslyn#	Prob at risk	-	-11.2
Dysinni#	Prob at risk	+	-84.3
Taff & Ely	Prob at risk	+	-75.6
Usk	Prob not at risk	+	6.2
Severn##	Prob not at risk	++	3.6
Wye	Prob not at risk	+++	-37.0

Stock vulnerability

Additional regulatory measures

Trend:

p<0.05	---
p<0.10	--
0.10<=p<0.30	-
0.30<=p<0.50	.
0.70=>p>0.50	+
0.90=>p>0.70	++
p>0.90	+++
p>0.95	+++

Review of Net Limitation Order 2017
England lead on fisheries regulation

Table 12 Overview of sea trout stock status and requirement for additional regulatory measures

River	Risk' status: 2021	Trend	Egg deficit/surplus on Management Target (%)
Usk	At risk	---	-79.3
Gwendraeth	At risk	---	-77.9
Taf#	At risk	---	-55.3
Taff & Ely	At risk	---	-86.9
Tawe	At risk	---	-69.5
Ystwyth	At risk	---	-25.9
Rhymney	At risk	--	-88.0
Aeron	At risk	--	-59.5
E&W Cleddau#	At risk	--	-54.4
Loughor	At risk	--	-53.2
Afan	Prob at risk	--	-4.4
Severn##	Prob at risk	-	-15.5
Neath	Prob at risk	-	0.4
Artro	Prob at risk	+	-28.9
Glaslyn#	Prob at risk	+	-23.5
Tywi#	Prob at risk	+	-21.6
Dwryd#	Prob at risk	++	-51.4
Seiont	Prob not at risk	++	-36.3
Wye	Prob not at risk	++	-13.6
Teifi#	Prob not at risk	++	-13.6
Gwyrfai	Prob not at risk	++	-6.6
Ogmore	Prob not at risk	++	8.6
Ogwen	Prob not at risk	++	19.1
Nevern#	Prob not at risk	++	19.5
Llyfni	Prob not at risk	+++	-31.1
Dwyfawr	Prob not at risk	+++	-5.5
Clwyd	Prob not at risk	+++	-32.3
Rheidol	Prob not at risk	+++	-4.4
Dysinni#	Not at risk	+++	26.5
Dee	Not at risk	+++	5.8
Conwy#	Not at risk	+++	24.7
Dyfi#	Not at risk	+++	28.4
Mawddach#	Not at risk	+++	68.7

Stock vulnerability

Additional regulatory measures

Trend:

p<0.05	---
p<0.10	--
0.10<=p<0.30	-
0.30<=p<0.50	.
0.70=>p>0.50	+
0.90=>p>0.70	++
p>0.90	+++
p>0.95	+++

Review of Net Limitation Order 2017
England lead on fisheries regulation

6.2. Regulating fishing to achieve stock savings

NLOs and byelaws

The regulation of fishing activity is undertaken to provide the basis of fish stock protection measures. The protection of stocks seeks to manage exploitation, the killing of fish, to ensure that sufficient numbers of fish survive to spawn. This is necessary in order to populate our rivers with the optimum number of juvenile fish for future stock maintenance.

In the current circumstances, there are many factors that are contributing to the reduction in stock levels. These include the current low level of survival, mainly of salmon at sea, but it also includes other factors that harm the habitat of fish and consequently suppress their recruitment and survival. These and other 'challenges to stocks' are discussed in Section 4. Whilst we and partner bodies seek to resolve these matters it is important to ensure that as many adult fish as possible survive to spawn each year.

The fisheries around most of our coast, including the estuaries of many rivers, are in public ownership. The amount of fishing for salmon and sea trout in these areas is regulated so that stocks are not over-exploited. This is achieved by statutorily limiting the number of licences that are available through a Net Limitation Order (NLO) that limits the number and type of nets that can legally operate. A NLO is time limited and must be reviewed prior to its expiry within ten years from the time it was introduced. NLOs also provide for the selection of applicants for licences in situations where the number of applicants exceeds the number of licences available. In some cases NLOs can be set at zero, when no licences are made available.

Full details of each of the 13 public fisheries covered under the 2009 NLO can be found in Annex 6.

The Wye fishery is a private fishery which is owned by NRW. It is located within the lower Wye estuary and extends out close to the mid-point of the Severn Estuary down to a line close to the M4 crossing. The drift and stop-boat fisheries that operated here closed in 1984, however the Black Rock Heritage lave net fishery continues to operate under the terms of a lease granted to the organisation that includes a catch limit for the whole fishery of 15 salmon.

Rod and net fishing are both regulated by a system of licensing, however controls on precisely how fishing may take place are established through byelaws.

Byelaws are used to control levels of exploitation of salmon and sea trout in Wales through regulation of fishing gear that may be used by both rod and net fishermen, where and when fishing may take place, and whether fish can be deliberately killed or not.

The nature of the two legal systems regulating fishing for salmon and sea trout may be summarised as:-

NLOs - sets the maximum number of net licences that NRW may issue (Table 13).

Byelaws - these define fishing controls for seasons, locations, and methods, etc. Ultimately they may be used to close fisheries.

NRW also have emergency byelaw powers to respond to unforeseen and critical matters such as severe disease outbreaks.

6.3. Current net fishing regulation by NLO

There are currently two NLOs in Wales:

- the Dee trammel and draft nets set at zero for both fisheries is in place and is set to expire in January 2025
- the 2009 'All Wales' NLO, covering the remaining 13 public net fisheries and is the subject of this review (Annex 6). This NLO is due to expire in 2017.

The current NLO is summarised in Table 13 below.

Table 13 2009 NLO fishery and licence details

Area	River	Fishery	Licences Available	2016 Uptake
North	Dysynni	Draft nets	1	1
	Dyfi	Draft nets	3	3
	Conwy	Daft nets	3	3
	Glaslyn	Draft nets	0	0
	Mawddach	Draft nets	3	2
South West	Taf	Coracle	1	1
		Wade	1	1
	Nevern	Draft	1	1
	Cleddau	Compass	6	6
	Tywi	Coracle	8	8
Draft		3	3	
Mid Wales	Teifi	Coracle	12	12
		Draft	3	3
Total			45	44

6.4 Current net fishing regulation by byelaws

In addition to NLOs there are a number of byelaws controlling fishing with nets. These include, though not exclusively, the:

- 1995 Salmon and Sea Trout Netting Byelaws
- 1996 National Byelaws
- 1999 National Salmon Byelaws
- 2003 Salmon and Sea Trout Netting Byelaws
- 2003 Salmon and Sea Trout Netting Byelaws (Use of Nets)

These principally control, the close season, close times, use of nets, marking and carrying nets and the Prohibition of monofilament and monoplided nets

Over the past 10 years two important national byelaws have been renewed and introduced to control exploitation of salmon.

National spring salmon byelaws

In response to a widespread decline in early-running multi-sea-winter (MSW) salmon in the 1980s and 1990s, it was determined that exploitation of this important stock component needed to be significantly reduced. In 1999 the national spring salmon measures were introduced, under these measures, netsmen are banned from killing, and in most cases fishing for, salmon before 1 June. However, there are derogations that allow fishing in some areas where netting is predominantly for sea trout. On the basis that any salmon caught are returned alive.

The total package of national (England and Wales) spring salmon measures were reviewed, consulted upon and renewed for a further 10 years in December 2008. They are due to expire in December 2018.

Carcass tagging and log books

Since the introduction of these measures in 2009 there has been 100% compliance in the return of logbooks and unused tags in Wales, improving the reliability of reported catches

In addition to improved catch reporting and traceability of fish it also improved our enforcement capability and led to a successful prosecution in relation to the illegal catch and sale of fish from the Teifi in 2010.

While these byelaws were introduced to help regulate the licensed net fisheries, a complementary byelaw was introduced making it illegal for rod caught salmon and sea trout to be sold in England and Wales along side the National Spring Salmon Byelaws.



Carcass tags are attached to individual fish, through the mouth and gill cover.

Sea fishing byelaws

Welsh Government Marine and Fisheries Division is responsible for enforcement in all inshore fisheries in Wales. NRW works closely with Marine Fisheries Officers around the coast of Wales to protect vulnerable salmon and sea trout stocks as they approach the coast and estuaries.

A number of 'sea fisheries' byelaws are designed to protect salmon and sea trout. Some of these were introduced by EA Wales and its predecessors when they acted as a sea fisheries committee (powers now resting with Welsh Government). These measures included the restriction of areas in which netting may take place, and the regulation of mesh sizes, and prohibition of defined netting methods where salmon and sea trout are likely to be present. Importantly other more recent byelaws e.g. the establishment of bass nursery areas and recent limits on bass fishing, also add important additional protection to migratory salmonids.

Copies of the sea fishing byelaws can be found on the Welsh Government web site:

[Inshore Fishery Legislation- South Wales](#)

[Inshore Fisheries Legislation - North Wales](#)

Previous experience at controlling net exploitation.

The NLOs in 1997 reduced the number of nets available in some fisheries, for example following public enquiries the number of Compass net licences on the Cleddaus was reduced from 8 to 6. Due to the protection afforded to existing netsmen however, the reduction in licence numbers only occurred over a period of time once the first 2 existing netsmen left the fishery, some 6 to 8 years later.

NLOs offer limited scope to control or reduce exploitation levels. It is therefore concluded that exploitation management and the reductions in catch-and-kill that may be required are better expedited by the revision or addition of byelaws, controlling season length and requiring all salmon to be returned alive.

This approach also has the advantage of ensuring the pool of net licensees and, to some extent, endorsees is maintained and does not lead to risk of reducing the number of participants in these traditional and sometimes heritage fisheries.

Traditional and Heritage fisheries

NLOs introduced in 2007 and 2009 resulted in the removal of 4 Tywi coracle and 6 Tywi seine licences, respectively (and also 1 Teifi seine as a result of the 2007 NLO). Following approval of the 2009 NLO the Minister for Rural Affairs asked us to consult with netsmen on a new net licence category for Wales with the intention of protecting the long-term future of the net fisheries in Wales.

In March 2011 we wrote to 50 existing netsmen in Wales, enclosing a questionnaire, to seek views on how a new 'heritage' licence category might work in practice. This issue had also been discussed at face-to-face meetings with the netsmen in 2009 and 2010.

Completed questionnaires were received from the following fisheries:-Tywi coracles (8), Tywi seine (2), Teifi coracles (5), Taf wade (1), Cleddau compass (3), Conwy seine (2), Dyfi seine (2), Mawddach seine (1), Dysynni seine (1). The results of this are summarised as:

- A total of 25 responses was submitted by netsmen (50% return rate). This included a letter from the Carmarthen Coracle Netsmen's Association on behalf of the 8 existing Tywi coracle licencees
- The majority of respondents, including the 8 Tywi coracle licencees, were opposed to a new net licence category with a number of netsmen noting that they wish to continue to be viewed as commercial fishermen.
- It is clear that many netsmen are keen to protect their traditions and promote the heritage aspects of their fisheries where possible by, for example, signage for visitors or use of promotional tags to advertise that the fish were from for example the coracle fishery.

6.5 Current rod fishing regulation by byelaws

The current byelaws that regulate fishing by rod and line are set out here:-

[Angling byelaws 2017](#)

The inclusive opening and closing dates of fisheries seasons, catch and release and method restrictions are summarised in Annex 7.

The licensing system for rods does not limit the number of licences available, exploitation is managed by the use of byelaws controlling amongst other things length of seasons, method restrictions and C&R controls. A summary of the current byelaws is found in Annex 7. A compendium of angling controls and advice can be found on the NRW web site at:

[NRW Fishing page](#)

Byelaws

Similar to the net fisheries over the past 10 years important England and Wales national byelaws have been renewed and introduced to control exploitation of salmon. Firstly the National Spring Salmon Byelaws, prohibiting the killing of salmon before the 16th June but also importantly restricting methods to ban the use of bait. These byelaws were introduced in 1999 reviewed, consulted upon and renewed for a further 10 years in December 2008. They are due to expire in December 2018.

Ban on the sale of rod caught salmon and sea trout

Anglers' are no longer able to sell salmon or sea trout caught on rod and line. This byelaw was brought in at the same time as the Logbook and carcass tag schemes for all net caught fish.

The byelaw became active on 31st January 2009 and brought England and Wales in line with similar initiatives taken earlier by Scotland and Ireland.

Wye, and Taff & Ely C&R byelaws

Following wide scale concern about the numbers of returning adult salmon in 2012 Environment Agency Wales introduced new byelaws requiring full catch-and-release. These were confirmed for 10 years for the river Wye, and six years for the Taf and Ely.

6.6 Engagement and liaison with stakeholders

The status of our stocks of salmon and some sea trout, catchments, continue to give serious cause for concern. NRW Directors and Board agreed the development of fishing controls to respond to these in July 2015 and March 2016 and finally in June 2017

The Board reiterated NRW's commitment to take action to achieve our aspirations for a long-term solution. The proposals were fully supported and the Board emphasised the importance of the planned ongoing consultation with catchment groups.

We have eight Local Fishery Groups (LFGs) around Wales, and these provide valuable opportunities to:

- provide a forum for liaison with to key stakeholders and interested parties on fisheries management.
- seek and take account of the views and advice from members on fisheries management and related issues.
- act as a communication link with key stakeholders and customers on fisheries management and related issues.

Following our LFG meetings and other engagement workshops in November 2015 and taking into account the input and feedback from participants, we further sought views through a questionnaire that was emailed to all participants around Wales. This was designed to be read in conjunction with the March 2016 Board paper 'Management Options to Address the Decline in Stocks of Salmon and Some Sea Trout in Wales'.

The aim of the questionnaire was to collate views and comments in a systematic way on the matters discussed at the engagement events and to help guide our approach.

We received a total of 67 responses:-

Individual anglers 19,
Angling Associations 33,
Private Fisheries 10
Netsmen 5).

There was a wide geographical spread of responses:-

North 13,
Mid-Wales 13,
South West 25
South East 16),

Responses were received from interests on the rivers:-

SE Wye, Usk, Taff, Thaw
SW Neath, Tawe, Loughor, Tywi, E&W Cleddau,
Mid Teifi, Ystwyth, Rheidol, Severn,
North Dyfi, Llyfni, Conwy, Clwyd, Dee, Dwyfor, Ogwen, Amman, Afan, Cothi,
Llyfni

We have carefully considered the responses to the questionnaire, and the valued views and comments received at a total of approximately 25 meetings of key stakeholders. Our approach has been developed taking these into account whilst also attempting to take a rational, reasonable and proportional approach between both net and rod fisheries.

6.7 Options for salmon

As identified in Section 5, the salmon stocks across Wales (with the exception of the R. Usk) are classified as either “At risk” or “Probably at Risk” of failing to meet the management objective, based on the 2016 stock assessment, and are also predicted to remain in that category in five years-time.

As such, our Decision Structure guides us to “Identify a range of options to ensure sufficient spawning escapement to move to <50% probability of failure (of meeting the management objective) within five years (Probably not at risk category) while looking to maintain socio-economic benefits where possible.”

The combined kill of salmon by both the net and rod fisheries should therefore cease in order to help to improve the status of the stock in the short term. Options to reduce the current level of kill are considered below.

Salmon Option 1 – No change – maintain current fishing restrictions for rod and net fisheries

Given the strong and compelling evidence on the current and predicted status of salmon stocks, the prevailing strong downward trend in abundance, and the recent reduction in juvenile salmon numbers, then simply maintaining the current fishing restrictions for another ten year period does not meet our own Decision Structure guidance and is therefore not considered any further as a viable option.

Salmon Option 2 – Reduce exploitation by nets and rods

Options to reduce exploitation here could include a combination of the following:

- Reduce the number of net licences available.
- Extending the annual close time for nets.
- Extending the weekly close time for nets.
- Mandatory catch and release for nets and rods.
- Fishing method restrictions for rods.
- Adoption of methods for voluntary reduction in catches.

An assessment of the pros and cons associated with each of these options is listed in the table below.

Table 14 Pros and cons associated with potential controls.

Potential control	Pro	Con
Reduce net licences available (NLO)	Reduces net fishing effort	<p>May take considerable time for netsmen to leave the fishery.</p> <p>Reduction in effort may not deliver the same proportional reduction in catch. Remaining licensees may potentially fish more tides within the available fishing time.</p> <p>Net fisheries mainly based on sea trout could face an unnecessary and disproportionate burden.</p>
Extend annual net close time	Reduces net fishing effort.	<p>Delivers only potentially modest savings on its own.</p> <p>Licensees may potentially fish more tides within the available fishing time.</p>
Extend weekly net close time	<p>Reduces net fishing effort.</p> <p>This restriction is preferred by some existing netsmen, over other possible restrictions.</p>	<p>Few nets currently fish all or even the majority of tides available.</p> <p>The benefit of reducing the available fishing time could be partly negated if the netsmen fished more of the available tides within the reduced fishing period.</p>
Mandatory catch and release	<p>Reduces kill by nets and rods</p> <p>Helps maintain most of socio economic values in rod fishery</p> <p>Allows nets to continue to exploit sea trout.</p>	<p>There will still be a residual mortality of fish, approximately 10% for rod caught fish. Unquantified for the net fisheries.</p> <p>May reduce angling effort.</p>
Fishing method restrictions for rods	<p>Improves survival of released fish.</p> <p>Note the majority of salmon are either caught on worm or by spinning with treble hooks which are not commensurate with good catch and release practice.</p>	<p>Likely modest benefit of applying this measure on its own in terms of salmon saved.</p>
Voluntary reduction in number of salmon killed	Voluntary restrictions are more acceptable than mandatory controls to the fisheries.	<p>Voluntary restrictions difficult to apply for net fishery.</p> <p>Voluntary C&R rates particularly low circa 60% on some of the main salmon fisheries.</p> <p>Voluntary measures have been promoted for some considerable time and are unlikely to substantially change further in the short term.</p>

Of the potential controls identified, the mandatory C&R management option identified would reduce the kill of salmon by these fisheries and help to improve the status of the salmon stock in Wales. In addition method restrictions would help ensure the survival of released fish.

A combination of measures will therefore be required to deliver the savings required for improvement for the salmon stock.

Salmon Option 3 – Zero kill of salmon – close net fishery and apply mandatory catch and release to the rod fishery.

Closure of the net fishery would have a disproportionate effect and would be viewed as contrary to equitable treatment of the two fishery sectors. Although this would save salmon, it would also remove any access to sea trout for the nets whilst allowing rod fishing to continue, albeit with some restrictions on harvest of fish.

Nonetheless continuing to kill fish whilst stocks are unsustainable cannot continue.

Our principle is that action taken to conserve fish in one fishing sector should be balanced against action in the other sector

We acknowledge that there will still be a residual mortality of fish released from both the nets and rods, but balanced against this is the potential loss of social, cultural and economic benefits associated with the fisheries.

Salmon Option 4 – Zero kill of salmon – close net fishery and rod fishery

At the present time we do not believe that full closure of net and rod fisheries is warranted.

Salmon preferred option

The preferred option for salmon at present is Option 2 to reduce exploitation of fish in both the net and rod fisheries, through a considered package of measures so that all salmon are released, and have a good chance of survival. These measures will allow many of the social and economic benefits of the two fisheries to be maintained. Our proposal, therefore is for:

- Mandatory C&R of all salmon by both nets and rods
- Extend annual close time by closing all net fisheries on 31st July and opening them on 1st May.
- Method controls for rod fisheries (no bait fishing, ban trebles, barbless hooks)

The detail and rationale behind these proposals is explored further in section 7.

6.8 Options for sea trout

As identified in section 4, several of the main sea trout stocks across Wales are performing poorly with – in some cases – significant deficits in the target egg deposition.

We propose to adopt the precautionary approach implicit in the salmon ‘decision structure’ and apply this to sea trout also to identify a range of options to ensure sufficient spawning escapement to improve stock status and sustainability.

The kill of sea trout in some net and rod fisheries should therefore be reduced to help to improve the status of stocks in the short-term. Options to achieve this are set out below.

Sea Trout Option 1 – No change – maintain current fishing restrictions for rod and net fisheries.

A number of sea trout fisheries (21 of 33) have vulnerable and unsustainable stocks and warrant further protection. Considerable concern has been expressed by fisheries about current catches, especially in the rivers Tywi and Teifi, the two main sea trout fisheries.

Sea Trout Option 2 – Reduce exploitation by rods and nets

The status of some of our sea trout stocks warrants further mandatory reduction in exploitation. However, maintaining the existing high level of voluntary C&R angling for most stocks is considered essential.

Options to reduce exploitation is focussed on protection of the early running fish. Most of these are female and, due to their size and fecundity, are amongst the most valuable in terms of the spawning stock. The options include a combination of the following:

- Delay the start of the net season until 1st May
- Close net fisheries after the 31st July, removing August from the season. Whilst this measure is primarily aimed at protecting salmon, it will also have some benefit for sea trout
- Implement a 60cm maximum size for rod caught sea trout (a ‘slot limit’). This would support a commensurate reduction in catch between the rods and net fisheries, with large early-season fish saved from exploitation by the net fisheries protected from subsequent kill in the rod fisheries.
- Method restrictions for the rod fishery (no treble hooks, barbless hooks, hook size and restriction to use of a single worm) to increase the survival of released fish.

Sea Trout Option 3 – Zero kill of sea trout – close net fisheries and apply mandatory catch and release to the rod fishery throughout the season.

Closure of the net fishery to protect sea trout is not fully warranted at the present time. Equally, the application of mandatory C&R fishing throughout the season in the rod fisheries for sea trout is not warranted at present.

Sea trout Option 4 – fishery closure

We do not consider that this option is necessary.

Sea Trout Preferred Option

The preferred option for sea trout at present is Option 2 to reduce exploitation and introduce catch controls in both the net and rod fisheries, through a considered package of measures.

The rationale for these measures is explored further in section 7.

6.9 Management in other Jurisdictions

A synopsis of the approach to managing salmon fisheries in England, Scotland and Ireland is summarised in Annex 8.

7. LEGAL FRAMEWORK AND POTENTIAL MANAGEMENT OPTIONS

The Natural Resources Body for Wales - *Vires* for action

In order to progress with proposals for any statutory regulation of fishing, it is necessary to establish the legal basis to do so. The *vires* for regulation of fishing is set out in the Box below:

1. Relevant Enabling Powers

The proposed byelaws find statutory authority in section 210 of the Water Resources Act 1991 ("the 1991 Act"). That section gives effect to Schedule 25 to the 1991 Act which confers on the Natural Resources Body for Wales ("NRW") powers to 'make byelaws for purposes connected with the carrying out of its functions'.

2. Byelaw-making power

2.1 Paragraph 6 of Schedule 25 provides NRW with byelaw making powers for the purposes of its fisheries functions. Paragraph 6(1) reads:

[NRW] shall have power, in relation to the whole or any part or parts of the area in relation to which it carries out its functions relating to fisheries under Part V of this Act, to make byelaws generally for the purposes of -

(a) the better execution of the Salmon and Freshwater Fisheries Act 1975; and

(b) the better protection, preservation and improvement of any fisheries of fish to which this paragraph applies.

2.2 Paragraph 6(1A) states that the whole of paragraph 6 of Schedule 25 applies to:

(a) salmon, trout, eels, lampreys, smelt, shad and freshwater fish; and

(b) fish of such other description as may be specified for the purposes of this paragraph by order under section 40A of the Salmon and Freshwater Fisheries Act 1975.

3. Lawful purpose of Byelaw making power

3.1 In addition to the general purposes set down in paragraph 6(1), paragraph 6(2) of Schedule 25 sets out the more specific purposes for which NRW may make byelaws under paragraph 6(1). These include power:

"in relation to the whole or any part or parts of the area mentioned in sub-paragraph (1) above to make byelaws for any of the following purposes ...

(2)(a) prohibiting the taking or removal from any water, without lawful authority, of any fish to which this paragraph [6] applies, whether dead or alive;

(2)(aa) specifying close seasons or times for the taking of any fish to which this paragraph [6] applies by such means as may be prescribed by the byelaws;..

(2)(c) prohibiting the use for taking of fish to which this paragraph [6] applies of any instrument in such waters and at such times as may be prescribed.

3.2 Whilst it might appear that catch and release byelaws fall within the scope of one or more of the above specific purposes, this question was considered by the Court of Appeal in *R v Ministry of Agriculture, Fisheries and Food and the Secretary of State for Wales, ex parte Mott* [2000] WL 33116468.

3.3 In that instance, the owner of a fishery challenged the Environment Agency's powers to make catch and release byelaws for salmon fishing. The Court held that sub-paragraph (2)(a) above related to poaching and therefore did not provide the necessary authority for catch and release byelaws. Sub-paragraph 2(c) was also considered by the court but deemed not applicable because it related to the prohibition of instruments for taking of salmon whereas catch and release byelaws allowed the taking of salmon and only prohibited the removal of such fish when so taken.

3.4 The Court of Appeal found that paragraph 6(1)(b) provided the Environment Agency with sufficient authority to make the proposed catch and release byelaws.

3.7 Accordingly, NRW rely on section 210 of, and paragraph 6(1)(b) of Schedule 25 to the 1991 Act in order to make these byelaws.

4. Geographical scope of byelaw making power

4.1 Paragraph 6(1) of Schedule 25 specifies that the 'area' over which the power to make byelaws is that in respect of which NRW carries out fisheries functions under Part V of the 1991 Act'. Section 114 of the 1991 which set down the fisheries functions has been repealed and NRW's functions are now set down in section 6(6) of the Environment Act 1995. This reads:

It shall be the duty of [NRW] to maintain, improve and develop fisheries of:

(a) salmon, trout, eels, lampreys, smelt and freshwater fish, and

(b) fish of such other description as may be specified for the purposes of this subsection by order under section 40A of the Salmon and Freshwater Fisheries Act 1975.

4.2 Section 6(7) of that Act identifies the area over which NRW should exercise these functions as being the whole of Wales, together with such parts of the territorial sea adjacent to Wales as extends for six miles from the baselines from which the breadth of that sea is measured ("the Area").

4.3 Accordingly, it is this Area, to which the byelaw making power in section 210 of the 1991 Act applies.

This technical case makes the case for a new NLO and byelaws for net and rod fishing in Wales. The technical case for rod fishing in the border rivers will also draw on the same *vires*.

7.1. Byelaws proposed for net fisheries

Summaries of all proposals are presented in the Summary of Options (p.130), and details are presented here.

All measures are proposed for a period of 10 years, with a review after 5 years.

7.1.1. Salmon

To protect vulnerable salmon stocks on all of the NLO rivers we propose an all Wales byelaw prohibiting the killing of salmon. This should ensure that all captured salmon are returned immediately to the water and without undue harm. We note that the Teifi coracle net fishermen have already unilaterally introduced this measure for 2017 and we welcome that.

It is acknowledged that there will likely be mortality of fish released from the net fisheries. It should however be noted that any salmon currently caught pre -1st June are already subject to mandatory C&R fishing under the National (E&W) Spring Salmon Byelaws.

In addition radio tracking studies carried out in Wales have used net caught salmon and sea trout as a source for tagging and telemetry tracking studies, and these have shown high levels of post release survival.

- Mandatory catch-and-release (C&R) of all salmon from net fisheries exploiting vulnerable stocks. The following stocks are identified (Table11) as requiring 'additional regulatory measures':

Eastern and Western Cleddau, Dyfi, Dwyrdd, Taf, Tywi, Teifi, Conwy, Nevern, Mawddach, Glaslyn, Dysynni.

To further reduce the risk of salmon mortality caught in the net fisheries, and without unduly compromising sea trout net fisheries, we propose to close all net fishing at the end of July. Few sea trout are caught in August (in 2015 29 salmon and 35 sea trout were caught during August and in 2016 29 salmon and 20 sea trout were caught).

- Close netting season on 31st July (to take effect on 1st August). This will be the common end date for all net fishing within the NLO rivers.

The additional rivers affected by this are:

E&W Cleddau, Teifi, Dyfi, Mawddach, Dysynni, Conwy.

Salmon stock savings:

Five-year average declared catches of salmon for the net fisheries subject to the NLO review in 2017 are shown in Table15a. In total, these fisheries have caught around 190 fish per year, on average over the last 5 years, of which the great majority (~90%) have been taken by the seine and coracle fisheries on the Tywi and Teifi (with average catches for combined gears on these rivers of 89 and 81 salmon, respectively).

Hence, introduction of mandatory C&R fishing for salmon on these net fisheries will, in terms of landings, primarily affect the fishermen on the Tywi and Teifi, (although as noted any salmon currently caught pre -1st June are already subject to mandatory C&R under the National (E&W) Spring Salmon Byelaws).

The efficacy of operating full-season C&R on these fisheries is indicated by the number of additional eggs likely to arise from this measure (Table 16a - these estimate are based on the latest 5-year mean June-August catches).

Implementing a common 31st July end to the season across all net fisheries (previously 31st August) will prevent capture of approximately 19% of the current salmon catch, thereby avoiding any risk of C&R mortality. This measure should also have little effect on sea trout net catches – with less than 2% of the 5-year average catch for all net fisheries in Wales (some ~1,600 fish) taken in August (see Table 15b).

7.1.2. Sea trout

To assist in the protection of sea trout, we propose to delay the start of the netting season in some fisheries. This will assist in achieving greater escapement, principally of large multi-sea winter and previous spawner sea trout to contribute to the spawner and egg deficit targets identified principally on the rivers Tywi, Taf and Teifi.

Whilst no spawner deficit has been identified for both the Dyfi and Nevern (Table 12), only three sea trout have been reported caught in the early part of the season (pre May) in the past 5 years. For consistency, we therefore propose a common opening date for these net fisheries also.

- Those net fisheries currently exempt from the national spring byelaws, allowing fishing for sea trout whilst returning all salmon, will also open on 1st May:

Tywi, Taf, Nevern, Teifi, Glaslyn, Dyfi

Note that commensurate C&R byelaws for rod fisheries are also proposed during this period and, in addition, the introduction of a 60cm maximum length (slot limit) is proposed for rod fisheries to protect early run sea trout saved by the reduction in net exploitation.

Table 15. 5-year average declared salmon and sea trout catches (2012-2016) for the net fisheries subject to NLO review in 2017

Salmon

River	Gear	Average number of licences	5-year average declared salmon net catch; 2012 to 2016:						Total
			Mar	Apr	May	Jun	Jul	Aug	
Tywi	Seine	3	0.0	0.0	1.4	10.8	14.0	0.0	26.2
	Coracle	8	0.2	1.2	2.2	21.8	37.2		62.6
	Total	11	0.2	1.2	3.6	32.6	51.2		88.8
Taf	Wade	1				0.0	0.0		0.0
	Coracle	1	0.0	0.0	0.0	0.6	0.0	0.0	0.6
	Total	2	0.0	0.0	0.0	0.6	0.0	0.0	0.6
E&W Cleddau	Compass	6				0.4	1.4	1.2	3.0
Nevern	Seine	1		0.0	0.0	0.0	0.0	0.2	0.2
Teifi	Seine	3		0.0	0.6	4.6	2.8	15.2	23.2
	Coracle	12		1.0	8.0	16.0	18.6	14.0	57.6
	Total	14		1.0	8.6	20.6	21.4	29.2	80.8
Dyfi	Seine	2		0.0	0.0	0.0	0.2	0.2	0.4
Dysynni	Seine	1				1.8	0.4	1.0	3.2
Mawddach	Seine	2				0.0	0.0	0.0	0.0
Dwryd	Seine								
Glaslyn	Seine	0				0.0	0.0	0.0	0.0
Conwy	Seine	3				0.6	4.4	6.2	11.2

Sea trout

River	Gear	Average number of licences	5-year average declared sea trout net catch; 2012 to 2016:						Total
			Mar	Apr	May	Jun	Jul	Aug	
Tywi	Seine	3	7.4	47.2	123.6	147.4	31.0		356.6
	Coracle	8	23.8	139.8	203.0	198.6	77.6		642.8
	Total	11	31.2	187.0	326.6	346.0	108.6		999.4
Taf	Wade	1				0.0	0.0		
	Coracle	1	0.0	1.0	2.0	0.4	0.0	0.0	3.4
	Total	2	0.0	1.0	2.0	0.4	0.0	0.0	3.4
E&W Cleddau	Compass	6				0.4	0.2	0.4	1.0
Nevern	Seine	1		0.0	3.5	9.6	1.0	0.0	14.1
Teifi	Seine	3		0.6	28.4	68.6	5.0	0.8	103.4
	Coracle	12		61.6	181.0	177.8	36.0	11.4	467.8
	Total	14		62.2	209.4	246.4	41.0	12.2	571.2
Dyfi	Seine	2		0.6	4.0	13.8	6.4	0.0	24.8
Dysynni	Seine	1				11.6	2.8	5.4	19.8
Mawddach	Seine	2				0.2	0.0	0.2	0.4
Dwryd	Seine								
Glaslyn	Seine	0							0.0
Conwy	Seine	3				5.2	5.4	1.4	12.0

Sea trout stock savings:

As with salmon, the seine and coracle net fisheries operating on the Tywi and Teifi account for most of the net caught sea trout in Wales (approximately 95% - see Table15b). This proportion increases to more than 99% for catches prior to 1st May and indicates that, as a regulatory measure, a 1st May start to the season would be especially protective of stocks on the Tywi and Teifi (both identified as vulnerable stocks in Table12). At the same time, if (primarily to simplify and align byelaws across Wales), it was extended to other net fisheries exploiting less vulnerable stocks, then the impact on these fisheries would be minimal.

Estimates of the numbers of additional sea trout escaping the net fishery and their subsequent egg contribution as a result of a 1st May start to the season are summarised in Table16b. As indicated above, on most rivers, the benefits of this measure will be small, with the Tywi and Teifi seeing the biggest gains – some 0.60 and 0.14 million eggs respectively (based on the most recent 5-year average catches pre-May). These figures relate to the numbers of eggs laid in the first year by fish spared the fishery. However, the benefits of this measure will extend beyond one year as some fish will survive to spawn in a number of subsequent years and provide an accumulated and amplifying benefit.

This accumulated benefit can be estimated based on our understanding (from intensive monitoring programmes such as that on the Welsh Dee) of the processes of:-

- i mortality (i.e. the proportion of fish in a given cohort dying year-on-year), and
- ii growth (i.e. increase in size and, for females, number of eggs carried year-on-year).

Understanding these two processes enables estimates to be made of the 'Future Lifetime Eggs' (FLE) likely to be contributed by an individual or population as a benefit, for example, of increased escapement from a fishery. The FLE calculation will always be a larger figure than the number of additional eggs deposited in the first year. For example, when estimates of FLE were calculated for a 1st May net season change on the Tywi and Teifi, values were up to 1.7x greater than the first year egg figure alone. Further details of the FLE approach can be found in Milner (2016).

Table 16. Estimated benefits of proposed salmon and sea trout measures expressed as additional eggs laid in year 1. [Note all estimates are based on average net and rod fishery performance in the latest (2012-2016) 5-year period.]

a. Salmon

River	Additional eggs laid in year1:	
	Mandatory C&R nets	Mandatory C&R rods
Wye		1,271
Usk		422,697
Rhymney		
Taff & Ely		931
Ogmore		6,891
Afan		
Neath		
Tawe		52,383
Loughor		
Gwendraeth		
Tywi#	187,543	381,405
Taf#	1,197	57,512
E&W Cleddau#	5,984	28,942
Nevern#	399	18,276
Teifi#	143,378	312,863
Aeron		
Ystwyth		
Rheidol		11,751
Dyfi#	821	67,169
Dysynni#	6,652	2,455
Mawddach#	0	44,285
Artro		
Dwryd#	0	4,997
Glaslyn#	0	17,420
Dwyfawr		12,544
Llyfni		
Gwyrfai		
Seiont		10,924
Ogwen		41,607
Conwy#	16,927	94,938
Clwyd		13,923
Dee		195,512
# Net fishery subject to NLO review in 2017		

b. Sea trout

River	Additional eggs laid in year 1:		60cm (~5.75lb) slot' limit rods
	1st May start to net season	Mandatory C&R pre-1st May rods	
Wye		550	0
Usk		791	2,957
Rhymney		197	0
Taff & Ely		363	0
Ogmore		900	14,408
Afan		0	7,939
Neath		3,236	36,099
Tawe		1,324	8,419
Loughor		1,425	15,204
Gwendraeth		0	790
Tywi#	604,328	30,282	223,418
Taf#	2,291	1,076	17,014
E&W Cleddau#	0	859	6,695
Nevern#		1,516	16,349
Teifi#	138,371	10,241	32,422
Aeron		741	695
Ystwyth		0	11,551
Rheidol		0	22,228
Dyfi#	1,244	2,985	238,530
Dysinni#	0	13,832	6,718
Mawddach#	0	1,138	25,014
Artro		0	0
Dwryd#	0	0	1,764
Glaslyn#	0	85,497	3,009
Dwyfawr		0	12,134
Llyfni		0	813
Gwyrfai		0	0
Seiont		0	832
Ogwen		0	4,425
Conwy#	0	284	9,077
Clwyd		0	14,993
Dee		711	6,561
# Net fishery subject to NLO review in 2017			

Does C&R from nets work?

There will be some mortality and reduced fitness of salmon released from nets. Our own radio tracking studies for salmon and sea trout have used seine netted fish as a source and have shown that, if handled correctly, then the survival of fish is high.

However there are no survival estimates for fish released from a coracle net. The coracle net enmeshes the fish in a pocket, similar to a trammel net rather than a gill net. It should be noted also that once a fish is felt to hit the net, held between a pair of coracles, the fish is brought into the boat and either dispatched or released. It is not held within the net for a prolonged period of time.

It is commonly assumed that many bycatch fish might be injured and die during the capture process, particularly in gillnets or immediately after release from a net. Thompson *et al.* (1971) recorded mortality of 80 to 100 percent for gillnet escapees (chinook salmon and coho salmon), and Thompson and Hunter (1973) separated scale damage mortalities from those associated with combined physical injuries and physiological stress. They suggested that scale damage alone resulted in mortalities of 40 percent, while scale damage and stress accounted for 80 percent of mortalities among salmon escaping from gillnets.

Generally, gillnet fisheries appear to cause substantial damage to fish, and fish released from a gillnet may suffer high mortality. Post-release mortality caused by gillnet injuries is variable, and is species- and fishery-dependent. This is in contrast to the net types used in the seine net and coracle fisheries in Wales.

There has been no indication during the past 18 years, during which time the coracle fishermen have released salmon prior to the 1st June, of issues with dead or damaged fish. The other net fisheries (seine and compass and wade) are not expected to result in substantive damage to released fish.

7.2. Byelaws proposed for rod fisheries

Summaries of all proposals are presented in the Summary of Options (p.130), and details are presented here.

All measures are proposed for a period of 10 years, with a review after 5 years.

7.2.1. Salmon:

Stocks considered to be vulnerable and in need of additional regulatory measures would remain covered by the proposed byelaws until the byelaws were reviewed. A possible change in stock status in 2018 would not automatically result in amendment of measures.

The following statutory C&R measures are proposed:

- Mandatory catch-and-release of all salmon from rod fisheries exploiting vulnerable stocks (identified in Table 11) as requiring 'additional regulatory measures':

Clwyd, Seiont, Tawe, E&W Cleddau, Dee, Dyfi, Ogmere, Rheidol, Dwyrhyd, Taff, Tywi, Ogwen, Teifi, Conwy, Dwyfawr, Nevern, Mawddach, Glaslyn, Dysinni, Taff and Ely.

The Usk is added to the above group of rivers because of the recent and very fine margin by which the stock achieves 'Probably Not at Risk' status, but mainly due to the marked reduction in numbers of juvenile salmon evident from the 2016 electrofishing survey and concerns about subsequent returns of adult fish from these cohorts (see Section 5).

- Non-principal salmon rivers:

Recovering rivers that do not have Conservation Limits or Management Targets are deemed to be 'At Risk' as the main factors affecting salmon stocks, particularly marine survival, are believed to affect all stocks in Wales.

There is no evidence that the stocks on these rivers are in any better condition than the principal salmon rivers. In fact due to the small size of the stocks they may be more vulnerable than stocks in the principal salmon rivers.

Stock savings:

C&R has been widely promoted for a number of years as an effective means of helping to protect failing stocks while still allowing anglers to continue to fish. In recent years average levels of C&R for salmon have reached record high levels across E&W as anglers have been encouraged to conserve increasingly vulnerable stocks.

Average C&R rates for both salmon and sea trout now exceed 70% across Wales (Table 17). However these national rates include the existing statutory C&R period of salmon fishing as a result of the National Spring Salmon Byelaws, and other mandatory C&R provisions such as those on the Wye. The actual voluntary rate in Wales, as it is in England, is therefore lower than this. There is also substantial variability between rivers. .

Estimates of the additional eggs resulting from full-season mandatory C&R on the rod fishery are shown in Table 16a .

For stocks in the worst risk categories (i.e. 'At Risk' and 'Probably at Risk') the Decision Structure (Annex 4) requires that reduction in exploitation are achieved with urgency. If it is concluded that if levels, routinely in excess of 90% cannot be achieved by voluntary means, then mandatory controls should be introduced. In practice, the rules of the Decision Structure have rarely been applied with rigour, and the measures for the Wye and Taff/Ely – introduced by Environment Agency Wales - remain the only such examples.

Even with the best will from angling bodies, levels of C&R on stocks in the worst risk categories have rarely exceeded 90% by voluntary means. Where they have, such levels have not been maintained (Table 17). With salmon stocks across the southern

Atlantic range – including those of Wales – reaching all-time low levels, perhaps dangerously low on some river systems, mandatory C&R is considered the principal response and an entirely appropriate conservation measure.

Table 17. Angling catch-and-release rates for salmon and sea trout, 2012-2016

River	% Salmon released:					% Sea trout released:				
	Year:					Year:				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Severn*	74.3	68.6	78.7	72.4	77.8	83.3	88.2	82.4	76.5	95.0
Wye	100.0	100.0	100.0	99.6	100.0	94.4	95.1	89.7	98.8	100.0
Usk	68.1	70.5	77.4	83.0	81.8	84.1	64.9	89.9	82.5	84.5
Ebbw								50.0	100.0	80.0
Taff and Ely	97.6	100.0	100.0	100.0	100.0	99.2	100.0	52.2	95.7	100.0
Rhymney						75.0	100.0	66.7		0.0
Ogmore	58.1	62.5	96.4	100.0	95.2	85.6	89.1	89.6	92.2	77.9
Afan						77.7	56.9	66.7	89.9	72.5
Neath						73.0	81.9	92.1	90.6	75.5
Tawe	36.9	35.6	55.6	76.9	76.1	73.4	65.1	90.9	62.3	85.3
Loughor						60.3	54.2	66.9	78.3	86.0
Gwendraeth						64.0	50.0	71.9	76.7	94.4
Tywi	39.5	51.7	58.3	60.4	59.0	58.4	69.4	72.5	75.5	74.6
Taf	30.0	30.0	69.0	69.2	50.0	40.8	42.2	60.2	68.1	60.0
E&W Cleddau	47.4	71.8	56.8	64.3	80.0	65.7	84.1	72.8	81.3	82.4
NeVERN	36.4	60.6	96.8	85.0	75.0	52.5	44.3	56.4	60.3	49.4
Teifi	46.9	58.8	72.1	62.1	66.1	70.0	74.4	79.9	73.8	73.6
Aeron						32.6	43.3	46.8	58.0	73.9
Ystwyth						75.4	68.0	81.7	75.0	72.3
Rheidol	31.8	72.7	100.0	88.9	100.0	85.5	89.0	88.7	83.8	77.9
Dyfi	34.8	52.3	72.0	71.8	72.9	75.4	76.2	78.3	72.1	78.4
Dysynni	75.0	80.0	100.0	75.0	80.0	83.8	88.1	89.0	85.8	86.7
Mawddach	60.7	44.4	71.8	65.9	68.4	78.4	78.3	86.3	78.3	86.2
Arto						71.4	62.5	56.0	29.4	27.8
Dwryrd	0.0	25.0	75.0	50.0	0.0	55.9	21.6	78.2	35.9	80.0
Glaslyn	73.1	53.2	66.7	81.5	78.6	63.3	75.9	80.0	80.3	71.0
Dwyfawr	20.0	66.7	55.6	25.0	77.8	63.8	82.7	58.9	73.9	58.4
Llyfni						72.9	76.3	74.8	68.4	78.8
Gwyrfai						40.0	60.0	57.1		77.8
Seiont	34.5	37.5	100.0	50.0	33.3	45.5	45.5	63.2	60.0	87.4
Ogwen	34.6	22.9	53.8	52.9	46.7	63.4	57.3	67.5	62.2	69.3
Conwy	53.9	57.7	45.2	66.2	70.8	78.6	83.5	78.0	79.4	86.7
Clwyd	73.7	80.0	71.4	100.0	83.3	83.0	85.1	84.5	87.1	84.9
Dee	74.4	81.2	87.6	86.3	86.3	83.1	95.4	83.2	81.8	83.7
All rivers	52.3	60.2	76.5	73.3	72.1	70.0	71.2	73.6	75.4	75.7

* note that the Severn is not included in the proposals in this technical case

7.2.2. Sea trout:

The following statutory C&R measures are proposed:

- Mandatory catch-and-release of all sea trout caught by rod before the 1st May on rivers with vulnerable stocks – identified in Table 12 as requiring ‘additional regulatory measures’:

Gwendraeth, Taf, Taff and Ely, Tawe, Ystwyth, Rhymney, Aeron, Eastern & Western Cleddau, Loughor, Afan, Neath, Artro, Glaslyn, Tywi, Dwyrhyd, Seiont, Wye, Teifi, Gwyrfai.

Addition of other rivers to the above group where net fisheries have a common 1st May start date – see above:

Nevern, Dysynni, Conwy, Dyfi, Mawddach.

- Additionally a single national size limit, or slot length is proposed:

60cm (~5.75lb) ‘slot limit’ applied to all rod fisheries in order to provide further protection of large/fecund/specimen sea trout which have escaped the net fishery.

Sea trout stock savings:

The above group of measures – both C&R and the proposed 60cm slot limit – focus on the rod fishery and are intended to provide ‘balance’ in terms of stock conservation, equivalent to the postponement of commencement and earlier end to the net fishery season. The estimated egg ‘savings’ from these measures (calculated for all rivers) are given in Table 16b.

The aim is to provide additional protection to sea trout stocks while not being excessively restrictive of angling opportunity. The benefits from these measures, while small in some cases, would be expected to accumulate and amplify as stocks rebuild.

This is part of an iterative approach for sea trout, and is appropriate to the emerging but therefore tentative conservation targets derived from a new and developing stock assessment methodology. Like all options proposed in this document, this will be subject to review after 5 and 10 years, should the byelaws be implemented.

7.3. Maintaining fisheries under C&R in the rod fishery

The practice of C&R in rod fisheries has become increasingly common as a salmon management and conservation measure in light of the widespread decline in salmon abundance across the North Atlantic range of the Atlantic salmon. In some countries, principally Canada and USA, C&R fishing has been extensively practised since the early 1980s. In more recent years it has also been widely used in many European countries both as a result of statutory regulation and through voluntary practice.

The key aim of C&R angling is to ensure that individual fish, once they have been caught and released back to the river, survive to contribute to the fish stock by

successfully spawning. Implicit in C&R is the assumption that fish experience low rates of mortality and minimal sub-lethal effects and that consequently, they demonstrate high rates of survival.

There has been a large and welcome increase in the uptake of C&R fishing by anglers in Wales in recent years (Figure 30), and this represents a significant cultural change by anglers. This is in part a result of the ongoing call for voluntary measures as a result of concerns around declining stocks, but also reflects the mandatory legal requirement introduced by national byelaw to protect early-running MSW salmon in 1999 and subsequently renewed in 2009. This was also reinforced by the introduction of mandatory full C&R on the rivers Wye, Taff and Ely in 2012.

On the Rivers Tywi and Taf the end of the angling season was shorted by 10 days following the 1997 NLO review as a commensurate measure to the reduction in net salmon exploitation which removed August from the net fishing season. In 2007, recognising the growing acceptance of C&R, these last ten days of the season were returned to the rod fishery on a C&R basis with method restrictions of fly and spin fishing only. The month of August was not reapplied to the net fishing season.

There has been a continued steady increase in the declared C&R rate from 1994 to 2016 (Figure 30, and Table 17).

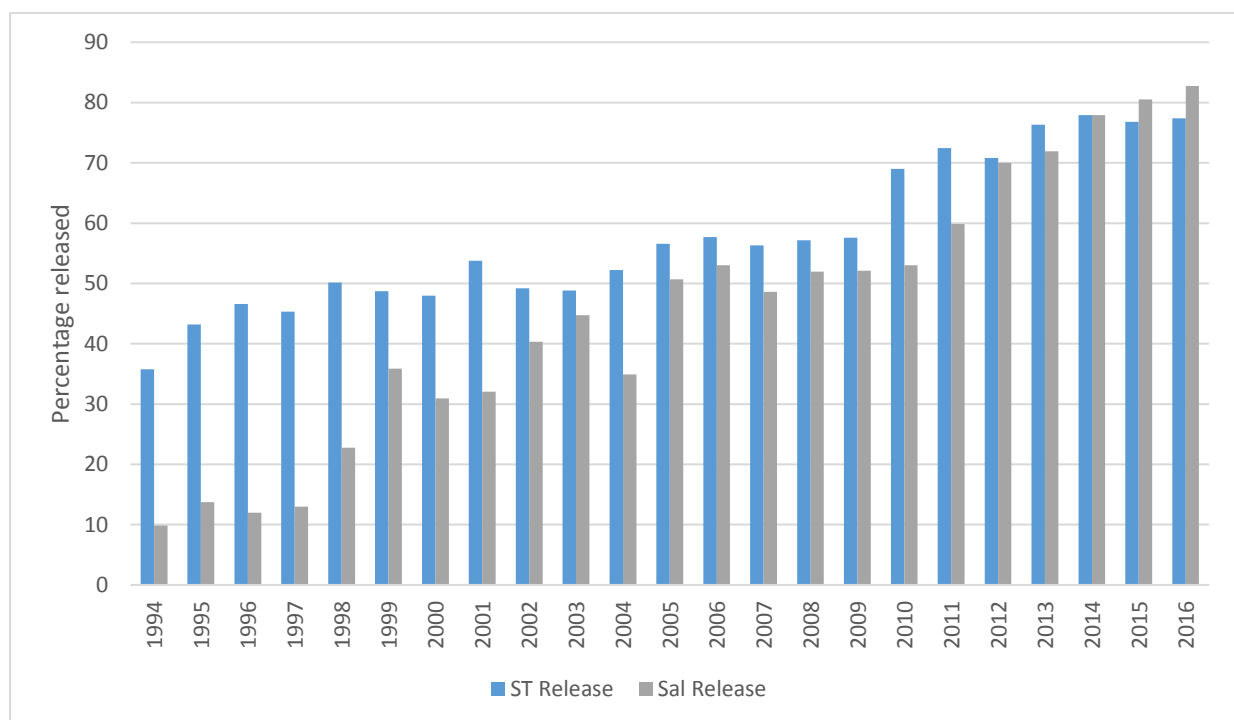


Figure 30. Percentage of salmon and sea trout released throughout the season

Whilst there has been an encouraging response to calls for greater voluntary effort in C&R, it must be noted that the figures above include the mandatory periods where all salmon must be released. These figures therefore mask differing behaviours in catchments and when anglers have a choice on whether or not to release salmon. The data in Table 18 below indicates, from the 2015 rod returns, the proportion of salmon returned in catchments in total, and voluntarily when anglers have a choice.

There is a wide range of voluntary figures from zero to 100%. Perhaps the most notable figures are from the Tywi and Teifi, both rivers having faced continued requests for voluntary restraint over the past three years. They are two of the top five fisheries in terms of recorded catch each year in Wales. Voluntary rates however remain relatively low at 55 and 59% respectively.

Table 18. Total and voluntary salmon C&R rates (2015)

River	Total % released	Voluntary % released
Wye	100	Mandatory 100%
Usk	83	79
Taff & Ely	100	Mandatory 100%
Ogmore	100	100
Tawe	77	76
Tywi	60	55
Taf	69	66
E & W Cleddau	64	63
E Cleddau	53	50
W Cleddau	75	71
Nevern	85	82
Teifi	62	59
Rheidol	89	83
Dyfi	72	61
Dysinni	75	75
Mawddach	66	62
Dwryyd	50	50
Glaslyn	82	81
Dwyfawr	25	25
Seiont	50	0
Ogwen	53	53
Conwy	66	61
Clwyd	100	100
Dee	86	85

The practice of C&R is aimed at increasing the number of fish surviving to spawn and thus supporting other initiatives as NRW and partners seek to ensure that rivers are more likely to meet their conservation limits and achieve the goal of long-term sustainability. Such improvement is benefiting stocks and therefore future catch prospects, however it is clear that more can and must be done.

Survival after C&R

As C&R has become an increasingly popular management tool to maintain fisheries there have been extensive reviews and investigations into its effectiveness and impacts. Although there is extensive information on the C&R of salmon and non-anadromous trout (brown and rainbow), there is comparatively little known about the efficacy of C&R on sea trout. However despite this paucity of information on sea trout it seems likely that the impacts and effectiveness will be broadly similar.

Most of the studies that report mortality rates after C&R have used skilled anglers or artificially hooked captive fish. This may lead to lower estimates of mortality rate than might be expected if less experienced anglers caught the fish. Efforts have been made in a number of countries to inform anglers about good C&R practice through, for example, free instruction videos and advisory leaflets.

The main factors that can reduce survival are:

- the fishing method used
- deep hooking leading to tissue damage and bleeding
- physical damage from poor handling leading to scale loss abrasions and infection,
- fish being kept out of the water for a prolonged period causing tissue and gill damage,
- high water temperatures above 20°C

Physical injury caused by hooking is the most important cause of post-release mortality. Hooks that penetrate vital organs or tissues can cause critical damage. If hooks are deeply embedded (penetrating the oesophagus and/or stomach with resultant damage to internal organs such as the heart and liver), this will almost certainly result in serious injury and mortality.

The fishing gear used by anglers can influence the hooking damage and condition of fish captured. The three main fishing methods are bait, lure or spinner, and fly. There are wide ranging estimates of survival using the three methods, though it is generally considered that survival is highest with fly (often above 90%), lower with lures (around 50-80% survival) and lowest with bait fishing (generally less than 50% with worm but rather higher for shrimp).

In the most recent extensive review made of pan-holarctic post release mortality of angled Atlantic salmon, Lennox et al (2017) concluded that salmon captured by flies had higher survival (95%) than salmon captured by lures (85%) or bait (86%).

Hooks

A large variety of different hook designs are readily available to anglers. In most cases the selection is a matter of personal choice. However some fisheries prescribe, via local voluntary or mandatory codes, the number and size and design of hooks.

A number of byelaws already exist in Wales to control fishing. These have been introduced in the past for a range of reasons in order to reduce the potential risks from foul hooking and to reduce injury to fish.

Traditionally barbed hooks are used to minimise loss of fish once hooked. In many forms of angling (especially C&R based fisheries), barbless hooks are now regarded as preferable and equally effective, and have in some cases become the standard hook pattern used because they are more easily removed from fish.

Exposure to air is one of the key factors in fish survival post capture. Arlinghaus et al (2007) concluded that barbless hooks are consistently less injurious and result in less mortality than barbed hooks, and suggest that barbless hooks should be widely adopted by anglers.

The use of single barbless hooks complements the growing interest and adoption of good practice catch-and-release principles.

Trebles and doubles

Hooks used in fly fishing may be single, double or treble hooks, with or without barbs. Treble and double hooks are also used in combination with tubeflies and waddington shanks. Traditionally one or several sets of treble hooks are used with spoons, spinners and plugs. When fishing with worms, single hooks are most commonly used, but whilst fishing with shrimp or prawn treble hooks are normally employed.

Comparative studies of fish mortality linked to the use of singles, doubles and trebles have shown contradictory results (Olsen et al 2010). Single hooks may be more deeply ingested than treble or double hooks however, if ingested, treble hooks can cause more severe injuries.

Generally treble hooks are less easily manipulated and removed when compared to double or singles, and therefore the removal of treble hooks generally requires longer handling times. Replacing treble hooks with single hooks (or even double hooks) is a means of reducing injuries associated with hook penetration. Generally, using fewer hooks or single hooks, instead of doubles or trebles, reduces potential physical injury and reduces unhooking times.

Flying C type lures.

Increasing concern has been expressed about the deep hooking potential and subsequent survival of fish caught on the popular spinner baits that are known as 'flying Cs'. These lures have become highly popular due to their effectiveness, however they have a reputation for engulf them and to be hooked deeply in the back of the mouth/oesophagus and in the gills.

Gargan et al (2015) reported on the survival of wild Atlantic salmon after C&R angling in three Irish rivers. In total, 76 fish were tagged with radio transmitters after C&R angling. Survival to spawning was much higher for fly caught fish (98% survival – 59 of the 60 fish surviving) than lure caught fish (55%, 6 of 11

fish survived). Importantly, the lures in this study were spinning lures (flying C type lures).

The risks from these types of lures can be reduced if the treble hooks are replaced with an appropriate single hook. Some suppliers in Wales have already recognised this and are stocking this type of lure with single hooks for anglers who want to increasingly release fish. Experience with single-hook flying c lures on the River Wye has been very good with few fish believed to be lost due to the hook type (Marsh-Smith, pers. com.).

Recovery – exposure to air and water temperature

In general, air exposure is harmful and potentially lethal to all captured salmonids. The effects of air exposure is dependent on numerous factors including water temperature, water quality, 'playing' time, handling time, weather conditions and the size of the fish.

C&R of salmon in rivers with water temperatures less than 17-18°C has been widely reported to result in low mortalities (0-6%, subject to capture method). Several studies suggest that temperatures of 17-18 °C and above can result in elevated levels of both immediate and delayed mortality.

Recovery is affected by a number of factors. Fish that are caught in either warm weather conditions, become fully exhausted, or are handled extensively are likely to require the longest period to recover. Studies mainly on trout have shown that fish played to exhaustion can still have a high level of survival (greater than 90%), however mortality increases rapidly with exposure to air and has been suggested to reduce to 60% after 30 seconds exposure and to around 30% after 60 seconds.

7.4. The Benefits of C&R

ICES (2009) report that C&R recreational fisheries provide an intermediate management strategy between a full retention fishery and fishery closure for populations that are below target levels. C&R fisheries would be expected to result in population sizes that are higher than those in a full retention fishery.

The evidence we have suggests that if fish are caught and handled according to good practice guidelines, most of them will survive. Carefully releasing fish rather than retaining them can therefore make a real contribution to conservation.

7.5. Socio-economic and cultural impacts

NRW has a duty under section 6(6) of the Environment Act 1995 "to maintain, improve and develop fisheries of salmon, trout, eels, lampreys, smelt and freshwater fish".

Migratory salmonid fisheries depend on the capacity of a stock to endure exploitation, and we assess this through our annual stock assessment procedures. This tells us what the deficit or surplus in annual spawning egg deposition is and therefore indicates the relative urgency in protecting spawning escapement.

Maintaining economic benefit that arises from fisheries must be balanced against stock resilience. Our clear view is that fishing of unsustainable stocks must be very carefully managed if stocks are to be restored to sustainability. Conditions on exploitation could then potentially be relaxed.

Background

NRW is required to consider the socio-economic impacts of any proposed regulatory action.

WE are very conscious that the economic benefit arising from migratory salmonid fisheries in Wales, both by nets and by rods, is very important. We are also aware that the way to maximise this benefit is through the recovery of stocks so that runs and catches are more abundant. Our management proposals are intended to achieve this.

Measures to bring about stock recovery will be unpopular with some fishermen and may result in reductions in uptake of fishing and, therefore, licence revenue. However the view of NRW is that stock protection and improvement must take precedence as an investment in future stock sustainability.

Socioeconomic analysis

In December 2007 the Environment Agency published two reports on inland fisheries in England and Wales and these are summarised in a later management report (EA, 2009). The first report explored the welfare benefits that arise using the techniques of contingent valuation and choice experimentation, and the second a (short term) impact evaluation looking at:

- a. Estimated annual expenditure on different types of freshwater angling
- b. Estimated impact on regional economies of potential increases and decreases in types of angling (coarse fishing and fly fishing for trout, salmon and sea trout)
- c. Estimated impact categorised by types of surface water rivers, canals and still-waters.

The following caveat was clearly stated in the executive summary to the second report:

“In the public domain, the total expenditure of anglers and the employment generated is often used for advocacy purposes. In some instances, the findings of an impact study are used inappropriately. This inappropriate use may be deliberate but may also be misguided. Both culpable and innocent misuse is best tackled by ensuring that all sides are familiar with the scope and limitations of impact studies and we therefore recommend that users of this study consult the main scientific report .”

There have been examples of confusion between the use of economic impact analysis (EIA) and total economic value assessments (TEV) which, as noted by the EA, “cannot generally be added together.” It is important therefore to be cautious about citing economic figures.

The principles of the sustainable management of natural resources set out in the Environment (Wales) Act 2016 require NRW, inter alia, to:

- “take account of the benefits and intrinsic value of natural resources and ecosystems, and
- “take account of the short, medium and long term consequences of actions.”

These principles imply a TEV rather than an EIA approach. Only TEV can simultaneously take account of benefits and intrinsic value through concepts of use-value and non-use value. Moreover EIA can only adequately address the short term issues.

The first EA report on Inland Fisheries (EA, 2007) used a contingent valuation methodology to examine an “all or nothing scenario” and a choice experiment to try to assess the marginal values lying in between. The scenario chosen for this was a fish disease causing a 95% collapse in salmon populations for 25 years. The authors concluded that, on average, households across England and Wales were prepared to pay £15.80 to prevent such a severe decline in salmon stocks, or about £350 million a year.

Capitalising this over 25 years (using the UK Government Green Book discount rate of 3.5% per annum) would give a capitalised value of the benefits of about .£6 billion. On a comparable basis the figure for Wales alone would be about £290 million.

Adjusting for nominal growth in the economy and the number of households since the study a decade ago, the overall sum for England and Wales might now be in the region of £12 billion, with a figure for Wales of about £600 million.

This is an estimate of the value of the fish stock NRW is trying to protect by taking action to conserve salmon, in line with SMNR principles:

- “manage adaptively, by planning, monitoring, reviewing and, where appropriate, changing action;
- “take action to prevent significant damage to ecosystems.”

In contrast the EIA contribution of salmon and sea trout to output in 2007 was £5.3 million within an economy producing £48.6 billion, or 0.01%. This is substantially less than the margin of error surrounding the overall output estimate. This figure is now out of date, but there is no evidence to suggest that the structure of the economy has changed enough to alter the overall insignificance of the impact.

The measures now being proposed would not ban fishing, merely the killing of salmon or sea trout, so the overall impact would be even less. It is difficult to avoid the conclusion that the conservation of valuable stocks far outweighs any transitory impact on economic activity.

Socioeconomic and social benefits

An assessment of the socioeconomics and social benefits of fishing for migratory salmonids was undertaken as part of the Celtic Sea Trout Project (CSTP 2016). This concluded that the most recent report ‘Fishing for Answers’ (Substance 2012) provide a comprehensive review of the social and community benefits for angling in the UK.

They listed six complex and interrelated benefits:

- 1) Sports participation,
- 2) Health and Wellbeing,
- 3) The Natural Environment
- 4) Community Development,
- 5) Rural Communities and Angling Tourism
- 6) Young People.

The contribution salmon and sea trout angling fisheries makes to each of these is unknown, but will depend on a wide range of variables largely on the nature and extent of angling activity and opportunities within catchment areas. The report noted however, in areas where sea trout are more common and abundant than other freshwater fish species, their contribution may be of significant importance and value.

7.5.1. Rods

We have considered the possible further decline in the uptake of rod fishing as a result of introducing mandatory C&R and method control byelaws for salmon and sea trout.

Wherever possible our proposals seek to minimise the risk of a reduction in fishing activity, although this must be balanced against the overall need to secure our key objectives of the promotion of stock recovery.

It is difficult to be certain, however experience from the River Wye, where mandatory C&R measures were introduced in 2012, does not suggest that there will be a marked decline in fishing for migratory fish as a result of the new measures now proposed.

During our discussions with fisheries interests over the past 18 months concern has been expressed that a proposed ban on bait fishing will effectively close some fisheries as they can only be effectively fished with bait. This alone could reduce the uptake of angling in some locations. We have made the case in this document for a total ban on bait fishing for salmon, however we recognise the concerns and have not proposed a total ban on bait fishing for sea trout.

Although we wish to protect all salmon by eliminating the risks associated with bait fishing, we also recognise that bait fishing for sea trout may continue if those stocks are sustainable. Although this will inevitably result in some salmon being incidentally caught on bait our case is that these salmon have a poor chance of survival if deeply hooked. To reduce the risks of salmon bycatch and accidental mortality whilst maintaining a sea trout fishery, we propose restricting bait fishing for sea trout to a single worm and a barbless hook with a maximum gape size to 8mm. This should reduce the risk associated with ongoing sea trout bait fishing and of some anglers surreptitiously targeting salmon.

Should salmon or sea trout larger than 60cm be caught, the proposed use of a small barbless hook should facilitate fish being released more quickly with less potential harm.

The proposed introduction of byelaws is intended to prevent further decline and initiate stock recovery. This would therefore bring about an improvement in stocks and the socioeconomic benefits for Welsh fisheries. Our actions are intended to improve the stock so that fishing uptake will increase in the future.

We believe that any decline in uptake of fishing will be small and transient, and that this should be acceptable to the overall fishing community as an investment for future stock improvements.

7.5.2. Nets

The potential impacts of the proposed measures on net fisheries have also been considered. The first sale value of fish taken by nets in Wales during 2016 was estimated using reported catches from returns and a first sale value of £6 per lb. The total value of the salmon and sea trout catch was £ 46,032.

If we assume that a byelaw requiring all salmon to be returned had applied in 2016, the value of the 'lost' salmon catch is estimated at £11,958 approximately 26% of the 2016 total.

The proposed measure delaying the start of the net fishing season (with all net seasons to start on 1st May) to protect early running sea trout would mainly affect the Tywi and Teifi fisheries (26 of the 54 licences available in Wales). There were only 3 other sea trout reported caught in Welsh nets before this date in 2016.

Delaying the start of the net season to start on the 1st May in 2016 would have resulted in a reduction in the catch of 9% (129 fewer caught from a total of 1,384) with an estimated value of £3,173 representing approximately 7% of the total catch value.

If the combined proposed measures for salmon and sea trout fishing had been introduced in 2016, it would have had the effect of reducing first sale value from £46,032 to £30,901, a reduction of 19% across Wales.

It is recognised that this loss in income would not be shared equally across net fisheries or indeed within the fisheries themselves, with highly variable levels of participation and fishing effort between different netmen.

The majority of net fisheries would be only lightly affected by the proposals. The coracle and seine net fisheries on two principal rivers, the Tywi and Teifi, would be affected to the greatest extent. It should be noted however that the performance of these two fisheries and the status of stocks are amongst those that cause most concern.

7.5.3. Heritage value

In 2004, the Environment Agency (EA, 2004) tested a valuation methodology designed to provide a preliminary estimate of the heritage value of the Welsh coracle fisheries. The heritage value was derived by determining how much members of the public would be willing to pay in order to maintain the minimum and current levels of traditional salmon fishing methods.

The Welsh coracle fisheries comprised fisheries on the River Tywi, the River Teifi and the River Taf.

The study identified preliminary estimates of the heritage value of the salmon fisheries under consideration. The contingent valuation technique was utilised in this instance to establish the general public's willingness to pay (WTP) to:

1. maintain the minimum level of traditional fishing methods; and
2. maintain the current level of traditional fishing methods.

The estimated heritage value for the Welsh coracle fisheries within Environment Agency Wales (based on a one-off donation to maintain the minimum level of traditional fishing methods) was estimated as £1.5m.

Although 24% of the 392 people that took part in the study were willing to donate to maintain the minimum level of traditional fishing methods, just 3% were willing to donate an amount in addition to this to maintain the current level.

The low level of willingness to pay an additional amount to maintain the fisheries at the current level, suggests that the preservation of the fishing methods on the rivers is the issue, and not the level at which they are operating.

NRW does not, therefore, believe that the combination of measures proposed (i.e. no change in the number of licences available, controls prohibiting the take of salmon, changes to the fishing seasons, while still allowing fishing for sea trout during May, June and July) poses a threat to the heritage value of the coracle fisheries. We do not believe the heritage values and social benefits are dependent on the continued targeting of early run sea trout or the take of salmon.

Heritage net licence category

In response to some concerns raised by netsmen during the 2007 NLO process, we agreed to further investigate options for introducing a heritage licence category for certain net fisheries in Wales. The Welsh Fisheries Strategy (2008) also includes an action to "consider the benefits of introducing an optional recreational licence for heritage net fisheries" although it should be noted that a number of netsmen have stressed that they do not wish to be viewed as 'recreational' fishermen.

We sought legal opinion on the matter and have been advised by our lawyers that current legislation (Salmon and Freshwater Fisheries Act 1975) does allow for the introduction of a new heritage net licence category (together with associated byelaws) and that this could be achieved under existing NLOs.

A possible model for how a heritage licence scheme might work on the River Tywi was discussed with netmen. It was proposed that a combination of commercial and heritage coracle licences could exist under the current NLO (for example, four commercial and four heritage licences). A reduced fee could then be considered for the heritage licence and a new byelaw introduced to limit the heritage fishery catch (a limited number of carcass tags would be issued with the licence). Fishing would either cease once all the allotted tags had been used, or fishing could continue on a strictly C&R basis, for example during demonstration events. In addition, consideration could be given to amending the weekly close time byelaw to allow fishing to take place at weekends during daylight hours for demonstration purposes.

A consultation and questionnaire was undertaken in 2011 with all of the netmen licenced at that time and 25 responses (50% of netmen) were received.

The majority of respondents, including the 8 Tywi coracle licensees, were opposed to a new net licence category with a number of netmen noting that they wish to continue to be viewed as 'commercial' fishermen.

Given that there was no apparent demand for a new licence category, it was recommended that the consultation be taken no further.

7.6. Allocating catch between net and rod fisheries

In many parts of Wales both salmon and sea trout are available for capture by both nets and rods. The net fisheries in tidal waters and the lower reaches of rivers generally catch both species although local practices may target one species or the other. The behaviour and seasonal availability of each species often varies and this determines what might be caught.

The National Spring Salmon Byelaws (NSSB), introduced in 1999 and renewed for a second 10-year period in December 2008, introduced statutory C&R fishing for salmon in all rod fisheries in England and Wales, and postponed the start of salmon net fishing until 1st June each year. However net fisheries in West Wales that were identified primarily as sea trout fisheries were allowed, under dispensation, to commence fishing at an earlier start date on condition that any salmon caught were returned, as safely as possible, alive to the water. The net catch of salmon has been reported each year and differentiates between those salmon returned alive under the NSSB each year and those retained. Over the last 5 years 2012-2016 the net fisheries have reported returning an average 21 salmon per year (range 1-30), this represents approximately 20% of the annual net catch.

The same NSSB also introduced new controls on rod fishing for salmon with statutory C&R fishing required everywhere prior to 16th June each year and the introduction of early season bait control.

The NSSB therefore introduced fishing controls on both sectors and, as such, may be considered a precedent for further requirements for action in both sectors to protect fish stocks.

The primary management objective is to ensure the conservation or restoration of the stock(s). When new management measures are considered, socio-economic factors may be taken into account to influence the nature and balance of controls affecting different stakeholder groups and the rate of stock recovery that is planned (see the NASCO Implementation Plan for England and Wales):-

[NASCO Implementation Plan for the period 2013-18](#) .

Consideration is also given, inter alia, to:

- whether a proposed measure will have an unreasonable effect on someone's livelihood (e.g. net fishing) or the value of their property (e.g. fishing rights); this may mean that it is necessary to reduce the impact of a conservation measure, for example by planning the recovery of the stock over a longer period;
- whether one group of stakeholders will be unreasonably affected relative to another; where reductions in exploitation are required, the effects on netsmen and anglers should be equitable;
- the effect of controls on the viability of commercial and recreational fisheries; for example, C&R controls will generally have a greater economic effect on commercial rather than recreational fisheries;
- the heritage value of the fishery; where fishing methods are unique to a very small number of locations, consideration is given to retaining a residual fishery and/or permitting a low level of catch.

Rod and net fisheries may be regarded as competing for the same resource which for most Welsh rivers includes both sea trout and salmon. Provided enough fish are allowed to escape the fisheries and survive to spawn then the protection of stocks of both species should be assured. Biologically it is irrelevant how fish are caught and killed, however other matters are of course relevant such as selectivity of fisheries and the post-release survival of returned fish.

Although there are comparatively few netsmen (a total of just over 53 licences may be issued each year), there are usually just over 5,000 migratory salmon rod licences sold each year (noting that some are short-term and may represent fewer individuals). Both sectors represent value to the Welsh economy.

Net fisheries may be significant locally, contributing to employment and cultural interest. Recently the catch of sewin (sea trout) by coracles in West Wales has been awarded the status of 'protected designations of origin' and 'protected geographical indications' by the EU (commission implementing regulation (EU) 2017/596) which protects the product against imitation in order to gain market advantage. This therefore recognises the status of coracle-caught sewin and will presumably add to their economic value.

The rod fisheries contribute significantly more to the local economy, through the revenue derived from permitting fishing and the local economic benefit derived from visiting anglers.

The balance of social and economic benefits may differ with any revision to the allocation of catch between net and rod fisheries. This is a difficult balance and is an area of work that will be explored in future. However the over-riding need is to protect both salmon and sea trout stocks so that economic benefit will be assured through sustainability and will increase in future as stocks recover.

7.6.1. Analysis of impact on net fisheries

The estimated potential impact on the net fisheries of the introduction of all proposed measures for sea trout is shown in Table 19, and is based on the catches reported in 2016. This assumes there was no increase in effort in May and July as a result of the season starting later and finishing earlier in the net fisheries.

Overall, based on the average catch 2012-2016, there would be an 18% reduction in the sea trout net catch across Wales, The reductions would be greatest in the two principal net fisheries on the Tywi (coracles and seine) and Teifi (coracle), the majority of fisheries would be unaffected.

The value of first sale catch was estimated between 2010-2016 (Table 20) with sale value estimated using a value of £6 per pound.

Table 19 5-Year Average catches of sea trout (2012-2016)

Fishery	Method	Mar	Apr	May	Jun	Jul	Aug	Average total catch 2012-2016	Average catch with proposed restrictions	Average number of sea trout saved	Percentage reduction in catch
Cleddau	Compass				0	0	0	1	1	0	40%
Nevern	Seine		0	4	10	1	0	14	14	0	0%
Taf	Coracle		2	2	0	0	0	4	2	2	41%
	Wade				0	0	0	0	0	0	0%
Teifi	Coracle		62	181	168	36	11	458	385	73	16%
	Seine		1	28	69	5	1	103	102	1	1%
Tywi	Coracle	15	91	176	175	55	0	512	406	106	21%
	Seine	16	96	150	171	54	0	487	375	113	23%
Conwy	Seine				6	5	1	11	10	1	7%
Dyfi	Seine		1	4	14	6	0	25	24	1	2%
Dysynni	Seine				12	3	5	20	14	5	27%
Mawddach	Seine				0	0	0	0	0	0	50%
TOTAL		31	251	546	624	165	19	1,636	1,334	302	18%

Table 20 Estimate of first sale value of the catch of salmon and sea trout

		2010	2011	2012	2013	2014	2015	2016	Average	Range Min	Range Max
Black Rock	Lave nets	£282	£288	£360	£0	£0	£0	£312	£177	£0	£360
Cleddau	Compass nets	£492	£875	£81	£143	£361	£192	£24	£306	£0	£875
Conwy	Seine net	£414	£804	£756	£792	£654	£702	£486	£658	£414	£804
Dyfi	Seine net	£1,964	£1,052	£512	£1,518	£810	£252	£246	£908	£246	£1,964
Dysynni	Seine net	£285	£180	£225	£288	£978	£894	£492	£477	£180	£978
Mawddach	Seine net	£0	£156	£0	£84	£0	£42	£0	£40	£0	£156
Nevern	Seine net	£90	£0	£258	£183	£189	£246	£0	£138	£0	£258
Taf	Coracle	£0	£0	£0	£0	£672	£0	£0	£96	£0	£672
	Wade net	£0	£0	£0	£0	£0	£0	£0	£0	£0	£0
Teifi	Coracle	£21,504	£20,558	£10,537	£17,931	£13,179	£13,394	£15,216	£16,046	£10,537	£21,504
	Seine net	£7,410	£7,053	£1,206	£4,200	£4,747	£1,953	£4,488	£4,437	£1,206	£7,410
Towy	Coracle	£24,510	£22,800	£18,540	£24,411	£31,818	£32,052	£17,310	£24,492	£17,310	£32,052
	Seine net	£10,224	£10,657	£12,603	£10,578	£8,205	£13,170	£7,452	£10,413	£7,452	£13,170
	Totals	£67,175	£64,422	£45,078	£60,128	£61,614	£62,898	£46,032	£58,188	£45,078	£67,175

Estimating the impact of the proposed measures on the first sale value of the fish (salmon and sea trout) as a result of the proposed measures for nets saved is estimated below in Table 22. This again assumes a first sale price of £6 per lb.

Table 22 Estimate of first sale value of the catch of salmon and sea trout in 2016 and the lost income resulting from the fish saved by the proposed new measures.

Fishery	Method	Estimated 2016 catch value	Estimated value of sea trout 'saved'	Estimated value of salmon catch 'saved'	Estimated lost income from proposed measures	Value of saved fish per licence
<i>Cleddau</i>	<i>Compass</i>	£24	£0	£0	£0	£0
<i>NeVERN</i>	<i>Seine</i>	£0	£0	£0	£0	£0
<i>Taf</i>	<i>Coracle</i>	£0	£0	£0	£0	£0
	<i>Wade</i>	£0	£0	£0	£0	£0
<i>Teifi</i>	<i>Coracle</i>	£15,216	£1,107	£4,471	£5,578	£465
	<i>Seine</i>	£4,488	£0	£800	£800	£267
<i>Towy</i>	<i>Coracle</i>	£17,310	£2,288	£4,230	£6,518	£815
	<i>Seine</i>	£7,452	£123	£1,650	£1,773	£591
<i>Conwy</i>	<i>Seine</i>	£486	£0	£294	£294	£98
<i>Dyfi</i>	<i>Seine</i>	£246	£0	£48	£48	£16
<i>Dysynni</i>	<i>Seine</i>	£492	£148	£150	£298	£298
<i>Mawddach</i>	<i>Seine</i>	£0	£0	£0	£0	£0
TOTAL		£46,032	£3,665	£11,643	£15,308	£340

Total first sale income is currently estimated to be approximately £46,032.

The estimated value of the fish if the proposed measures to 1) release all salmon, and 2) introduce a reduction in season length of net fisheries for sea trout (1st May – 31st July inclusive) had been implemented would represent a reduction of approximately £15,000 ~30% across all the net fisheries.

It is noted that while this represents a reduction on average of £340, a number of net fisheries are unaffected, with the Tywi and Teifi fisheries affected most.

7.6.2. Analysis of impact on rod fisheries

Concern has been expressed about possible further decline in the uptake of rod fishing as a result of a full C&R byelaw for salmon. Although it is difficult to be certain, we do not believe this will occur.

Most of the fisheries in Wales, with the exception of the Wye, Usk, and Dee, are mixed fisheries for both salmon and sea trout, with sea trout making up the majority of

catches. It should be noted that although mandatory measures for total C&R are proposed for salmon fisheries, the measures for sea trout fisheries still enable anglers to kill some fish, though we would encourage the high levels of voluntary release rates to be maintained and, where stocks are still vulnerable, increased.

It is evident that a decline in fishing effort is occurring across Wales, (Figure 12) , the reasons for this are complex, however they include fewer anglers (rod licence sales (table 5) and trips/effort (Figure 13), an aging demographic of salmon and sea trout anglers, and possibly as a result of recent low catches and poor stock status.

It is considered possible that fishing effort will decline further if stocks remain at the current depleted levels, and that this might accelerate if the stocks decline further.

Evidence from the Wye was that declines in effort were occurring prior to 1999 when the National Spring Salmon Byelaws were introduced. This trend has reversed since 2006 with a steady increase in uptake of fishing opportunity, partly because of the success of catchment restoration undertaken by the Wye and Usk Foundation, NRW and EA. Participation has remained steady with some indication of an increase in effort since the introduction of mandatory measures in 2012 and as result of the very encouraging stock recovery.

It is also possible that should some anglers elect not to fish if a C&R byelaw is brought in. Effective promotion of the fishing opportunities has in some cases attracted a corresponding number of more conservation-minded anglers to take their place.

7.7 Revocation of byelaws

We propose that the current byelaw (byelaw 12A of the 1995 Rod and Line Byelaws (limit on Catch)) shall be revoked.

In response to concerns with stocks in the early and mid- 1990s and the reviews of net and rod catch controls ongoing at that time, bag limits were introduced within the West Wales Fisheries District. These had the effect of setting a daily bag limit of two salmon and four sea trout; and a weekly bag limit of five salmon.

In the 22 years since its introduction this byelaw has proven ineffectual in reducing or limiting the number of fish killed. There have been no enforcement cases in relation to the byelaw. In discussing and developing our approach to catch controls with fisheries interests and relevant Local Fishery Groups, this byelaw was cited as a reason for not introducing further voluntary measures to return all salmon, and for clubs to abide by current NRW byelaws.

As stocks of salmon and sea trout have significantly declined further since, these limits are clearly no longer appropriate and are incompatible with the proposed measures and we therefore propose to revoke it.

8. Summary of management proposals

This section provides a simple table of the management proposals, the development and basis for which are set out in this technical case..

Summary of proposals – Measures for salmon and sea trout

Proposed Measure	Objectives & Reasoning	Rod Fisheries Affected	Net Fisheries Affected
<p>Byelaw.</p> <p>Full catch and release of salmon (no kill)</p>	<p>Requires the immediate release, alive and well, of all salmon by both rods and nets.</p> <p>Salmon stock levels in Wales are considerably below the level that we consider to be either sustainable or desirable. Continuing to kill fish whilst stocks are depleted presents an unacceptable risk.</p> <p>The Usk rod fishery is included. The stock is marginally classified as ‘Probably Not at Risk’, however the state of juvenile salmon stocks in 2016 is a matter of great concern not least with regard to the anticipated future reduction in returning adults.</p> <p>Dee and Wye – excluded here as a separate ‘border rivers’ byelaw package for these rivers is under development with the Environment Agency.</p> <p>Wye byelaws already in place until 2021</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p>	<p>All rivers in Wales (with the exception of the cross border rivers Dee, Severn and Wye).</p>	<p>Tywi Taf Cleddau Nevern Teifi Dyfi Mawddach Dysynni Conwy</p> <p>Exception: Wye Blackrock Heritage lare fishery (capped at <2 per licence)</p>
<p>Byelaw.</p> <p>Closure of all net seasons 31st July (removing August)</p>	<p>This brings a common end date of 31st July to all net fishing.</p> <p>Reduced risk of salmon net mortality in August without significantly compromising sea trout net fisheries (very low sea trout catch in any net fishery during August).</p> <p>There will be some mortality/reduced fitness of salmon released from nets. Few sea trout are caught in August (e.g. 2015, 29 salmon and 35 sea trout during August. 2016, 29 salmon and 20 sea trout).</p>	<p>N/A</p>	<p>Cleddau Nevern Teifi Dyfi Mawddach Dysynni Conwy</p>

Summary of proposals – Measures for salmon and sea trout

Proposed Measure	Objectives & Reasoning	Rod Fisheries Affected	Net Fisheries Affected
<p>Byelaw.</p> <p>No bait fishing for salmon - banning worm, prawn and shrimp</p>	<p>We seek to maximise post-C&R survival.</p> <p>Risk of salmon mortality caught on bait is comparatively high – generally in excess of 50%.</p> <p>Dee and Wye – excluded here as a separate ‘border rivers’ byelaw package for these rivers is under development with the Environment Agency.</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p>	<p>All rivers in Wales (with the exception of the cross border rivers Dee, Severn and Wye).</p>	<p>N/A</p>
<p>Byelaw.</p> <p>Barbless or de-barbed hooks only</p>	<p>Reduces risk of salmon and sea trout C&R mortality.</p> <p>Using barbless or de-barbed hooks markedly reduces handling time during unhooking and potential exposure to air during release phase.</p> <p>Promotes C&R good practice.</p> <p>Dee and Wye – excluded here as a separate ‘border rivers’ byelaw package for these rivers is under development with the Environment Agency.</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p>	<p>All rivers in Wales (with the exception of the cross border rivers Dee, Severn and Wye).</p>	<p>N/A</p>

Summary of proposals – Measures for salmon and sea trout

Proposed Measure	Objectives & Reasoning	Rod Fisheries Affected	Net Fisheries Affected
<p>Byelaw.</p> <p>Prohibiting the use of treble hooks</p>	<p>Measure is for salmon and sea trout.</p> <p>Reduce risk of salmon mortality following C&R. (50% mortality of fish caught on flying C type lures equipped with treble hooks)</p> <p>Dee and Wye – excluded here as a separate ‘border rivers’ byelaw package for these rivers is under development with the Environment Agency.</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p>	<p>All rivers in Wales (with the exception of the cross border rivers Dee, Severn and Wye).</p>	<p>N/A</p>
<p>Revocation.</p> <p>Byelaw 12A of the Rod and Line Byelaws 1995 (Limits on Catch) to be revoked.</p>	<p>Measure is for salmon and sea trout</p> <p>Removes redundant provision of a bag limit for salmon and sea trout in the West Wales fisheries district</p>	<p>All rivers in the West Wales fisheries district</p>	<p>N/A</p>

Summary of proposals – Sea trout

Proposed Measure	Objectives & reasoning	Rod Fisheries Affected	Net Fisheries Affected
<p>Byelaw.</p> <p>Delay the start of the net season on net fisheries (that currently start earlier) to 1st May</p>	<p>Sea trout stock levels in some Welsh rivers are below the level that we consider to be either sustainable or desirable. Continuing to kill fish whilst stocks are depleted presents an unacceptable risk.</p> <p>Early-run large fish are amongst most valuable in terms of Future Lifetime Eggs.</p> <p>Conserves early run genetic component of run.</p> <p>Impact on additional eggs:- (see Table 16) Tywi = 0.60 Million egg gain (approx. 220 fish per annum) Teifi = 0.14 Million egg gain (approx. 60 fish per annum)</p> <p>A consistent start date for net fishing in all relevant net fisheries.</p>	<p>N/A</p>	<p>Tywi Taf (Coracle) Nevern Teifi Dyfi</p>
<p>Byelaw.</p> <p>Catch and release of rod caught sea trout before 1st May</p>	<p>Commensurate reduction in rod harvest (compatible with proposals for net fisheries).</p> <p>Those additional rivers identified as vulnerable and identified in Table 11 as requiring additional regulatory measures.</p> <p>Dee and Wye – excluded here as a separate ‘border rivers’ byelaw package for these rivers is under development with the Environment Agency.</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p>	<p>Tywi, Taf, Nevern, Teifi, Dyfi, Usk, Gwendraeth, Taff & Ely, Tawe, Ystwyth, Rhymney, Aeron, E & W Cleddau, Loughor, Afan, Neath, Arto, Glaslyn, Dwyrhyd, Seiont, Wye, Gwyrfai.</p>	<p>N/A</p>

Summary of proposals – Sea trout

Proposed Measure	Objectives & reasoning	Rod Fisheries Affected	Net Fisheries Affected
<p>Byelaw.</p> <p>Slot length of 60cm (maximum size of fish that may be taken)</p>	<p>Commensurate reduction in rod harvest, (compatible with proposals for net fishery).</p> <p>Fish saved by reducing net exploitation will be vulnerable to rod exploitation throughout the season.</p> <p>Introducing a maximum size will:</p> <ul style="list-style-type: none"> Protect fish 'saved' from net fishery Assist in balancing exploitation controls between the fisheries <p>Impact on additional eggs:- (see Table 16)</p> <ul style="list-style-type: none"> Teifi 0.04 million additional eggs per year Tywi 0.22 million additional eggs per year <p>Measures extended to all other rivers in Wales for reasons of consistency and good practice.</p> <p>Dee and Wye – excluded here as a separate 'border rivers' byelaw package for these rivers is under development with the Environment Agency.</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p>	<p>All rivers in Wales (with the exception of the cross border rivers Dee, Severn and Wye).</p>	<p>N/A</p>

Summary of proposals – Sea trout

Proposed Measure	Objectives & reasoning	Rod Fisheries Affected	Net Fisheries Affected
<p>Byelaw. No bait fishing for sea trout before 1st May</p>	<p>Commensurate reduction in rod harvest (compatible with net fishery).</p> <p>Reduce risk of sea trout mortality caught on bait. High mortality of fish caught on bait (>50%)</p> <p>Those additional rivers identified as vulnerable and identified in Table 11 as requiring additional regulatory measures.</p> <p>Measures extended to all other rivers in Wales for reasons of consistency and good practice.</p> <p>Dee and Wye – excluded here as a separate ‘border rivers’ byelaw package for these rivers is under development with the Environment Agency.</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p>	<p>Tywi, Taf, Nevern, Teifi, Dyfi,</p> <p>Gwendraeth, Taff and Ely, Tawe, Ystwyth, Rhymney, Aeron, E & W Cleddau, Loughor, Afan, Neath, Artro, Glaslyn, Dwyrdd, Seiont, Wye, Gwyrfai.</p>	<p>N/A</p>

Summary of proposals – Sea trout

Proposed Measure	Objectives & reasoning	Rod Fisheries Affected	Net Fisheries Affected
<p>Byelaw.</p> <p>Single hook and single worm - restricting maximum hook 8mm gape size when worm fishing for sea trout after 1st May</p>	<p>Reduce risk of salmon bycatch from using bunches of worms on large hooks and associated post C&R mortality from bait caught fish.</p> <p>Measures extended to all other rivers in Wales for reasons of consistency and good practice.</p> <p>Dee and Wye – excluded here as a separate ‘border rivers’ byelaw package for these rivers is under development with the Environment Agency.</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p> <p>Wye also excluded as existing permanent byelaws prohibit the use of bait</p>	<p>All rivers in Wales (with the exception of the Dee, Severn and Wye).</p>	<p>N/A</p>
<p>Byelaw.</p> <p>Barbless or de-barbed hook</p>	<p>Reduces risk of salmon by-catch mortality.</p> <p>Using barbless or de-barbed hooks, markedly reduces handling time during unhooking and potential exposure to air during release phase.</p> <p>Measures extended to all other rivers in Wales for reasons of consistency and good practice.</p> <p>Dee and Wye – excluded here as a separate ‘border rivers’ byelaw package for these rivers is under development with the Environment Agency.</p> <p>Severn – excluded as Environment Agency takes integrated lead for fisheries matters in the catchment.</p>	<p>All rivers in Wales (with the exception of the Dee, Severn and Wye).</p>	<p>N/A</p>

8. Conclusions

This technical case document, and associated annexes, represents the evidence base, options, and proposals for further fishing controls in Wales.

NRW is well aware how contentious these proposals are, however it is also well aware that the status of most of our fish stocks fully warrants the higher level of protection.

In coming to our concluding position, NRW is paying careful attention to the recent legislation requiring a focus on the sustainable management of natural resources which is a key area of work for public sector bodies in Wales.

The resource is shared between society, including those who target the fish for recreation and for their market value but also those for whom the stocks are a vital component of our natural resources. This additional value and importance is recognised by the designations of habitats and species for their fundamental nature conservation value. The issue is not simply one of provision of a resource for exploitation, although that is an important part of the debate.

Our objective is the sustainable management of our natural resource of salmon and sea trout, including their sustainable exploitation, and this document sets out the current status and the range of challenges and actions that are required to sustain the stocks.

We have identified the options preferred by NRW which are reactive to the current poor state of the stocks but also precautionary. We commend these options. They are intended to co-exist alongside a range of initiatives to restore the quality of freshwater habitats so that the future output of smolts is optimised in each river. We recognise that we cannot do this overnight and we have identified medium-term plans that should enable these outcomes to be achieved.

NRW has stated that, in contrast to some occasions in the past on some rivers, fishing pressure is not the principal driver of the downturn in stock status. There are other factors that must be addressed and NRW and valued partners are active in addressing these. Some remain very difficult and very challenging however our firm intention is to address all wherever it is within our power to do so and, in the case of other matters, to seek to influence management decisions taken by other parties.

The proposals in respect of the byelaws are set out here for formal public consultation, and this follows over a year of informal liaison and discussions with many stakeholder groups across Wales including our Local Fisheries Groups. The proposed new NLO, which is also supported by this technical case will be advertised as concurrently as possible.

The liaison and discussion process has included stakeholders on the cross-border rivers Dee and Wye where NRW takes the management lead for diadromous fish stock management. These rivers are not included in the current EA “5 Point Approach” for salmon management. Discussions with the EA have resulted in agreement that NRW and EA will seek to agree a single technical case and set of byelaws in the autumn for

a further statutory consultation with the intent to introduce new measures prior to the 2018 fishing season. These proposals also seek to ensure an integrated approach to fishery regulation in these catchments.

NRW recognises the management agreement for the cross-border River Severn, which does fall within the EA “5 Point Approach” and where the EA takes the lead role for diadromous fish management. On this river the NRW therefore defers to the EA for appropriate management proposals.

These current proposals are in response to the poor condition of stocks of salmon, and some sea trout, across Wales and are intended to maximise spawning escapement and to promote stock recovery towards improved resilience and sustainability. In the case of salmon these proposals are also our response to ongoing commitments implicit through our representation on organisations established under international convention.

What are we consulting on?

The consultation for Wales is on our proposals for new byelaws that will affect the net and rod fisheries.

We are also advertising a new ‘all Wales’ NLO.

The measures will, if approved, affect fisheries for both salmon and sea trout, and will last for 10 years from the date of confirmation.

The cross border rivers will be dealt with separately, and existing controls will apply there until and unless new proposals are confirmed.

The measures are quite complex but are best understood, first by considering the fishing sector, and then by considering measures for each species.

Byelaw proposals for net and rod fishing across Wales (excluding cross-border rivers).

Nets

- Season commencement and closure aligned across all fisheries within the NLO:-

Season starts	1 st May
Season ends	31 st July

The drivers for this, and the implications for catch and socio-economics are considered within the document.

- Statutory C&R fishing for salmon in all fisheries at all times.

Exception: Wye (Blackrock heritage lave net fishery).
Supporting stock is 'Probably Not At Risk'. Fishery catch capped at <2 per licence under terms of a formal lease.

Rods - salmon

- Statutory C&R fishing in all rivers at all times

Exceptions: the 3 cross-border rivers (see below)

- Method controls prohibition on:-
bait (worm, prawn and shrimp)
treble hooks
barbed hooks (barbless acceptable)

Rods – sea trout

- Statutory C&R fishing in rivers in the period when net fishing is also constrained
- Method controls prohibition on:-
bait fishing before 1st May (targeted rivers)
treble hooks (all rivers)
barbed hooks (barb-removed acceptable) (all rivers)

Method control: single hook (<8mm gape) only for bait fishing

Slot length of 60cm (all larger fish to be returned).

Shared ownership

NRW has a range of statutory duties for the management of fish and fisheries and also the broader environment in which they live. However there are many people and organisations for whom the fish resource is of great importance, and notable amongst these are fisheries owners, fisheries tenants, and the fishermen who pay to participate in their sport.

All are stakeholders in the resource and it is NRW's ambition, in addition to its statutory roles and priorities, to manage and improve fisheries for the benefit of all. We believe that the fisheries resource is shared by all stakeholders and more broadly by society as a whole.

We hope that everyone can subscribe to our **overall objective for salmon and sea trout in Wales:-**

“To protect, through the application of best-practice science and management, the sustainability of our natural resource of wild salmon and sea trout stocks in Wales.”

These proposals are intended to facilitate this objective and to return our iconic salmon and sea trout resource to health.

9. NEXT STEPS

This document supports a public consultation exercise that seeks views from any stakeholder into the future management of salmon and sea trout populations and fisheries in Wales.

We have set out options for both species, and for both fisheries that currently exploit them, and we have provided background to enable people to consider the issue and their preference for future fishing controls.

The consultation will run for a period of 12 weeks from the date of publication.

We will review responses and, as far as is practicable, we will respond to each one. Subject to the outcome of this we will make our case for any required legislative change to the Welsh Government Minister for Natural Resources.

The position in July 2017 is summarised below.

1. Consultation with Environment Agency.
 - a. The cross-border nature of 3 of the principal salmon rivers (Wye, Severn and Dee) necessitates ongoing engagement with the EA and, through them, DEFRA and Natural England.
 - b. We are currently in agreement that we will progress a single set of byelaws for the border rivers, relying on a single technical case.
 - c. The salmon is a feature of both the Wye and Dee Special Areas of Conservation, and both NRW and the EA are required to consider whether our proposals will have a likely adverse affect.
 - d. We have previously been advised (precedent having been set following consultation for renewal of the 1999 National fishing byelaws) that proposed measures to reduce exploitation by rods will not trigger a need for an Appropriate Assessment under the Habitats Regulations (1994).

STATUS: ONGOING

2. We will confirm the *vires* for action through consultation with WG and DEFRA, notifying them of our proposals and seeking permission to advertise the made byelaws.

STATUS: ONGOING

3. Completion of informal consultation with relevant stakeholders
 - a. This process was completed for stakeholders in Wales, and also for those with interests in the cross-border rivers, following a series of debates at Local Fisheries Groups.

STATUS: COMPLETED

4. Make the byelaw
 - a. The legal process in which the statutory byelaws instruments are 'made' and confirmed ready for publication as part of the consultation process.

STATUS: ONGOING

5. Statutory advertisement of made byelaw.
 - a. This requires completion of sign-off procedures for:-
 - i. The made byelaws
 - ii. The technical case
 - iii. Response forms
 - iv. A 'frequently-asked questions' paper

STATUS: ONGOING. PROJECTED COMMENCEMENT END OF JULY 2017

6. Final application to the Welsh Government Cabinet Secretary for the NLO to be approved.

STATUS: SCHEDULED FOR AUTUMN 2017

7. Final application to the Welsh Government Cabinet Secretary for the rod and net byelaws to be approved.

STATUS: SCHEDULED FOR AUTUMN 2017

8. If successful publicise the new measure, advise stakeholders, amend registers and notify enforcement staff.
9. Review.

10. GLOSSARY

Adult - Salmon after the middle of the first winter spent at sea, after which the main categorisation is by sea-age, measured in sea-winters (e.g. grilse, or 1SW; two sea winter, or 2SW).

Anadromous fish - Fish, born in freshwater, that migrates to sea, to grow and mature, and then returns to freshwater as an adult to spawn (e.g. salmon, sea trout).

At Risk – When river stocks are statistically failing to meet their management objective.

Buy out – Payment made to a net fisherman to permanently relinquish his/her fishing licence.

By-catch -The capture of non-targeted fish.

Catch and Release – a method of angling where some or all of the fish caught are released after capture.

Catchment - The area of land drained by a river (e.g. River Tywi catchment).

Conservation Limit (CL) - The minimum spawning stock levels below which stocks should not be allowed to fall. The CL for each river is set at a stock size (defined in terms of eggs deposited) below which further reductions in spawner numbers are likely to result in significant reductions in the number of juvenile fish produced in the next generation.

CPUE - Catch per unit effort.

Diadromous Fishes - Diadromous is a general category describing fish that spend portions of their life cycles partially in fresh water and partially in salt water. These represent both anadromous and catadromous fish.

Ecosystem - A community of organisms and their physical environment interacting as an ecological unit.

Egg shortfall – The difference in the number of eggs required to meet conservation limit and what is calculated to be produced.

Endorsee – Persons authorised to use licensed netting instruments if they are accompanied at all times by the licence holder, or if they have consent from NRW.

Escapement - Fish that survive to spawn after exploitation of the stock.

EU Directive - A European Union legal instruction, binding on Member States, but which must be implemented through national legislation within a prescribed time-scale.

Exploitation - Removal of fish from a stock by fishing.

Fishery - The area where it is, or may be, lawful to fish and where the resource is exploitable.

Fry - Young salmon that have hatched out in the current year, normally in May at the stage from independence of the yolk sac as the primary source of nutrition up to dispersal from spawning areas (redds).

Good ecological status - A key target under the EU Water Framework Directive. Water bodies of 'good ecological status' should have the biological and chemical characteristics expected under sustainable conditions. Practicality and the cost to

society have to be considered in achieving this and this principle is also inherent in the WFD.

Grilse - An adult salmon that has spent only one winter feeding at sea (1SW salmon) before returning to freshwater to spawn; normally only applied to salmon in homewaters.

Heritage fishery – A fishery which uses a method that is considered to have an aspect of worth or importance attached by people to qualities of places, communal or historical value. e.g. coracle fishing.

Juvenile - Young fish including fry and parr, mostly similar in form to adult but not yet sexually mature. In some cases refers to a stage unlike the adult in appearance.

Licensee – a holder of a licence which permits them to fish with the use of a net

Management target (MT) - A spawning stock level for managers to aim at in order to meet the management objective. The 'management objective' used for each river in England and Wales is that the stock should be meeting or exceeding its CL in at least four years out of five (i.e. >80% of the time), on average.

Mixed stock fishery (MSF) - A fishery that predominantly exploits mixed river stocks of salmon. The policy in England and Wales is to move to close coastal net fisheries that exploit predominantly mixed stocks where the capacity to manage individual stocks is compromised. Fisheries, including MSFs, operating within estuary limits are assumed to exploit predominantly fish that originated from waters upstream of the fishery; these fisheries are carefully managed to protect the weakest of the exploited stocks, guided by the decision structure and taking into account socio-economic factors and European Conservation status where applicable.

Multi-Sea-Winter (MSW) salmon - An adult salmon that has spent two or more winters at sea.

Natura 2000 - The European network of protected sites (SPAs and SACs) that will be established under the Birds and Habitats Directives

Net limitation Order (NLO) - Mechanism within the Salmon and Freshwater Fisheries Act, 1975 whereby the competent authority may apply to limit the number of nets or traps fishing a public fishery. Each order limits the number of licences for fishing with nets that may be issued in any specific fishery for up to 10 years

Not at Risk – When river stocks are statistically meeting their management objective.

One-Sea-Winter (1SW) salmon - An adult salmon that has spent one winter at sea (see also grilse).

Parr - Juvenile salmon in the stage following fry until its migration as a smolt, Salmon parr are typically <16 cm long and have parr-marks (dark vertical bars) on the sides of the body.

Post-smolt - Young salmon, at the stage from leaving the river (as smolts) until the middle of its first winter in the sea.

Preference man – Any person that can demonstrate in the preceding prescribed time for which the licences are allocated to that person held a licence issued by NRW in respect of an instrument which is the subject of the current application; and that person's livelihood is dependent upon fishing.

Principal Salmon River – Rivers which on average have a catch of over 50 fish per year and therefore require a Salmon Action Plan to ensure that conservation limits are met.

Probably At Risk – When the likelihood of river stocks passing their management objective is less than 50%.

Probably Not At Risk – When the likelihood of river stocks passing their management objective is greater than 50%.

Quantitative Survey - Quantitative surveys utilise a catch depletion method, which gives a population estimate. Electric fishing is carried out for a measured length of the watercourse, which is netted at either end to ensure a closed population. This area is fished three times successively or until a good depletion is obtained. The fish are then identified, measured and counted.

Recruits - The abundance of fish measured at a particular point in the life cycle, e.g. at the juvenile stages, the smolt stage, prior to the first fishery (recruitment to the fishery), or as returning spawners.

Reference point - An estimated value derived from an agreed scientific procedure and/or model which corresponds to a state of the resource and/or of the fishery and can be used to assess stock status or inform management decisions

Run - The number of adult salmon ascending, or smolts descending, a river in a given year. The main smolt run takes place in spring, whereas adult salmon runs may occur in spring, summer, autumn or winter.

Salmonid - A fish belonging to the family *Salmonidae*, which includes the Atlantic salmon (*Salmo salar*), brown trout / sea trout (*Salmo trutta*), char (*Salvelinus alpinus*) and rainbow trout (*Oncorhynchus mykiss*).

Sea age - The number of winters that a salmon has remained at sea.

Sea trout - Anadromous form of the trout (*Salmo trutta*) from the post-smolt stage; the brown trout remains in freshwater throughout its life.

Semi-Quantitative Survey - Electric fishing is carried out for a measured length of the watercourse. The fish are then identified, measured and counted. Unlike the quantitative method this method does not rely on a depletion so a P value can be applied to calculate and estimate of what a quantitative method would have produced.

Smolt - The stage in the life cycle of a salmon when the parr undergo physiological changes, become silver in appearance and migrate to sea. Salmon smolts are typically 12–16 cm long and migrate to sea in spring.

Smolt age - The number of winters, after hatching, that a juvenile salmon remains in freshwater prior to emigration as a smolt (this does not, therefore, include the winter in which the egg was laid).

Smolt Output – A general term that refers to the numbers of salmon or sea trout smolts produced by a river system – usually on an annual basis. The capacity of a system to produce smolts (and earlier life stages) is largely dependent on the extent and quality of the freshwater environment. This capacity is also referred to as the ‘carrying capacity’ and signifies that there are limits to the numbers of fish any one river can produce. Poor survival at sea is currently a major and universal constraint on the numbers adults returning to our rivers, but an area where we have little control.

Hence, ensuring that as many fish as possible survive to spawn and maintaining and improving the quality of the freshwater environment in order to maximise smolt output are key management objectives.

Spatial Survey – Surveys that are completed once every 6 years on a rolling programme and consist of a greater number of sites which cover the entire catchment. These surveys aim to show spread of species rather than trends over time (see temporal surveys).

Spawning stock - The part of a stock which is mature and breeding, the number or biomass of all fish beyond the age or size class in which 50% of the individuals are mature.

Spring salmon - Multi-sea-winter salmon which return to freshwater early in the year, usually before the end of May.

Statistically Significant – When there is a less than 95% chance that the outcome is down to chance

Stock - A management unit comprising one or more salmon populations, which may be used to describe those salmon either originating from or occurring in a particular area. Thus, salmon from separate rivers are referred to as “river stocks”. (N.B. Very large management units, such as the salmon exploited at West Greenland, which originate from many rivers, are often referred to as ‘stock complexes’).

Stock recruitment models - Fishery models that predict the amount of juvenile recruitment as a function of the parent stock.

Stocking - The intentional release of fish into an ecosystem.

Sustainable management of natural resources (SMNR) - Using natural resources in a way and at a rate that maintains and enhances the resilience of ecosystems and the benefits they provide, in doing so, meet the needs of current generations without compromising the ability of future generations to meet their needs, and contribute to the achievement of the well-being goals set out in the Well-being of Future Generations Act. Also referred to as sustainable management

Sustainable use - The use of a biological resource in a way and at a rate that does not lead to the long-term decline of its potential to meet the needs and aspirations of present and future generations. Sustainable use does not imply that abundance is constant.

Tagging - Marking, or attaching a tag to an individual or group of individuals, so that it or they can be identified on recapture; used for the study of movement, migration and stock delineation, for the examination in a stock and for the recovery of biological specimens.

Temporal Survey – Surveys that are completed once a year to show population trends over time.

Traditional Fishery – A fishery which uses a long-established method such as seine netting.

Vires – The legal power to carry out statutory duty.

11. Abbreviations

1SW – One sea winter

ACAP - Agreement on the Conservation of Albatrosses and Petrels

AEWA - African-Eurasian Migratory Water bird Agreement

ASCOBANS - Agreement on the Conservation of Small Cetaceans in the Baltic, North-East Atlantic, Irish and North Seas

BTA – British Trout Association

C&R – Catch and Release

CEFAS – Centre for fisheries management, environmental protection and aquaculture

CL - Conservation Limit

CPUE – Catch per Unit of Effort

DCF – Data Collection Framework

DEFRA – Department for environment, food and rural affairs

DIDSON - Dual Frequency Identification Sonar

DS – Decision structure.

DSAP – Dee Stock Assessment Programme

E&W – England and Wales

EUROBATS - Agreement on the Conservation of Populations of European Bats

FHI – Fish Health Inspectorate

FLE – Future Lifetime Egg

GVA – Gross added value

IAEA - the International Atomic Energy Agency

ICES - International Council for the Exploration of the Sea

IMO - the International Maritime Organization

ISA - International Seabed Authority

IUCN – International Union for Conservation of Nature

MSW – Multi sea winter

MSY – Maximum Sustainable Yield

MT – Management Target

N2K – Natura 2000

NASCO - North Atlantic salmon Conservation Organization

NEAC – North-East Atlantic Commission

NEAFC - North-East Atlantic Fisheries Commission

NLO – Net Limitation Order

OSPAR – Mechanism by which 15 Governments and the EU cooperate to protect the marine environment of the North-East Atlantic (Os –Oslo, PAR – Paris Agreement)

PFA – Pre-fisheries abundance

PSB – Public Services Board

RAFTS – Rivers and Fisheries Trusts of Scotland

RSEs - Returning Stock Estimates

SACs - Special Areas of Conservation

SER – Spawner escapement reserve

SMNR – Sustainable Management of Natural Resources

SONAR – State of Natural Resources Report

SR – Stock recruitment

UDN – Ulcerated Dermal Necrosis

UN ECE - the UN Economic Commission for Europe

WG – Welsh Government

WTP - Willingness to pay

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