	North-East Atlantic Commission *Report of the Meeting of the Working Group on* Gyrodactylus salaris *in the North-East Atlantic Commission Area*	**NEA(21)05** **Agenda item 5**

Report of the Meeting of the Working Group on Gyrodactylus salaris *in the North-East Atlantic Commission Area*

Purpose of the Paper

To present the Report of the Meeting of the Working Group on *Gyrodactylus salaris* in the North-East Atlantic Commission Area, which met virtually in March 2021, and highlight its recommendation.

Decision

- whether to agree to the recommendation of the Working Group, that because only a virtual meeting was possible in 2021:

  '*a face-to-face, two-day meeting of the Working Group on* Gyrodactylus salaris *in the North-East Atlantic Commission Area take place in March 2022. If it remained impossible to hold a face-to-face meeting, no meeting should be held.*'

Background

At the 2020 Annual Meeting of the North-East Atlantic Commission (NEAC), Parties were '*reminded that the Commission had agreed in 2018 that the Working Group on* Gyrodactylus salaris *should meet again in 2021. Terms of Reference were also agreed in 2018'*, NEA(20)18.

As requested, the Secretariat worked with the Working Group Chair, Haakon Hansen (Norway) to organize and conduct the meeting, which took place 'virtually' on 17 March 2021.

The Working Group on *Gyrodactylus salaris* in the North-East Atlantic Commission Area

In 2004, NASCO's NEAC organized a workshop to discuss the need to minimise the threat posed by *Gyrodactylus salaris* to Atlantic salmon, NEA(04)3. The Workshop developed many recommendations and, following further work, these were collated into a 'Road Map' (amended in 2006) outlining responsibilities and a timeframe for action (see Annex 1 of NEA(16)6).

In view of the serious threat posed by this parasite, the NEAC established a Working Group on *G. salaris* and meetings were held in both 2006 and 2007, NEA(06)3 and NEA(08)3. In 2008, the Commission agreed to retain an item on its Annual Meeting agenda to allow developments in relation to the parasite to be monitored, NEA(08)8. While this provided an opportunity to report to the Commission on any new information relating to *G. salaris*, there was limited time available, few Parties / jurisdictions provided reports and those that were tabled were not comprehensive in terms of the elements in the 'Road Map'.

In 2015 the Commission asked that the Secretary prepare a background document on the 'Road Map' and the reporting arrangements in place relating to *G. salaris*. 'The parasite *Gyrodactylus salaris'* was produced, NEA(16)6.

In 2016, NEAC agreed to reconvene the Working Group. The Working Group met in London in March 2017 and its main output was a revised and simplified 'Road Map'. The Working Group recommended that the Commission consider adopting the document given the potentially devastating impacts of this parasite on wild salmon stocks if introduced, NEA(17)4.

The 'Road Map' was adopted in 2018, and the Commission agreed that the Working Group on *Gyrodactylus salaris* should meet in 2021 with the Terms of Reference set out in the Report

below, NEA(18)13.

The full Report of the Meeting of the Working Group on *Gyrodactylus salaris* in the North-East Atlantic Commission Area, is provided below.

Secretariat
Edinburgh
30 April 2021

GSWG(21)13

Report of the Meeting of the Working Group on Gyrodactylus salaris *in the North-East Atlantic Commission Area*

By Video Conference
17 March 2021

1. Opening of the Meeting

1.1 The Chair, Haakon Hansen (Norway), opened the meeting and welcomed the participants. He noted that although the intention had been to hold the meeting in person, this had not proved possible because of ongoing restrictions due to the Covid-19 pandemic. He invited brief introductions from all participants.

1.2 A list of participants is contained in Annex 1.

2. Adoption of the Agenda

2.1 The Working Group adopted its Agenda, GSWG(21)09 (Annex 2).

3. Consideration of the Terms of Reference

3.1 The Working Group considered its Terms of Reference (ToRs) as agreed by the North-East Atlantic Commission in 2018. These request that the Working Group undertakes the following tasks:

- provide a forum for exchange of information among the Parties / jurisdictions on research on, and monitoring, control and eradication programmes for, the parasite *G. salaris*;
- review progress in relation to the recommendations contained in the Commission's 'Road Map' including progress with the development and testing of contingency plans; and
- develop recommendations for enhanced co-operation on measures to prevent the further spread of the parasite and for its eradication in areas where it has been introduced.

3.2 The Chair advised the Working Group that it was not possible to make changes to the ToRs and that the Working Group Meeting Report and any recommendations will be considered by the North-East Atlantic Commission of NASCO at its Thirty-Eighth (2021) Annual Meeting by video conference in June. The Chair noted that the next meeting of this Working Group is scheduled for 2024. He noted that the virtual nature of the meeting may result in curtailed discussions and asked whether participants wished to recommend to the North-East Atlantic Commission that a face-to-face meeting be held in 2022, to allow the valuable in person discussion to take place. The ''Road Map' to enhance information exchange and cooperation on monitoring, research and measures to prevent the spread of *G. salaris* and eradicate it if introduced', NEA(18)08, states that:

> '*The Working Group on G. salaris in the North-East Atlantic Commission Area should meet again in 2018 and then every 3 years thereafter, or more frequently if circumstances require, to provide a forum for more detailed information exchange and review of progress in implementing this 'Road*

Map'' (underline added).

3.3 The Working Group agreed to recommend that a face-to-face, two-day meeting of the Working Group on *Gyrodactylus salaris* in the North-East Atlantic Commission Area take place in March 2022. If it remained impossible to hold a face-to-face meeting, no meeting should be held.

3.4 In preparation for the 2021 meeting, each Party / jurisdiction was asked to prepare a paper updating the reports that were made at the Working Group's 2018 Meeting on Agenda items 4, 5 and 6. The following reports were received:

- GSWG(21)03 – Update Report on Finland's Work on *Gyrodactylus salaris* (Annex 3);
- GSWG(21)04 – Update Paper – Contribution From Marine Scotland (Annex 4);
- GSWG(21)05 – Results of *Gyrodactylus salaris* monitoring in the Russian Federation (Annex 5);
- GSWG(21)06 – Update on *Gyrodactylus salaris* Monitoring in Northern Ireland (Annex 6);
- GSWG(21)07 – Briefing paper on *Gyrodactylus salaris* – EU – Ireland (Annex 7);
- GSWG(21)08 – Updating since the Working Group's 2018 Meeting – Norwegian Food Safety Authority (Annex 8);
- GSWG(21)11 – *Gyrodactylus salaris* in Sweden (Annex 9);
- GSWG(21)12 – Briefing Paper on *Gyrodactylus salaris* – UK – England and Wales (Annex 10); and
- GSWG(21)13 – Surveillance for *Gyrodactylus salaris* in England and Wales – UK – England and Wales (Annex 11).

4. On-going and Planned Research Concerning *G. salaris*

4.1 The Chair invited presentations from the Working Group participants. A presentation from Norway was made. Research from the Norwegian Veterinary Institute (NVI) was presented by the Chair, Haakon Hansen. Two published papers on *G. salaris* (see below) where researchers from NVI are authors were presented.

- Rusch, J.C., Hansen, H., Strand, D.A., Markussen, T., Hytterød, S. and Vrålstad, T. 2018. Catching the fish with the worm: a case study on eDNA detection of the monogenean parasite *Gyrodactylus salaris* and two of its hosts, Atlantic salmon (*Salmo salar*) and rainbow trout (*Oncorhynchus mykiss*). Parasites Vectors, 11:333, 12pp. https://rdcu.be/chwPh.

4.2 The results from this paper were presented at the last meeting in 2018. The study demonstrates for the first time that environmental DNA (eDNA) detection, using water filtering and digital droplet PCR (ddPCR) analysis, can be used to detect *G. salaris* and its main hosts, Atlantic salmon, *Salmo salar*, and rainbow trout, *Oncorhynchus mykiss*.

- Paladini, G., Shinn, A.P., Taylor, N.G.H., Bron, J.E. and Hansen, H. 2021. Geographical distribution of *Gyrodactylus salaris* Malmberg, 1957 (*Monogenea*, *Gyrodactylidae*). Parasites Vectors, 14:34, 20 pp. https://rdcu.be/chwPy.

4.3 This paper gives an updated geographical distribution of *G. salaris*, obtained through a detailed assessment and study of all reports of *G. salaris* and an evaluation of whether they can be considered valid.

4.4 The work on eDNA monitoring has been followed up in a study where the aims were to evaluate the sensitivity and detection limits for eDNA monitoring of *G. salaris.* This was done through a challenge trial with individually isolated Atlantic salmon and *G. salaris*, where parasite numbers were counted weekly and at the same time corresponding water samples were taken. The eDNA copy numbers were then compared to the corresponding infection intensities. In addition, assays for detecting different variants of *G. salaris* were developed and tested. The minimum number of parasites per fish required for positive detection (with 95 % confidence) of *G. salaris* eDNA under experimental conditions was determined, but it was not possible to relate parasite numbers directly to eDNA copy numbers. The number of samples required for positive detection at varying levels of parasite intensity, under the same experimental conditions, was also calculated. The study is ongoing and will be submitted to a scientific journal shortly.

4.5 In addition, eDNA monitoring in combination with electrofishing is used to demonstrate absence of Atlantic salmon and *G. salaris* upstream of a recently closed migration barrier in the river Drammenselva. This barrier was closed in 2018 and it was expected that some Atlantic salmon infected with *G. salaris* would still be present in 2020. The eDNA results and results from electrofishing and parasitological examination corresponded well. Very few salmon, but with high intensities of infections, were found upstream of the migration barrier, while a high density of highly infected salmon were found downstream of the barrier. Corresponding to this, the highest concentration of eDNA of both *G. salaris* and Atlantic salmon was found below the barrier. The monitoring will be repeated in 2021. The report from this year's study is available on the NVI web site.

4.6 The NVI together with the Finnish Food Authority / Ruokavirasto, Institute of North Industrial Ecology Problems – Subdivision of the Federal Research Center «Kola Science Center of the Russian Academy of Sciences» (INEP KSC RAS), and the Karelian Research Centre of the Russian Academy of Sciences (KarRC RAS) is continuing to collaborate on studies related to the recent infections of *G. salaris* in the Russian north. This is an ongoing collaboration that will be taken further through the project 'GyroStop - Detect and stop the spread of *Gyrodactylus salaris* on the North Calotte' funded by Kolarctic CBC (https://kolarctic.info/). The aims are to:

a) enhance collaboration and information flow between researchers and authorities in the collaborating countries with the aim of contributing to co-ordinated contingency plans for *G. salaris*;

b) assess the current distribution of *G. salaris* and its different strains and variants on the North Calotte through a collaborative effort including intensive field work and laboratory work;

c) during the same field work, to test and assess environmental DNA methods for the detection of *G. salaris* in water filtrates from both fish transports and watersheds; and

d) lay the foundation for a larger cross-border research project in the future.

4.7 The work on developing new markers for strain characterisation and species identification using comparative genomics is ongoing as a collaboration with Dr.

Christoph Hahn at the University of Graz, Austria. Several genomes, representing different populations of *G. salaris* and *G. thymalli*, are in the process of being sequenced and further populations will be added when available.

5. Exchange of information on monitoring and control programmes for *G. salaris*, and updates on its distribution

European Union – Finland

5.1 The water catchments running north in Finland remain free from the presence of *G salaris.* The river catchments of Tenojoki and Näätämöjoki are officially free, and the river catchments of the rivers Paatsoki, Uutuajoki and Tuulomajoki form a buffer zone. Yearly monitoring of *G. salaris* is performed in free-water catchments as well as in the buffer zone in northern Finland. All analysed samples have been negative for the presence of *G salaris*.

5.2 The occurrence of *G salaris* in the River Tornionjoki was investigated in a study in 2000–2004. Infection of salmon parr was common in the uppermost reach of the river system but decreased downstream and was rare in the lowermost reach. Samples from River Tornionjoki are collected at least every second year to provide information on the situation there. Samples from the other parts of Finland are occasionally examined due to export demands.

European Union – Ireland

5.3 *G. salaris* has not been recorded on the island of Ireland to date. Since 2005, wild salmon parr from selected river systems in Ireland are examined annually for the presence of *G. salaris*. This monitoring is undertaken in conjunction with the catchment-wide electrofishing programme managed by Inland Fisheries Ireland with sample analyses undertaken by the Fish Health Unit of the Marine Institute.

European Union – Sweden

5.4 *G. salaris* is a notifiable disease in Sweden. There is no eradication programme. *G. salaris* is endemic in east coast rivers (Baltic sea) and it is prohibited to transfer salmonid fish to certain rivers on the west coast. Monitoring takes place in seven rivers on the west coast of Sweden. This is carried out via electrofishing for parr, which are euthanised and preserved. Each fish is inspected under a stereo microscope and if *Gyrodactylus* spp. are found, the numbers are counted. If *Gyrodactylus* spp. is found in a new location, samples are sent to the Norwegian Veterinary Institute for species determination.

5.5 In Sweden there is still no *G. salaris* north of Göta älv, but it has spread within Rolfsån (to two new locations). Monitoring continues and work on the *Gyrodactylus* Road Map is in progress.

Norway

5.6 The measures for preventing and controlling *G. salaris* include: 1) Acts and regulations; 2) three surveillance programmes; and 3) plans for measures including treatment procedures (i.e. Contingency Plan and Action Plan). The Norwegian Surveillance Programme is described in the NEA(18)03 and comprises three parts: a surveillance programme on farms; a surveillance programme on watercourses; and a post-treatment surveillance programme. The surveillance programmes are designed to document the freedom of *G. salaris* in Norwegian watercourses and farms, detect and trace any spread

of the parasite to new watercourses or fish farms, and detect and trace any spread of the parasite to watercourses and farms previously declared free from infection.

5.7 The number of farms and watercourses sampled is set out in Annex 8. Every farm, both commercial farms and hatcheries for restocking of watercourses, will be inspected almost every year and sampled every second year. There are around 450 salmon watercourses in Norway. In recent years, from 69 to 77 of them have been sampled, chosen by certain criteria. In 2019, as part of this programme, *G. salaris* was detected in a watercourse – Selvikvassdraget. The detection of *G. salaris* in this watercourse was expected because it is in the Drammen Zone which contains other infected watercourses – Drammenselva, Lierelva and Sandeelva. Selvikvassdraget has its estuary near the Sandeelva and the short distance between the estuaries in a brackish sea water bay made it quite likely for this to happen. Due to the Contingency Plan for *G. salaris*, a 'central decision-making unit for cooperating the competent authorities to ensure actions on veterinary and environmental safety issues' was quickly established (as required in the EU Fish Health Directive).

5.8 The Post Treatment Surveillance Programme (PTSP) runs for a minimum of five years after treatment, to ascertain freedom from infection with *G. salaris*. This time period is based on a smolt age of four years, adding a one-year safety margin. In watercourses with a higher smolt age, the time to ascertain freedom from infection is increased proportionally. Following treatment, the catchment area is included in the PTSP to prove that the measures have been successful. If the programme proves that the parasite has been eradicated, the area can be declared free of *G. salaris*.

5.9 Norway also has the Epidemiologically Mapping Programme (EMP) which is initiated where the parasite is detected in a new watercourse or reappears in a treated watercourse, in order to find the source of the infection and how widespread it is within the watercourse and neighbouring watercourses. When it is decided that a treatment shall be carried out in an infected area, a programme to document the presence and distribution of *G. salaris* is implemented.

5.10 The status for treatment and conducting of PTSP in the 7 zones are as follows:

ESA's list of WCs still without additional guarantees. Includes 7 Zones and 29 WCs	Treatment	Status per 17.03.21:
The Skibotn Zone (3 WCs)	2015/16 (Rotenone)	PSTP will be finished ultimo 2021
The Rana Zone (1 WC)	2014/15 (Rotenone)	PTSP finished in 2020
The Vefsna Zone (10 WCs)	2011/12 (Rotenone)	PSTP finished for 9 WCs 2017
		PTSP in the last WC will be finished in 2024/25
The Driva Zone (4 WCs)	Barrier so far	PTSP will be finished in 2028
The Rauma Zone (6 WCs)	2013/14 (Rotenone)	PTSP finished in 2019
The Lærdal Zone (1 WC)	2011/12 ($AlSO_4$ + Rot.)	PTSP finished in 2017
The Drammen Zone (4 WCs)	Barrier so far	PTSP will be finished in 2030

	Treatment and PTSP finished
	Treatment finished, PTSP will be finished
	Still not treated

UK – England and Wales

5.11 At present, the UK is recognised as being free from *G. salaris* and as such the parasite is considered exotic to the country. The national controls implemented under the Aquatic Animal Health (England and Wales) Regulations 2009 mean that any suspicion of infection or mortality resulting from infection must be reported to the Fish Health Inspectorate (FHI). Failure to inform the FHI of any suspicion of *G. salaris* is an offence under the regulations.

5.12 The Cefas FHI carries out monitoring for *G. salaris* in England and Wales through a rolling programme of sampling covering all river catchments which contain salmon. Within England and Wales, there are 80 rivers that support salmon, although not all currently host large populations. Each of the catchments is sampled approximately every five years where possible. The fish sampled are usually approximately 15 cm in length and a total of 30 fish are sampled where possible. Generally, a sample of 30 salmon are required although where the numbers of salmon are too low to obtain this sample size, trout and grayling may be taken as a substitute. A Table showing species of *Gyrodactylids* found during FHI sampling 2017-2019 is found in Annex 10.

UK – Scotland

5.13 The surveillance undertaken continues to support Scotland's disease-free status with respect to *G. salaris*, as part of the GB health zone. No evidence of the parasite has been detected over the sampling period from 1 January 2018 to 31 December 2020. Since reporting in 2018 there have been no changes associated with the surveillance methodologies employed. In accordance with Council Directive 2006/88/EC, a risk-based surveillance programme is undertaken across aquaculture sites within Scotland.

UK – Northern Ireland

5.14 Testing for *G. salaris* began in 2007 in Northern Ireland and since then all results have been negative and therefore Northern Ireland remains free from *G. salaris*. *G. salaris* monitoring is carried out as part of Department of Agriculture, Environment and Rural Affairs (DAERA) Fish Health's disease testing regime. Detection of *G. salaris* DNA is done by the use of real-time PCR on *Gyrodactylus* spp. obtained from skin and fin scrapes. A rolling regime of testing takes place across both operational fin-fish farms and wild catchment areas (by electrofishing) in Northern Ireland as set out in Annex 6. Covid-19 restrictions brought in at various times and limited staff resources have impacted on meeting targets for sampling in 2020.

Russian Federation

5.15 In Russia, *G. salaris*, as a pathogenic parasite, was first recorded in the Keret River (Republic of Karelia, White Sea basin) in 1992. It has been monitored since 1993 in the salmon rivers of the Barents and White Seas. Since 2009, monitoring has been carried out on a regular basis within the framework of the Program of State Monitoring of Aquatic Bioresources of Inland Water. In the Murmansk region, *G. salaris* was recorded for the first time in the Pak River, a tributary to the larger Tuloma river, in 2015 and in another tributary, the Shovna River, in 2017. No *G. salaris* has been found in rivers Kanda and Kovda. Infestation rates of juvenile salmon in 2017-2020 are presented in Annex 5.

5.16 Therefore, there are currently two salmon rivers with *G. salaris* in the Murmansk region – the Pak River and the Shovna River in the basin of the Lower Tuloma Reservoir, from which the Tuloma River flows into the inner part of the Kola Bay. Even though there

is no invasion outside the Lower Tuloma Reservoir, there is a high risk of *G. salaris* spreading into the Kola River and other rivers draining into the Kola Bay, due to the low water salinity in the southern part of the bay, where a large volume of fresh water flows from the Lower Tuloma Reservoir and the Kola River. Therefore, *G. salaris* monitoring is planned in other at-risk rivers of the region in the coming years. No *G. salaris* monitoring is carried out in salmon rivers of the Arkhangelsk region and in the Pechora River. The presence of the parasite in these areas is unknown.

6. Update on enhanced co-operation on measures to prevent the further spread of the parasite and to eradicate it where it has been introduced including:

(i) international initiatives; and

(ii) national and regional initiatives

European Union – Finland

6.1 Measures including fish- and roe-transfer restrictions remain in place to prevent the risk of introducing the parasite into northern Finland. There has been no transfer of fish or eggs to the free area since 2004. It is forbidden to transfer bait fish from other parts of Finland to the free and buffer zones, as well as to transfer bait fish between these watercourses. The use of bait fish is forbidden in angling, ice-fishing and lure fishing. In the protected area, gutting of the fish originating from other Finnish watercourses is forbidden, as well as introducing gutting waste to waters of River Tenojoki, Näätämöjoki, Paatsjoki, Uutuanjoki and Tuulomajoki watercourses. Boats, canoes, fishing equipment like rod, lure, net, boots e.g. transferred from other parts of Finland must be dry or disinfected before their use in these watercourses.

6.2 Road signs, posters and brochures are in place to inform tourists in the protected area. Information is also delivered on the internet. Disinfection for fishing equipment is organized by authorities and private operators in Lapland.

6.3 A preliminary report for the contingency plan for river Tenojoki was made in Finland in 2013. It concluded that in the event of a *G. salaris* infection in the river Teno, it would not be possible to eradicate the parasite totally. An attempt to conserve the genetic material to live gene banks would probably be the option of choice in such a case. The report proposed the commencement of contingency planning with Norway. A project preparing a contingency plan together with Norway has been discussed, but concrete effort has been put on prevention (Annex 3).

European Union – Ireland

6.4 A detailed contingency plan for dealing with any outbreak of *G. salaris* in Ireland was produced in 2017. The plan sets out in detail the operational responsibilities and actions to be taken in the event of a suspected outbreak of *Gyrodactylosis* and includes: the convening of the National Disease Strategy Group (NDSG) to activate and oversee the implementation of the contingency plan; the establishment of National Control Centre (NCC) overseen by the NDSG for the purposes of co-ordinating control / eradication measures; a communications strategy; detailed actions to be implemented on the suspicion or confirmation of a *Gyrodactylosis* outbreak; sampling, testing and fish disposal protocols; and containment, eradication and treatment options.

6.5 In addition to the contingency plan, Inland Fisheries Ireland and the Marine Institute have co-produced and widely circulated awareness literature to highlight the issue of *Gyrodactylus salaris* among stakeholders and advise on biosecurity measures that can

be taken to minimise the risk of introduction of the parasite to Ireland. In addition, both state bodies host information in this regard on their respective websites (Annex 7).

Norway

6.6 As mentioned above, due to the Norway's Contingency Plan for *G. salaris*, a 'central decision-making unit for co-operation between the competent authorities to ensure actions on veterinary and environmental safety issues' has been established (as required in the EU Fish Health Directive). The plan defines the roles of the different authorities at different levels – and the Norwegian Veterinary Institute (NVI). Use of the plan during the recent incident, also described above, showed that it functioned well.

6.7 International Initiatives: Norway is not a member of the European Union. However, it is a member of the European Free Trade Association (EFTA). One of the main tasks of EFTA is to manage the Agreement on the European Economic Area – the EEA agreement – which brings together the Member States of the EU and the EFTA in a single market or the "Internal Market". Through the EFTA Surveillance Authority (ESA), Norway applied for and got an agreement with national measures and additional guarantees for *G. salaris* in 2006. An updated version of this agreement, the ESA Dec. 058/16 COL-D, states that Norway is free of *G. salaris*. However, the agreement defines an exception in its annex, including 29 watercourses in seven *G. salaris* zones. In order to remove any of the watercourses from the Annex, ESA recommended that Norway completed template Annex VI in the EU Commission Decision 2015/2444. Through working with this Norway improved its contingency plan by: including information about which measures are planned if *G. salaris* is detected in farms, not only in watercourses; and harmonising it further with Annex VII: 'Criteria and requirements for contingency plans' and the OIE Aquatic Code, chapters 4.5 and 10.3.

6.8 Norway and Finland would like to coordinate the contingency plans where possible / for the Tana and Neiden. In addition, the Norwegian Food Safety Authority is contributing to the funding of the Kolarctic – CBC-project GyroStop – 'Detect and stop the spread of *Gyrodactylus salaris* on the North Calotte', discussed above.

6.9 Additionally, Norway plans to meet with Swedish governmental bodies regarding:

- watercourse and catchment areas common to Sweden and Norway. Especially related to the *G. salaris* zones Skibotn, Rana and Vefsna, with reference to the OIE Aquatic Code, chapter 10.3. that states: 'If a zone extends over more than one country, it can only be declared as a zone free from infection with *G. salaris* if all the relevant competent authorities confirm that all relevant conditions have been met.'
- The west coast of Sweden - including those measures that will and should be taken if *G. salaris* is detected in watercourses north of the current distribution, i.e. north of Gothenburg.

UK – England and Wales

6.10 Currently, the UK is one of only a few countries to have a declared free status *for G. salaris*. The potentially catastrophic impact of this parasite makes it the most important disease threat to UK wild Atlantic salmon populations. In general, countries free of listed diseases rely on passive surveillance, notably farmer reporting of disease, for early detection of disease incursion. In England and Wales (E&W), Atlantic salmon are farmed in only a small number of catchments (and in low numbers). Early detection of

G. salaris, if introduced, relies on active surveillance in wild populations and reporting by declining salmon populations or observations of morbidity or mortality.

6.11 Active surveillance of wild salmonid populations for *G. salaris* has been made considerably easier by recent work at Cefas on the development and validation of a non-lethal hydrogen peroxide bath and filtration method for collecting gyrodactylid parasites from live fish (Thrush *et al*. 2019). This work represents an important step forward in surveillance of both wild and farmed fish populations for *G. salaris* as it removes the need for destructive testing of juvenile salmon, and importantly, increases parasite recovery rate compared to whole body examination of killed fish (84.6% and 51.9%, respectively). The approach increases the rate at which samples can be processed, potentially reducing the scope of a national surveillance programme from months to weeks. By allowing more samples to be analysed, the sensitivity of surveillance activities increases and our confidence in freedom from *G. salaris* increases. Non-lethal sampling applied in surveillance programmes, following detection of the parasite, allows uninfected river catchments to be rapidly released from controls, thus easing their economic impact. Although the method has not yet been used on fish infected with *G. salaris*, it is likely to be effective and is described in the updated chapter of OIE manual of diagnostic tests for aquatic animals for *G. salaris* (proposed for adoption at the OIE General Session, May 2021). This work underpins a robust and defensible *G. salaris* strategy for the UK and has been incorporated into Defra's (E&W) national aquatic animal disease contingency plan. Further information can be found in Annex 11.

UK – Scotland

6.12 Scotland (as part of the GB health zone) has recognised disease freedom with respect to *G. salaris*. As a result, trade restrictions, granted through EU Commission Decision 2010 / 221, are in place and assist in preventing the import of *G. salaris* through commercial activity involving the trade in live aquatic animals. With respect to *G. salaris,* imports are permitted only where they are accompanied by a health certificate confirming that the animals: originate from an area free from *G. salaris*, or they have been held immediately prior to dispatch in saltwater for a designated period, or in the case of eggs they have been disinfected prior to dispatch.

6.13 The Scottish Government's 'Home & Dry' campaign, involving the dissemination of leaflets, information and advice, remains in place where such information has been requested. Wild-fishery stakeholders continue to undertake measures aimed at preventing the introduction of the parasite within Scotland.

6.14 Scottish contingency plans for *G. salaris* are currently in their 4th edition and were last revised in March 2011. The need for further update and review is recognised and is planned for 2021 (Annex 4).

UK – Northern Ireland

6.15 Northern Ireland has recognised disease freedom with respect to *G. salaris*. As a result, trade restrictions, are in place and assist in preventing the import of *G. salaris* through commercial activity involving the trade in live aquatic animals. With respect to *G. salaris*, imports are permitted only where they are accompanied by a health certificate. All imports must match Northern Ireland's disease-free status and be certified as disease free, this includes *G. salaris*.

6.16 All primary salmon rivers have a number of index sites where juvenile fish are surveyed each year to assess year-to-year variation and densities at each site. This, along with

adult counter data, forms part of the overall scientific stock assessment to monitor and manage salmon stocks in Northern Ireland.

6.17 Anglers / Stakeholders are educated on the potential harm of bringing in invasive species into Northern Ireland. Anglers have been targeted to avoid the spread of invasives such as *G. salaris*, by complying with effective disinfectant procedures if fishing in other areas or importing fish from elsewhere. A UK-wide publicity campaign has been used with the "Check, Clean, Dry" line used to keep the message simple. There is a *G. salaris* Contingency Plan in place; however, there is a need to review the plan due to the changes required with the EU Animal Health Laws.

7. Other Business

7.1 The NASCO Assistant Secretary asked about Secretariat tasks in NASCO's North-East Atlantic Commission (NEAC) *Gyrodactylus salaris* 'Road Map', NEA(18)08. Specifically, under point 2c on Co-operation on management, she asked that participants shared links to Contingency Plans so that they could be linked on the NASCO website. Relating to point 7 of the Road Map, on publicity, education, and awareness, she asked participants to provide links to publicity material available in their Party / jurisdiction, so that they could be linked on the NASCO website.

7.2 Participants, also identified a number of papers that should be linked on the NASCO website, including:

Karlssen, S., Bolstad, G.H., Hansen, H., Jansen, P., Moen, T. and Noble, L.R. 2020. The potential for evolution of resistance to *Gyrodactylus salaris* in Norwegian Atlantic salmon. NINA Report 1812, 68 pp.

Paladini, G., Shinn, A.P., Taylor, N.G.H., Bron, J.E. and Hansen, H. 2021. Geographical distribution of *Gyrodactylus salaris* Malmberg, 1957 (Monogenea, Gyrodactylidae). Parasites Vectors, 14:34, 20 pp.

Thrush, M.A., Hill, T. and Taylor, N.G.H. 2019. Development of a non-lethal hydrogen peroxide treatment for surveillance of *Gyrodactylus salaris* on trout farms and its application to testing wild salmon populations, Transboundary and Emerging Diseases, 66 (5), 2107-2119.

7.3 The UK was asked whether the Fish Health Directive remained the basis for its *G. salaris* measures. UK – England and Wales replied that EU requirements had rolled over into UK law with existing domestic legislation still effective and in place. Discussions are on-going with respect to the future implementation of the new European legislation. It was commented that any future changes would need to acknowledge and maintain the aquatic animal health status of the UK, including that for *G. salaris*.

8. Report of the Meeting

8.1 The Working Group agreed a report of its meeting.

9. Close of the Meeting

9.1 The Chair thanked all participants for their contributions and looked forward to meeting face-to-face for the next meeting. He closed the meeting.

Annex 1

List of Participants

Haakon Hansen (Chair), Norwegian Veterinary Institute

Charlotte Axén, National Veterinary Institute, Sweden

Seamus Connor, Department of Agriculture, Environment and Rural Affairs, Northern Ireland

Peter Gough, Natural Resources Wales

Geir Jakobsen, Norwegian Food Safety Authority

Anders Koed, Technical University of Denmark

Hanna Kuukka-Anttila, Finnish Food Authority

Michael Millane, Inland Fisheries Ireland

Edmund Peeler, Centre for Environment, Fisheries and Aquaculture Science, UK

Sergey Prusov, PINRO, Russian Federation

Neil Purvis, Marine Scotland – Science

Jarle Steinkjer, Norwegian Environment Agency

David Stone, Centre for Environment, Fisheries and Aquaculture Science, UK

Ken Whelan, Atlantic Salmon Trust, NGO

John Worswick, Centre for Environment, Fisheries and Aquaculture Science, UK

Wendy Kenyon, Assistant Secretary, NASCO

Annex 2

GSWG(21)09

Meeting of the Working Group on Gyrodactylus salaris in the North-East Atlantic Commission Area

By Video Conference

17 March 2021 (9.30am – 2.30 pm UK time)

Agenda

1. Opening of the Meeting
2. Adoption of the Agenda
3. Consideration of the Terms of Reference
4. On-going and planned research concerning *G. salaris*
5. Exchange of information on monitoring and control programmes for *G. salaris*, and updates on its distribution
6. Update on enhanced co-operation on measures to prevent the further spread of the parasite and to eradicate it where it has been introduced including:
   (i) international initiatives; and
   (ii) national and regional initiatives
7. Other Business
8. Report of the Meeting
9. Close of the Meeting

Annex 3

GSWG(21)03

Update report on Finland's work on *Gyrodactylus salaris*

Hanna Kuukka-Anttila, Finnish Food Authority, Animal Health and Medication Unit

On-going and planned research concerning *G. salaris*

Finnish Food Authority participates in the project GyroSTOP (Detect and stop the spread of *Gyrodactylus salaris* on the North Calotte) where the aim is to take into use eDNA methods in detecting *G. salaris* from water samples and to obtain new information on the distribution of the parasite in Norway, Finland and Russia. The lead partner in the project is NVI (Norwegian Veterinary Institute). In addition to Finnish Food Authority, the Kola Science Center of the Russian Academy of Sciences participates in the project. The project was funded in 2020, but due to restrictions caused by the Covid19 situation, the starting of the project was postponed to 2021-2022.

Information on monitoring and control programmes for *G. salaris*, and updates on its distribution

The water catchments running north in Finland remain free from the presence of *G salaris*. The river catchments of Tenojoki and Näätämöjoki are officially free whereas the river catchments of the rivers Paatsoki, Uutuajoki and Tuulomajoki form a buffer zone (2010/221/EU). (Maps 1 & 2).

Map 1. *G salaris* protected area (Free area marked red, buffer zone orange and River Tornionjoki green).

Map 2. Three main water flow directions in northern Finland.

Background map © National Land Survey of Finland 2021, Water catchments / Source: SYKE Finland

Yearly monitoring of *G. salaris* is performed in free water catchments as well as in the buffer zone in northern Finland. All the samples have been negative for the presence of *G salaris* on the examined fish (Table 1).

The occurrence of *G salaris* in the River Tornionjoki was investigated in a study on 2000–2004 (Anttila et al. 2008). Infection of salmon parr (*Salmo salar*) was common in the uppermost reach of the river system but decreased downstream and was rare in the lowermost reach (Anttila et al. 2008). Samples from River Tornionjoki (Map 1) are collected at least every 2nd year to follow the situation there. Samples from the other parts of Finland are occasionally examined due to export demands etc.

Table 1. *G salaris* monitoring programme samples from Northern Finland in last 10 years.

Water catchment	Tenojoki (Tana) [1)]	Näätämöjoki (Neiden) [1)]	Paatsjoki (Påsvik) [1)]	Paatsjoki farmed fish		Tuulomajoki [1)]	Tornionjoki[1)]
Year	Salmon	Salmon	Grayling	Brown trout	Charr	Grayling	Salmon
2011	65	156	15	0	120	30	238
2012	100	120	15	0	100	0	240
2013	100	120	15	0	120	30	240
2014	100	120	15	0	120	30	240
2015	100	120	15	0	120	0	240
2016	101	120	15	0	120	10	232
2017	30	120	15	0	60	0	-
2018	99	120	15	60	0	22	226
2019	101	118	15	0	60	31	-
2020	103	121	15	0	66	32	240

[1)] Samples from wild fish

Update on co-operation on measures to prevent the further spread of the parasite and to eradicate it where it has been introduced

Measures including fish and roe transfer restrictions remain in place to prevent the risk of introducing the parasite into northern Finland. There has actually been no transfer of fish or eggs to the free area since 2004. It is furthermore forbidden to transfer bait fish from other parts of Finland to the free and buffer zones, as well as to transfer bait fish between these watercourses. The use of bait fish is forbidden in angling, ice-fishing and lure fishing. In the protected area, gutting of the fish originating from other Finnish watercourses is forbidden, as well as introducing gutting waste to waters of River Tenojoki, Näätämöjoki, Paatsjoki, Uutuanjoki and Tuulomajoki watercourses. Boats, canoes, fishing equipment like rod, lure, net, boots e.g. transferred from other parts of Finland must be dry or disinfected before their use in these watercourses.

Road signs, posters and brochures are in place to inform tourists in the protected area. Information is also delivered on the internet. Disinfection for fishing equipment is organized by authorities and private operators in Lapland.

Preliminary report for the contingency plan for river Tenojoki was made in Finland in 2013 (Koski, 2013). Koski concluded that in the event of a *G salaris* infection in the river Teno, there would not be possibilities for the total eradication of the parasite. An attempt to conserve the genetic material to live gene banks would probably be the option of choice in such case. Koski, however, proposed the commencement of contingency planning with Norway. In a contingency plan the possibility of keeping certain parts of the water system free of the infection and compensatory restocking programs should be analysed. In the long run, a more resistant stock of the River Teno salmon would presumably be needed for the restoration of the salmon population and fishing. A project preparing a contingency plan together with Norway

has been discussed but unfortunately no progress has been achieved so far. The concrete effort has been put on the prevention.

Anttila, P., Romakkaniemi, A., Kuusela, J. and Koski, P. 2008. Epidemiology of *Gyrodactylus salaris* (Monogenea) in the River Tornionjoki, a Baltic wild salmon river. Journal of Fish Diseases, 31(5), 373-382. (link)

Koski, P. 2013. Teno-ja Näätämöjokien suojelu *Gyrodactylus salaris*–loiselta. (PDF)

Annex 4

GSWG(21)04

Working Group on *Gyrodactylus salaris* in the North-East Atlantic Commission Area

Virtual meeting hosted by NASCO, 17-18 March 2021

Gyrodactylus salaris update paper – contribution from Marine Scotland
Neil Purvis – neil.purvis@gov.scot

Update for 2018, 2019 and 2020

1. Monitoring and distribution of gyrodactylids

1.1 Annex 1 provides sampling data for the years 2018 to 2020 (inclusive) concerning the activity undertaken in Scotland by the Competent Authority[1] in relation to sampling and sample analysis to determine the presence or absence of gyrodactylid species. The structure of this data set reflects historical reports and previous contributions made from Scotland.

1.2 The surveillance undertaken continues to support Scotland's disease free status with respect to Gyrodactylus salaris (Gs), as part of the GB health zone[2]. No evidence of the parasite has been detected over the sampling period from 01 January 2018 to 31 December 2020.

Surveillance

1.3 Since reporting in 2018 there have been no changes associated with the surveillance methodologies employed. In accordance with Council Directive 2006/88/EC, a risk based surveillance programme is undertaken across aquaculture sites within Scotland.

1.4 Passive surveillance and intelligence led initiatives are additional components of Scotland's aquatic animal health surveillance activity.

1.5 There is no targeted surveillance (the screening of healthy fish populations) for Gs but analysis of samples is undertaken through diagnostic investigations conducted either as a result of risk based surveillance in the case of farmed fish, or through intelligence initiatives, as an output from passive surveillance, in the case of farmed fish and fisheries[3].

1.6 Further description and details of the surveillance being employed is contained within GSWG(17) Annex 7.

[1] Marine Scotland performs the role of Competent Authority for Scotland on behalf of the Scottish Ministers

[2] The 'GB heath zone' comprises the territory of Great Britain which includes the countries of England, Wales and Scotland

[3] 'Fisheries' in this context refers to both wild fish populations and put-and-take / sport fisheries and these are differentiated where required throughout the report

Population surveys

1.7 Population survey work continued throughout 2018 to 2019 as part of an on-going programme as reported within GSWG(17) Annex 7. It is recognised that, whilst this activity is not actively searching for the presence of Gs, it does give an assessment, to a certain extent, of the ecological health of wild salmonid populations in any given area. Where repeated and structured surveys are undertaken this could provide a reliable indicator of a problem, e.g. a lack of juvenile salmon populations in an area where they were previously plentiful.

1.8 New structures are being developed for coordinated local sampling of fish to complement the salmon conservation regulations[4] and assess pressures on salmon stocks. This programme may well provide a generally structured and robust warning system with respect to the presence of Gs.

Diagnostic capability and activity

1.9 Marine Scotland Science (MSS) is the Scottish National Reference Laboratory for fish, mollusc and crustacean diseases.

1.10 The primary diagnostic methods employed in relation to Gs detection and confirmation, rely solely upon molecular techniques and include a real-time PCR multiplex assay, followed by DNA sequencing. This represents the standard diagnostic practice in relation to the diagnosis of gyrodactylids by MSS.

1.11 Morophological capabilities have been maintained and could be reintroduced in the future if required.

1.12 With regards to the detection of Gs, the diagnostic methods employed by MSS atisfies the recommended methodology detailed within the OiE Manual of Diagnostic Tests for Aquatic Animals (2019).

Impact of COVID-19

1.13 The global COVID-19 pandemic of 2020 has had an impact upon the surveillance, population survey and diagnostic activity conducted during that year. Despite these restrictions risk assessment and appropriate operational procedures were established and implemented to allow elements of this work to continue when restrictions permitted.

1.14 In terms of surveillance, all high risk aquaculture sites were inspected along with a lower than planned proportion of medium and low risk sites. Passive surveillance initiatives were increased with respect to both farmed and wild aquatic animals. Increased communication with wild fish stakeholders specifically in relation to red skin disease allowed for some continued diagnostic sampling in this area.

1.15 In relation to population survey work, all activity ceased during 2020 due to COVID impacts.

1.16 Diagnostic capability and capacity was maintained throughout 2020 with a lower rate of throughput from aquatic animal disease surveillance.

[4] http://www.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence

2. On-going and planned research concerning *G. salaris*

2.1 At present MSS is not actively involved in any scientific research work concerning Gs. Despite this, the organisation maintains knowledge of developments in this area through national and international discussions and contact with other research parties through attendance at conferences and meetings involving the scientific community and national reference laboratories.

3. Measures taken to prevent spread and to eradicate

International initiatives

Trade restrictions

3.1 Trade restrictions, as detailed within GSWG(17) Annex 7, remain in place. These are detailed below in paragraph 3.2.

3.2 Scotland (as part of the GB health zone), has recognised disease freedom with respect to Gs. As a result, trade restrictions, granted through EU Commission Decision 2010/221, are in place and assist in preventing the import of Gs through commercial activity involving the trade in live aquatic animals. With respect to Gs, imports are permitted only where they are accompanied by a health certificate confirming that the animals:

a) originate from an area free from Gs, or

b) they have been held immediately prior to dispatch in saltwater for a designated period[5], or

c) in the case eggs they have been disinfected prior to dispatch

3.3 These measures assist in protecting Scotland from the introduction of the parasite through commercial activity associated with live aquatic animal trade.

3.4 Scotland also supported the United Kingdom as an EU member state, by providing comments on the OiE Aquatic Code and Aquatic Manual. These documents cover international recommended standards and practices with respect to specific pathogens, including Gs. Areas covered include:

- trade in and movements of aquatic animals and aquatic animal products
- health status including disease freedom
- biological and aetiological characteristics of pathogens
- surveillance, sampling and diagnostic techniques and procedures

National and regional initiatives

'Home & Dry' campaign

3.5 The Scottish Government's 'Home & Dry' campaign involving the dissemination of leaflets, information and advice remains in place where such information has been requested.

[5] The certificate requires a minimum of 25ppt saltwater for at least 14 days

Actions taken by wild fishery stakeholders

3.6 As detailed within the 2017 report (GSWG(17) Annex 7) wild fishery stakeholders continue to undertake measures aimed at preventing the introduction of the parasite within Scotland. These include:

- ensuring disinfection of fishing equipment by action or certificate prior to use
- providing equipment to visiting anglers, to avoid potentially infected equipment being used
- educating anglers in best practice in relation to the risks of aquatic animal disease
- developing catchment and river contingency plans in the event of an outbreak of Gs
- mapping and surveying of catchments to facilitate with eradication if required

Contingency Planning

3.7 Scottish Government has developed and maintains generic contingency plans to deal with outbreaks of listed disease in accordance with Council Directive 2006/88/EC. In the event of an outbreak, operational and strategic responses will be undertaken by Marine Scotland with a view to containing and eradicating disease where possible.

3.8 In recognition of the additional challenges posed by Gs, in terms of the potential impacts on wild fish, discrete contingency plans have been developed to deal with an outbreak of the parasite in Scotland. Part of the contingency procedure recognises the extensive expertise and experiences within Norway in terms of containing and eradicating. Agreements have been established to utilise this expertise should the need arise.

3.9 Scottish contingency plans for Gs are currently in their 4th edition and were last revised in March 2011. The need for further update and review is recognised and is planned to be undertaken in 2021 as part of a programme of wider work on contingency planning for listed diseases.

Gyrodactylid sampling in Scotland 2018, 2019 and 2020 conducted by MSS

Overview

No *G. salaris* were identified.

Total No. of cases: 18

No. of farm cases: 6 (1 case relating to Marine Scotland's Marine Laboratory aquarium)

No. of wild cases: 11

Total No. of fisheries[6] sampled: 1

Total No. of fish examined: 83

Total No. of farmed fish examined: 61

Total No. of wild fish examined: 17

Total No. of fishery fish examined: 5

No. of +ve farm cases: 0

No. of +ve wild cases: 1

No. of +ve fisheries cases: 1

[6] Fishery / fisheries within this section refers to put-and-take / sport fisheries and excludes wild fisheries

Breakdown of sampling for gyrodactylids

Farmed fish sampling

Year	Fish species	Cases	No. sampled per case	Region	Result	Parasite species
2018	Atlantic salmon	1	5	Strathclyde	-ve	
2019	Atlantic salmon	3	5	Western Isles	-ve	
			5	Grampian[7]	-ve	
			30	Shetland	-ve	
2020	Atlantic salmon	1	5	Strathclyde	-ve	
	Rainbow trout	1	11	Borders	-ve	

Fishery sampling

Year	Fish species	Cases	No. sampled per case	Region	Result	Parasite species
2020	Rainbow trout	1	5	Central	+ ve	*G. d*

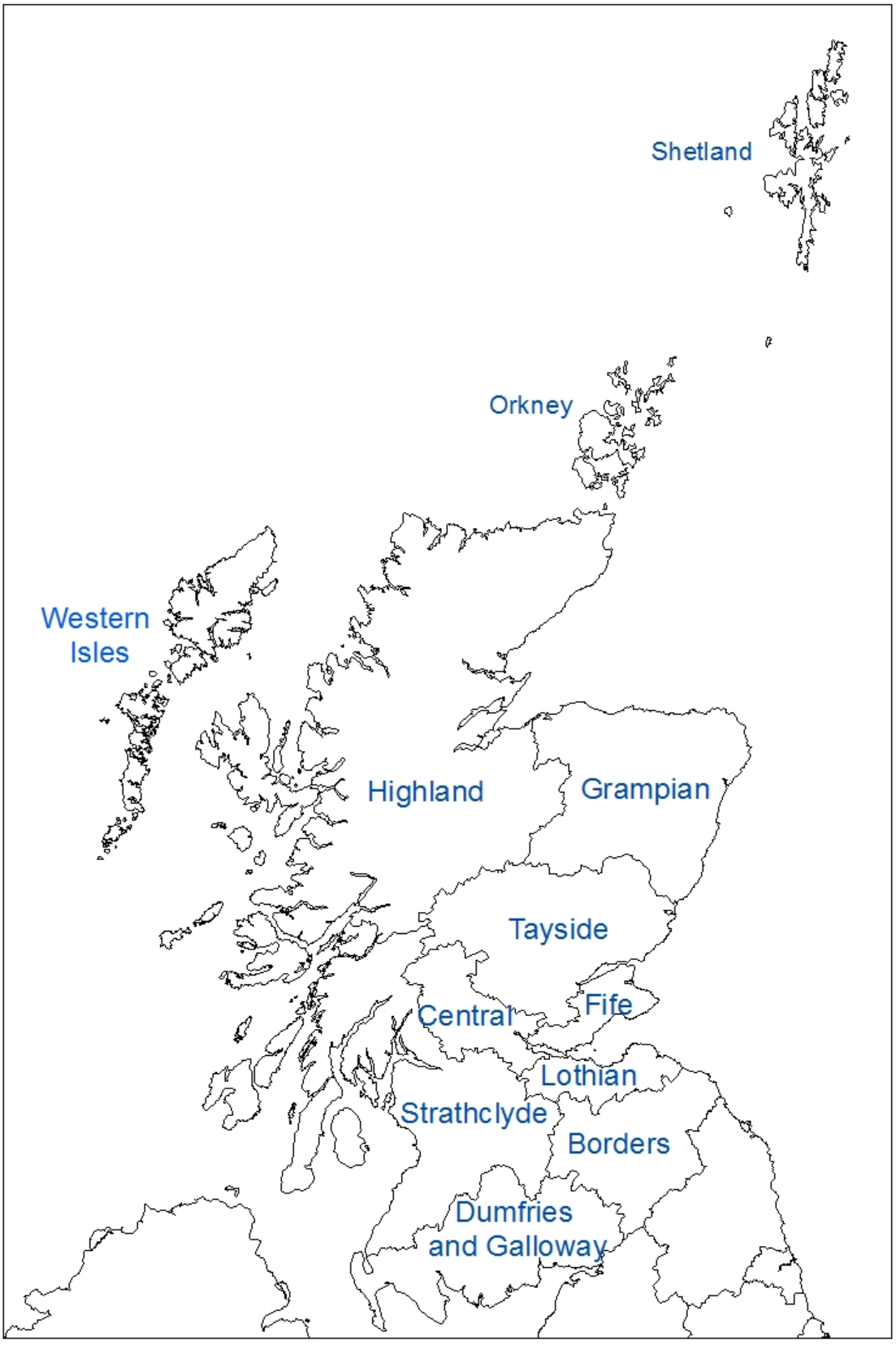
[7] This case relates to Marine Scotland's Marine Laboratory aquarium

Wild fish sampling

Year	Fish species	Cases	No. sampled per case	Region	Result	Parasite species
2018	Atlantic salmon	2	5	Strathclyde	+ve	*G. d*
			1	Western Isles	-ve	
2019	Atlantic salmon	8	1	Grampian	-ve	
			1	Grampian	-ve	
			1	Grampian	-ve	
			3	Highland	-ve	
			1	Highland	-ve	
			1	Highland	-ve	
			1	Highland	-ve	
			1	Highland	-ve	
2020	Atlantic salmon	1	1	Grampian	-ve	

G. d = Gyrodactylus derjavinoides

Map identifying the regions of Scotland



Annex 5

GSWG(21)05
NASCO Working Group on *Gyrodactylus salaris*
(Online, 17-18 March 2021)

Results of *G. salaris* monitoring in the Russian Federation

T.A. Karaseva, S.V. Prusov (PINRO named after N.M. Knipovich)

In Russia, *G. salaris*, as a pathogenic parasite, was first recorded in the Keret River (Republic of Karelia, the White Sea basin) in 1992. There are different views on how this parasite invaded into the river, but the most likely reason is an introduction of the parasite due to the fish transfersfor hatcheries. This resulted in reduction of adult salmon stock in the Keret River over 25 times.

G. salaris, therefore, has been monitored since 1993 in the salmon rivers of the Barents and White Seas. Since 2009, monitoring has been carried out on a regular basis within the frameworkof the Program of State Monitoring of Aquatic Bioresources of Inland Water bodies in the Murmansk region and the rivers of the Republic of Karelia in the White Sea basin. In the BarentsSea basin, *G. salaris* is monitored in the Kola River and tributaries of the Lower Tuloma (Nizhnetulomsky) Reservoir (rivers Pak, Pecha, Shovna, Pyaive), in the White Sea basin – in the rivers Kanda, Kovda (Murmansk region) and in the Keret River (the Republic of Karelia).

No *G. salaris* has been found in rivers Kanda and Kovda. In the Murmansk region the parasite

G. salaris was recorded for the first time in the Pak River in 2015 and in the Shovna River in 2017. An extent of infestation of juvenile Atlantic salmon in these rivers in 2017 was 64.1-71.4% with an abundance rate of 51.2-60.7 ind. per fish, respectively. In the Keret River an extent of invasion was 100%, an abundance rate was 364.6 ind., intensity - 5-2317 ind. Infestation rates of juvenile salmon in 2017-2020 are presented in the Table.

Table. Results of *G. salaris* monitoring in the rivers of the Lower Tuloma Reservoir and in the Keret River in 2017-2020

River	Year	Number of fish	Infestation rates		
			Extent, %	Abundance rate	Intensity, (min-max)
Pak	2017	39	64.1	51.2	1-899
	2018	38	0	0	0
	2019	31	9.7	2.3	1-53
	2020	23	52.2	59.9	1-1218
Pecha	2017	26	0	0	0
	2018	17	0	0	0
	2019	18	0	0	0
	2020	3	0	0	0
Pyaive	2017	22	0	0	0
	2018	30	0	0	0
	2019	14	0	0	0
	2020	21	0	0	0
Shovna	2017	7	71.4	60.7	1-347
	2018	20	25.0	0.9	1-7
	2019	11	0	0	0
	2020	5	40.0	35.1	4-804
Keret	2017	9	100	364.6	5-2317
	2018	25	0	0	0

Table shows that in 2018-2019 fish infestation in rivers Pak and Shovna was significantly lower than in 2017. The intensity of invasion in 2018 decreased assumedly due to an abnormally hot summer. Obviously, high water temperature in the salmon rivers did not allow *G. salaris*invasion to reach the critical level for juvenile salmon survival.

In 2020, number of parasite on juvenile salmon in rivers Pak and Shovna began to grow, however the rates of 2017 were not reached. In the Pak River an extent of infestation was 52.2%,an abundance rate - 59.9 ind. in the Shovna River - 40.0% and 35.1 ind, respectively.

Monitoring of Atlantic salmon juvenile densities in rivers Pak and Shovna in 2015-2020 showed that the number of parr (age 1+ and older) at spawning and nursery grounds was only once below10 par/100 m^2 – in the Pak River in 2018, and in the Shovna River in 2016. Peak values were observed in 2015, and rest of the observation period showed that the distribution density of parr varied from 10 to 20 parr/100 m^2 (figure), which was in line with other salmon rivers in the region with Atlantic salmon stocks that were assessed with good status.

It should be noted that, since 2015 during the spawning run of Atlantic salmon in the Kola River and the rivers of the Lower Tuloma Reservoir, death of adult salmon from a disease that was diagnosed as UDN has been observed annually, which, along with high level of IUU fishing in these rivers, led to a decrease in abundance of both salmon spawning stocks.

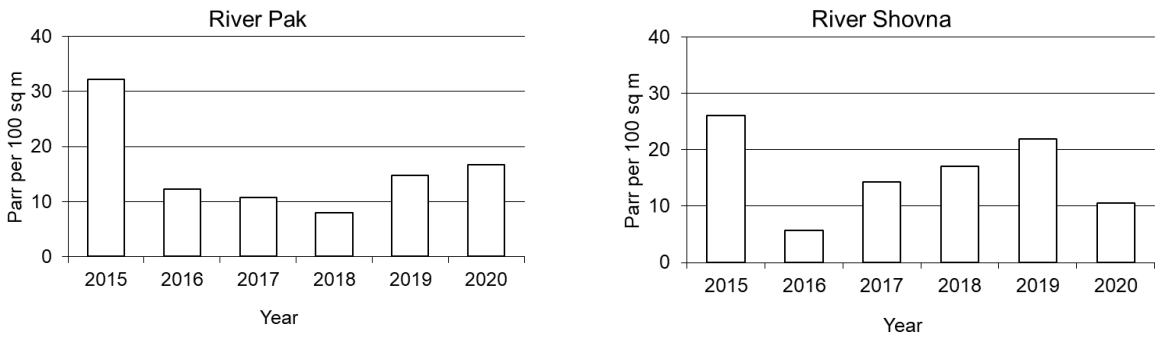


Figure. Parr densities at spawning and nursery grounds in rivers Pak and Shovna in 2015-2020,parr/100 m^2.

Thus, there are currently two salmon rivers with *G. salaris* in the Murmansk region – the Pak River and the Shovna River in the basin of the Lower Tuloma Reservoir, from which the TulomaRiver flows into the inner part of the Kola Bay. As a source of infestation of Atlantic salmon juveniles, an infected rainbow trout is considered which escaped the cages of aquaculture farms located in the reservoir. Even though, there is no invasion outside the Lower Tuloma Reservoir, there is a high risk of *G. salaris* spread into the Kola River and other rivers draining into theKola Bay, due to the low water salinity in the southern part of the bay, where a large volume of fresh water flows from the Lower Tuloma Reservoir and the Kola River. Therefore, G. *salaris* monitoring is planned in other at-risk rivers of the region in the coming years.

No *G. salaris* monitoring is carried out in salmon rivers of the Arkhangelsk region and in the Pechora River. The presence of the parasite in these areas is unknown.

Annex 6

GSWG(21)06

Update on Gyrodactylus salaris Monitoring in Northern Ireland

1. Current Monitoring Programme in Northern Ireland

GS monitoring is carried out as part of Department of Agriculture, Environment and Rural Affairs (DAERA) Fish Health's disease testing regime. Detection of *Gyrodactylus salaris* DNA is by using real time PCR in *Gyrodactylus* sp obtained from skin and fin scrapes. A rolling regimeof testing takes place across both operational fin fish farms and wild catchment areas (by electrofishing) in Northern Ireland as follows:

- Statutory sampling and testing of approximately 25 finfish sites every 18 months (30 fish per site) for the diseases listed under Directive 2006/88/EC and for the Article 43 diseases listed in Schedule 1 of the Aquatic Animal Health Regulations (NI) 2009.
- Testing of wild fisheries samples through electrofishing of 8 rivers annually for listed andArticle 43 diseases (30 fish per river).
- Finalisation of data required to achieve ISO 17025 Standard Accreditation for fish diseasetest methods. This includes the collection of validation data; statistical analysis of data; preparation of validation dossier; and participation in EQA/PT schemes.

The testing work is carried out by Agrifood and Biosciences Institute (AFBI) on behalf of DAERA as a part of the broader DAERA Annual Scientific Work Program. Covid 19 restrictions brought in at various times and limited staff resources have impacted on meeting targets for sampling in 2020 and thus less samples were taken.

Testing for GS began in 2007 and since then all results have been negative and therefore Northern Ireland remains free from GS. The results in Annex 1 highlight the results from samples taken from2018 to 2020.

2. Future GS Sampling Programme and Research

Subject to confirmation of the DAERA assigned scientific work programme, sampling for GSwill continue into the future as outlined above.

There is currently no research planned into GS by DAERA.

3. Trade Controls

NI has recognised disease freedom with respect to Gs. As a result, trade restrictions, are in place and assist in preventing the import of Gs through commercial activity involving the trade in live aquatic animals. With respect to Gs, imports are permitted only where they are accompanied by a health certificate. All imports must match our disease free status and be certified as disease free, this includes G.S.

4. Monitoring of Salmon Stocks

All primary salmon rivers have a number of index sites where juvenile fish are surveyed eachyear to assess year to year variation and densities at each sites. This, along with adult counter data, forms part of the overall scientific stock assessment to monitor and manage salmon stocks in NI.

5. Public Awareness for GS

Anglers / Stakeholders are educated on the potential harm of brining in invasive into Northern Ireland using both published information on leaflets etc and digital information on the Internet. In particular anglers have been targeted to avoid the spread of invasives such as GS, by complying with effective disinfectant procedures if fishing in others areas or importing fish from elsewhere. A UK wide publicity campaign has been used with the"Check, Clean, Dry" line used to keep the message simple.

6. GS Contingency Plan

There is GS Contingency plan in place, however there is a need to review the plan due to the changes required with the EU Animal Health Laws and this will be carried out as soon as possible once staff resources as in place.

Note an * denotes a fish farm sampling site the rest were wild salmon.

7. 2018 Sampling

Rivers Sampled

Straghan River	F18-494	2018
Ballygawley River	F18-484	2018
Glynn River	F18-400	2018
Blackwater River, Clogher	F18-510	2018
River Kesh	F18-617	2018
Carnlough River	F18-624	2018
Kilkeel River	F18-639	2018
Carey River, Ballycastle	F18-682	2018
River Derg	F18-734	2018

9 Rivers tested all results were negative for GS

8. 2019 Sampling

Rivers Sampled

Orritor	F19-273	2019
Clarkhill River, Annsborough	F19-407	2019
Tullymore River, Fermanagh	F19-406	2019
Oonagh River	F19-798	2019
Bannagher River (Roe catchment)	F19 - 768	2019
Ballykelly Burn	F19 - 769	2019
Ballygawley River Oona	F19-823	2019
Glenarm River White Bridge	F19-824	2019

8 Rivers tested all results were negative for GS

9. 2020 Sampling

Loughinsholin*	Northern Ireland	06/01/2020
Derrinleagh*	Northern Ireland	04/02/2020
Bushmills	Northern Ireland	06/02/2020
Articlave River	Northern Ireland	20/08/2020

All samples tested were negative for GS.

Annex 7

GSWG(21)07

Briefing paper on G. salaris – EU – Ireland

Scope

NASCO have requested that Ireland provide a briefing paper for the 2021 meeting of the Working Group on *Gyrodactylus salaris* in the North-East Atlantic Commission Area. The paper should provide country-specific details of the following: *monitoring and control programmes and distribution of the parasite; ongoing and planned research; and measures being taken to prevent the spread of the parasite and eradicate it where it has been introduced*.

1 Background

Gyrodactylus salaris is listed as a notifiable disease in Ireland and legislation is in place preventing the transfer of live fish capable of carrying the parasite to or within Irish waters. The parasite is not listed in Council Directive 2006/88/EC, which has been applied since 1 August 2008, and replaces the previous fish health regime under Directive 91/67/EEC. However, Ireland retained additional guarantees under Decision 2004/453/EC in respect of *G. salaris* and can continue to control imports and suspected or confirmed outbreaks under the European Communities (Health of Aquaculture Animals and Products Regulations) 2008. These additional guarantees have been recognised as "national measures" under Article 43 of Council Directive 2006/88/EC. This has been reflected in Commission Decision 2010/221/EU, which replaces Commission Decision 2004/453/EC.

2 Distribution of *Gyrodactylus salaris* in Ireland

Gyrodactylus salaris has not been recorded on the island of Ireland to date.

3 Monitoring and control programmes *Gyrodactylus salaris* in Ireland

Since 2005, wild salmon parr from selected river systems in Ireland are examined annually for the presence of *G. salaris* (Appendix 1, Table 1). This monitoring is undertaken in conjunction with the catchment-wide electrofishing programme managed by Inland Fisheries Ireland (IFI) with sample analyses undertaken by the Fish Health Unit (FHU) of the Marine Institute (MI). In a more general context, the MI are responsible for investigating unexplained abnormal or significant fish mortalities encountered in Ireland which may be a result of fish disease, while IFI have statutory responsibility for wild salmonid fisheries in Ireland.

4 Ongoing and planned research

There is no ongoing or presently planned research on *G. salaris* in Ireland, with the exception of the ongoing annual monitoring programme.

5 Measures being taken to prevent the spread of the parasite and eradicate it where it has been introduced.

A detailed contingency plan for dealing with any outbreak of *G. salaris* in Ireland was produced in 2017 by the FHU with input from IFI and other stakeholders with statutory interests in salmonids. This plan has been forwarded to the NASCO Secretariat.

The plan sets out in detail the operational responsibilities and actions to be taken in the event of a suspected outbreak of gyrodactylosis and includes the following:

- The convening of the National Disease Strategy Group (NDSG) to activate and oversee the implementation of the contingency plan. The group will comprise senior representatives from relevant Government Departments and State Bodies including IFI and MI as well as expert national and international veterinary scientists;
- The establishment of National Control Centre (NCC) overseen by the NDSG for the purposes of co-ordinating control / eradication measures. The NCC will include representatives of the FHU, IFI, Departmental veterinary inspectors, the cross-border Loughs Agency and relevant representation from Northern Ireland.
- A communications strategy.
- Detailed actions to be implemented on the suspicion or confirmation of a gyrodactylosis outbreak.
- Sampling, testing and fish disposal protocols.
- Containment, eradication and treatment options.

In addition to the contingency plan, IFI and MI have co-produced and widely circulated awareness literature to highlight the issue of *Gyrodactylus* among stakeholders and advise on biosecurity measures that can be taken to minimise the risk of introduction of the parasite to Ireland (e.g. *A Guide to Protecting Freshwater Fish Stocks in Ireland from the Parasite Gyrodactylus salaris* https://biturl.top/AZRniy). In addition, both state bodies host information in this regard on their respective websites.

6 Annual reporting to NASCO NEAC on roadmap NEA(18)08

Parties and jurisdictions of the North-East Atlantic Commission of NASCO are encouraged to report on progress in relation to the 11 recommendations in the 'Road Map' to enhance information exchange and co-operation on monitoring, research and measures to prevent the spread of *Gyrodactylus salaris* and eradicate it if introduced, as agreed by the Commission in 2018, NEA(18)08. EU (Ireland) provides updates in this regard in advance of the annual meetings of the North-East Atlantic Commission. The most recent such update can been accessed at https://nasco.int/wp-content/uploads/2020/06/NEA2015_Report-on-progress-in-relation-to-the-recommendations-in-NEA1808-concerning-Gyrodactylus-salaris-tabled-by-EU-Ireland.pdf .

Appendix 1

Table 1 Irish river systems sampled for the presence of *G. salaris* (2005 – 2020).

Catchment	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Avoca (Aughrim)										X						
Ballynahinch																X
Barrow (Greese)					X											
Barrow (Poulmounty)			X							X						
Boyne trib.									X							
Bride						X									X	
Bunowen															X	
Corrib (Abbert)						X		X								
Corrib (Cong)														X		
Corrib (Owenriff)														X		
Cloonee															X	
Colligan															X	
Dunkellin						X										X
Eanymore						X										
Emlagh							X									
Erne										X						
Erne (Aughnacliffe)				X												
Erne (Bunnoe)			X													
Erne (Burrin)			X													
Erne (Swanlinbar)			X													
Erriff						X	X						X	X	X	X
Feale					X				X							
Garavogue						X										
Glen							x									
Laune										X			X			

Catchment	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Leannan							X				X			X		X
Lee		X														
Maine											X		X			
Moy								X								
Mulkear (Bilboa)					X											
Munster Blackwater										X	X	X	X	X		
Munster Blackwater (Araglin)								X								
Munster Blackwater (Finnow)								X				X				
Owenascaul																X
Owennacurra																X
Owenboliska						X										
Owenea														X		
Owenwee							X									
Screebe		X	X					X								
Shannon (Brosna)			X						X							
Shannon (Carrigahorig)		X								X						
Shannon (Little Brosna)			X													
Shannon (Lower)															X	
Slaney (Derry)	X															
Suir											X					
Suir (Aherlow)	X															
Swilly																X
Tullaghobegley									X							
Waterville (Currane)													X			

Annex 8

GSWG(21)08

Updating since the Working Group's 2018 Meeting

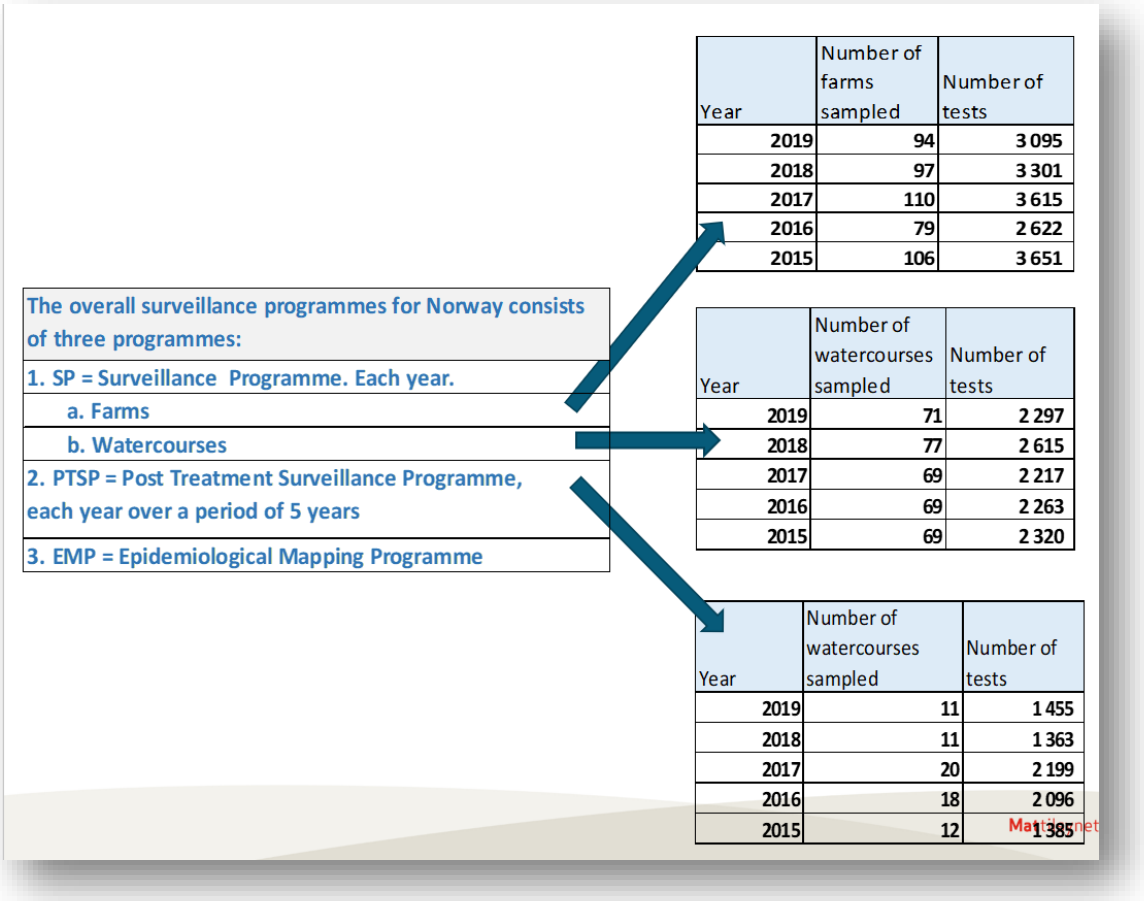
Norwegian Food Safety Authority.

Abbreviations:

- NFSA = Norwegian Food Safety Authority
- NEA = Norwegian Environment Agency
- NVI = The Norwegian Veterinary Institute
- EFTA = European Free Trade Association
- ESA = EFTA Surveillance Authority
- GS = *Gyrodactylus salaris*
- SP = Surveillance Programme
- PTSP = Post Treatment Surveillance Programme
- EMP = Epidemiological Mapping Programme
- WC = Watercourse

Monitoring and control programme. Contingency plan.

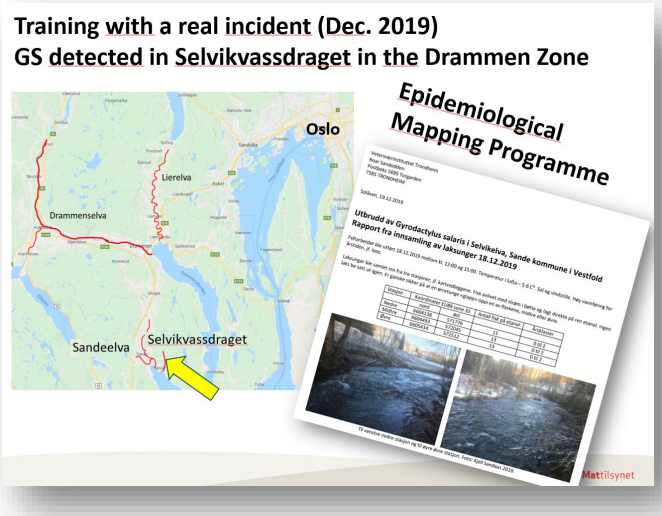
The Norwegian Surveillance program as described in the NEA (18)03.
This figure shows the sampling from 2015-2019:



All samples were negative except for the detection of GS in the WC Selvikvassdraget in Dec. 2019. The parasite was found through the Surveillance Programme in watercourses.

Co-operation on measures to prevent the further spread of the GS.
Regional and National iniatives.

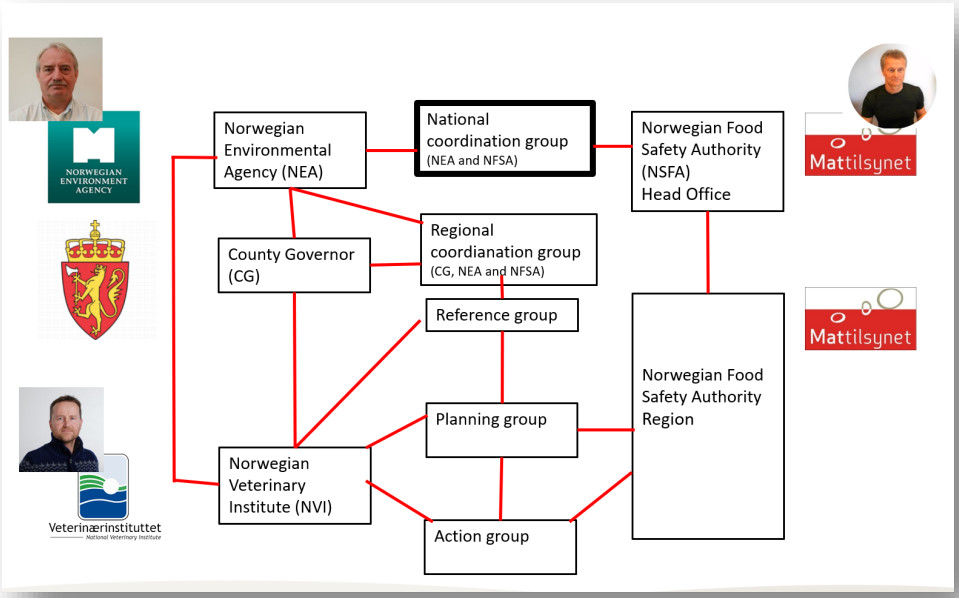
The detection of GS in the WC Selvikvassdraget was expected.
This WC is localized in the Drammen Zone (more details about zones, see later) which comprises the WCs Drammenselva, Lierelva and Sandeelva.



The WC Selvikvassdraget has its estuary near the WC Sandeelva.

The small distance between the estuaries in these to WCs in a brackish sea water bay made it quite likely for this to happen. Due to the Contingency plan for GS, we quickly established a "central decision-making unit for cooperating the competent authorities to ensure actions on veterinary and environmental safety issues", ref. the EU Fish Health Directive. See the figure below.

The unit ordered and funded quite quickly an Epidemiological Mapping Programme, finishing its investigations and report some weeks later. The report says something about the amount of smolt that migrates from this WC.



Since the meeting in 2018, the NFSA has updated the website with posters and brochures in many languages: https://www.mattilsynet.no/fisk_og_akvakultur/fiskehelse/fiske_og_skjellsykdommer/gyro/#publikasjoner

International iniatives.

Norway is not a member of the EU.
However, we are member of the EFTA, the European Free Trade Association.
EFTA is an intergovernmental organisation for the promotion of free trade and economic integration between its members.
One of the main tasks of EFTA is to manage the Agreement on the European Economic Area – the EEA agreement – which brings together the Member States of the EU and the EFTA in a single market or the "Internal Market".

It is through ESA, Norway applicated for and got an agreement with national measures and additional guarantees for GS in 2006.
An updated version of this agreement, the ESA Dec. 058/16 COL-D says that Norway is free of GS - and have additional guarantees. Norway has a total of about 450 WCs with salmon.

However, the agreement defines in its annex an exception from the agreement, including 29 WCs localized in 7 GS zones.

These zones are in accordance with the EU Fish Health Directive, Annex 1:
"More than one water catchment area, including their estuaries, due to the epidemiological link between the catchment areas through the estuary".

The status for treatment and conducting of PTSP in the 7 zones are as follows:

ESA's list of WCs still without additional guarantees. Includes 7 Zones and 29 WCs	Treatment	Status per 17.03.21:
The Skibotn Zone (3 WCs)	2015/16 (Rotenone)	PSTP will be finished ultimo 2021
The Rana Zone (1 WC)	2014/15 (Rotenone)	PTSP finished in 2020
The Vefsna Zone (10 WCs)	2011/12 (Rotenone)	PSTP finished for 9 WCs 2017
		PTSP in the last WC will be finished in 2024/25
The Driva Zone (4 WCs)	Barrier so far	PTSP will be finished in 2028
The Rauma Zone (6 WCs)	2013/14 (Rotenone)	PTSP finished in 2019
The Lærdal Zone (1 WC)	2011/12 ($AlSO_4$ + Rot.)	PTSP finished in 2017
The Drammen Zone (4 WCs)	Barrier so far	PTSP will be finished in 2030

	Treatment and PTSP finished
	Treatment finished, PTSP will be finished
	Still not treated

The ESA said they wouldn't remove any of the 29 WCs without additional guarantees, even if the PTSP is finished. Norway had to renew its application from 2006 first.
The reason was that the approval of 2006 emphasized the pure surveillance more than the pure contingency aspect.
They recommended to use template Annex VI in the EU Commission Decision 2015/2444.
Through working with this application, we improved our contingency plan by:

- saying more om about which measures we planned to conduct if GS was detected in *farms,* not only in WCs.
- harmonizing it even more with the Annex VII: "Criteria and requirements for contingency plans" and the OIE Aquatic code, chapter 4.5 and 10.3.

Here is a link to the updated contingency plan for GS.
https://matcim.no/file.php?fid=bbaa0ff4d3beacac0c16a5727d18774czfid

Since the meeting in 2018, an international meeting was arranged in Murmansk, Russia where issues as the situation in the North Calotte was discussed. The meeting was part BarentsVet of a series of meetings supported by the Barents secretariat. These meetings discuss the zoosanitary situation in the Barents regions and aims to stop the spreading of infectious diseases, both aquatic and terrestrial, across the country borders.

Finland has taken initiatives to coordinate the Norwegian and Finnish GS contingency plans for the WCs Tana and Neiden. The NFSA appreciate this initiative and will, together with the NVI, start collaborating on this issue within short.

In addition, NFSA is contributing to the funding of the Kolarctic – CBC-project GyroStop – "*Detect and stop the spread of* Gyrodactylus salaris *on the North Calotte*", that aims to assess the distribution and spreading of GS on the North Calotte and on measures to detect and stop this spread.

Norway, by NFSA and NEA plans to take initiatives to meetings with Swedish governmental bodies about the issues:

- WCs and catchment areas common for Sweden and Norway. Especially related to the GS zones Skibotn, Rana and Vefsna, with reference to the OIE Aquatic Code, chapter 10.3. that states: "*If a zone extends over more than one country, it can only be declared as a zone free from infection with GS if all the relevant competent authorities confirm that all relevant conditions have been met.*"
- The West Coast of Sweden. What measures will and should be taken If GS is detected in WCs north of the current distribution, i.a. north of Gothenburg, ref. the paper and presentation of Erik Dägerman in the NASCO-meeting of 2018.

17.3.21
Geir Jakobsen.
Norwegian Food Safety Authority.

Annex 9

GSWG(21)11

Swedish surveillance of Gyrodactylus salaris in 2020

INTRODUCTION

Gyrodactylus salaris is considered endemic in Swedish rivers emptying into the Baltic Sea and does not cause substantial damage in Baltic salmon (*Salmo salar*) parr. The Atlantic salmon (also *S. salar*), is more sensitive to *Gyrodactylus* infection and the parasite can have serious effects on the parr populations, as has happened in Norway. The first time the parasite was identified in Swedish rivers emptying into the Atlantic Ocean was in 1989 (Säveån, tributary to Göta älv). Since then, the infection has spread to several rivers along the Swedish west coast, all south of Göta älv. Only six rivers, all north of Göta älv, are still considered free from *Gyrodactylus salaris*. The parasite infections have not been as detrimental on the Swedish Atlantic salmon as it has been on the Norwegian wild salmon stocks, but the infection is monitored every year. In 2020, responsibility for monitoring was transferred from the Swedish University of Agricultural Sciences (SLU) to the Swedish Veterinary Institute (SVA).

MATERIALS AND METHODS

Sampling locations

Sampling is performed by the organisation Sportfiskarna, western region. In rivers Anråsån (one sampling point), Örekilsälven (three sampling points), Säveån (one sampling point), Kungsbackaån (three sampling points), Rolfsån (three sampling points), Himleån (two sampling points) and Ätran (five sampling points).

Sampling

Salmon parr are caught using electro fishing. The length, width and fished area of the sampling point as well as water and air temperature, water and river bottom properties are noted in a sampling protocol. Collected parr are euthanized, weighed, measured, and preserved in 70% ethanol.

Analyses

Presence of *Gyrodactylus* sp. is investigated at 40 *x* in a microscope. The number of parasites around and on the dorsal fin and the pectoral fins are registered in the sampling protocol. If *Gyrodactylus* sp. is found in a sampling point that is considered free from *G. salaris*, the parasites are sent for morphological and genetic analyses (species and haplotype) at the Norwegian veterinary institute (NVI). Genetic analysis is performed using conventional PCR and sequencing of the internal transcribed spacer region (ITS) and the cytochrome oxidase 1 gene (CO1) according to the OIE Aquatic manual (https://www.oie.int/index.php?id=2439&L=0&htmfile=chapitre_gyrodactylus_salaris.htm).

RESULTS

Presence of *Gyrodactylus* sp. in sampled rivers

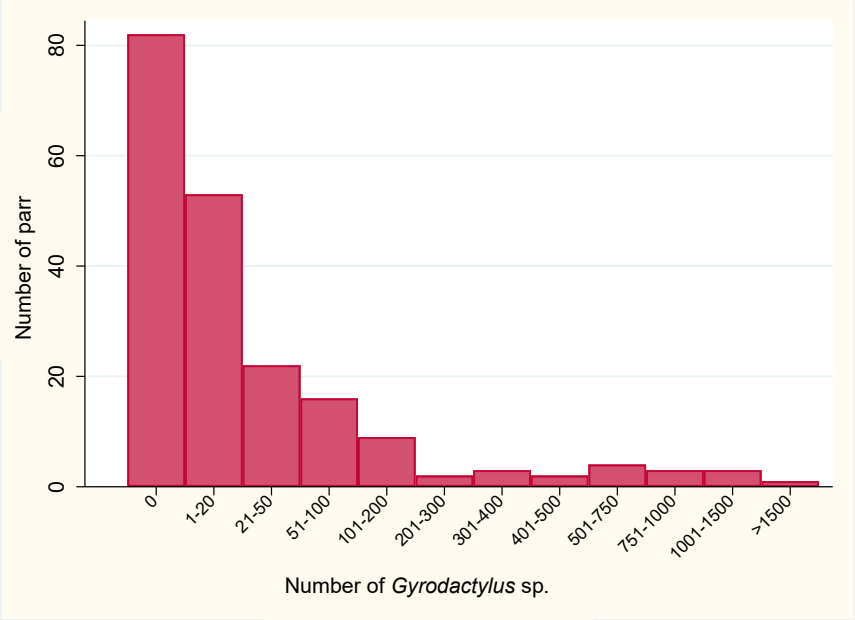
A total of 200 parr were collected. The number of parr per river and sampling point, median length and weight values (min, max), prevalence of infected parr and number of *Gyrodactylu*s sp. in infected parr is shown in Table 1. *Gyrodactylus* sp. was found in all rivers except Anråsån. The highest prevalence was found in Kungsbackaån and Himleån, where all parr was infected. In the other infected rivers, prevalence varied between 5 – 66%. In rivers with multiple

sampling points (Örekilsälven, Kungsbackaån, Rolfsån, Himleån and Ätran), the prevalence per sampling point varied between 0 – 100% per sampling point. Uninfected sampling points in these rivers were found in Örekilsälven (n=2) and Ätran (n=1) (**Table 1**). The number of *Gyrodactylus* sp. per infected parr was 1 - 1 880 (median 3, **Table 1**). Fifty-three (45%) of the infected parr had ≤20 *Gyrodactylus* sp. (**Figure 1**). The highest number of *Gyrodactylus* sp. per parr was found in Rolfsån (median 179, max 1 161 and 1 880 in two sampling points (**Table 1**)). Four parr had >1 000 *Gyrodactylus* sp. There was no significant size difference in uninfected and infected parr (Wilcoxon ranksum test, length Z=0.201, p>0.05, weight Z= -0.108, p>0.05).

Table 1. Results from electro fishing of salmon parr for the presence of Gyrodactylus sp. in seven Swedish west coast rivers 2020.

River **Sampling point**	**Date**	**No of parr**	**Lenght (cm)** median (min, max)	**Weight (g)** median (min, max)	***Gyrodactylus* sp.** Infected parr No (%)	 No of parasites, median (min, max)
Anråsån						
Kvarndalen	**18/4**	**13**	**7 (5.3, 11.7)**	**2.1 (0.9, 10.4)**	**0 (0)**	-
Örekilsälven	**23/7**	**21**	**12.8 (7.9, 14.5)**	**13.6 (3.6, 20.9)**	**1 (5)**	**5**
Munkedalsälven		8	12.6 (8.5, 13.4)	14.9 (4.7, 16.0)	0	-
Skäret		6	11.0 (8.1, 14.5)	9.3 (3.8, 18.1)	1 (17)	5
Stenhöljan		7	12.8 (8.1, 14.5)	13.1 (3.6, 20.9)	0	-
Säveån						
Jonsereds fabriker	**27/4**	**16**	**9.1 (6.8, 15.3)**	**7.2 (3.0, 32.2)**	**3 (19)**	**0 (0, 2)**
Kungsbackaån	**16/4**	**30**	**8.2 (5.4, 14.5)**	**4.2 (1.3, 23.9)**	**30 (100)**	**46 (3, 1030)**
Alafors		11	8.5 ((7.9, 14.5)	4.3 (2.0, 23.9)	11 (100)	25 (5, 407)
Hovgården Nordån		10	6.5 (5.4, 8.5)	1.9, 1.3, 4.1)	10 (100)	56 (3, 522)
Ålgårdsbacka		9	9.5 (7.5, 9.6)	(7.4, 8.8)	9 (100)	43 (4, 1030)
Rolfsån	**14/4**	**25**	**8.9 (6.5, 17.9)**	**5.8 (1.7, 41.5)**	**16 (64)**	**179 (1, 1880)**
Bosgården		6	16.2 (9.4, 17.9)	32.6 (6.4, 41.5)	6 (100)	302.5 (25, 1880)
Fälån		9	9.0 (7.9, 9.2)	6.5 (3.2, 6.9)	9 (100)	173 (43, 1161)
Island pool		10	7.6 (6.5, 10.4)	3.3 (1.7, 8.1)	1 (10)	1
Himleån	14/4	**15**	**11.7 (5.2, 15.9)**	**13.9 (1.0, 28.6)**	**15 (100)**	**49 (1, 699)**
Göingegården norrfåran		9	12.5 (8.6, 15.9)	14.2 (4.9, 28.6)	9 (100)	139 (7, 699)
Ön i Rolfstorp		6	7.4 (5.2, 14.5)	3.5 (1, 24.1)	6 (100)	22 (1, 49)
Ätran/Högvadsån	**15/12**	**80**	**7.4 (5.5, 14.0)**	**3.0 (1.4, 23.1)**	**53 (66)**	**8 (1, 830)**
Fageredsån		12	7.5 (6.9, 13)	2.8 (2.1, 14.2)	8 (75)	3.5 (0, 68)
Hjärtaredsån Grusgropen		5	10.4 (8.3, 11)	9.5 (4.9, 11.4)	0 (0)	-
Nydala kvarn		18	8.9 (6.4, 14)	5.1 (1.4, 21.5)	16 (89)	5 (0, 799)
Sumpafallet		34	6.8 (5.5, 12)	2.5 (1.5, 12.4)	24 (71)	5 (0, 830)
Århult		11	7.4 (5.7, 13.9)	3.2 (1.6, 23,1)	5 (45)	0 (0, 25)
Total		**200**	**8.2 (5.2, 17.9)**	**4.2 (0.9, 41.5)**	**118 (59)**	**3 (0, 1 880)**

Figure 1. Number of Gyrodactylus sp. per salmon parr in seven Swedish west coast rivers 2020.



Morphologic and genetic analyses

Gyrodactylus sp. from the infected parr in Örekilsälven and from five parr in Rolfsån (three from Bosgården, two from Fälån) were sent to NVI.

Morphologic investigation identified the *Gyrodactylus* sp. found in Örekilsälven as probable *G. derjavinoides* while the parr in Rolfsån were infected with typical *G. salaris*. PCR and sequencing confirmed the morhological identifications, and that the *G. salaris* in Rolfsån belonged to Haplotype A.

DISCUSSION

It was worrying that one parr in Örekilsälven was infected with *Gyrodactylus* sp., but fortunately it turned out to be *G. derjavinoides*. Thus, *G. salaris* still not been found in Swedish rivers emptying into the Atlantic Ocean north of Göta älv. Rolfsån was identified as *G. salaris* infected a few years ago. Haplotype A is the same haplotype that was first identified in the river, indicating the parasite has spread upstream rather than being introduced *de novo* from other rivers in the two new sampling points that were infected 2020.

In rivers Kungsbackaån and Himleån the parasite was found in all parr, and in Rolfsån in all parr in two of three sampling points. These were also the sampling points with the highest median of *Gyrodactylus* sp. per parr (22 – 302.5, **Table 1**), and the four parr infected with >100o parasites. The infection pressure in these rivers is therefore considered very high. Rivers Säveån and Ätran ha a lower infection pressure, with median number of 0 – 5 (max 830) *Gyrodactylus* sp per parr and sampling point.

CONCLUSION

Örekilsälven and Anråsån north of Göta älv can still be considered free of *G. salaris*. In Rolfsån, the parasite has spread upsteram and the infection pressure in Kungsbackaån, Rolfsån and Himleån is very high.

Annex 10

GSWG(21)12

Briefing Paper on Gyrodactylus salaris (Tabled by UK – England and Wales)

Scope

This paper is a briefing note presented on behalf of England and Wales for the NASCO Working Group on *Gyrodactylus salaris* in the North-East Atlantic Commission Area. The paper provides country-specific details of the monitoring and control programmes currently in place.

Legislative controls

At present, the UK is recognised as being free from *G. salaris* and as such the parasite is considered exotic to the country. The national controls implemented under the Aquatic Animal Health (England and Wales) Regulations 2009 mean that any suspicion of infection or mortality resulting from infection must be reported to the Fish Health Inspectorate. Failure to inform the FHI of any suspicion of *G. salaris* is an offence under the regulations.

Monitoring Programme

The Cefas FHI carries out monitoring for *G. salaris* in England and Wales through a rolling programme of sampling covering all river catchments which contain salmon. Within England and Wales, there are eighty rivers that support salmon, although not all currently host large populations. Each of the catchments is sampled approximately every five years where possible. The fish sampled are usually approximately 15 cm in length and a total of 30 fish are sampled where possible. Generally, a sample of 30 salmon are required although where the numbers of salmon are too low to obtain this sample size, trout and grayling may be taken as a substitute.

Diagnostic methods

In 2016 the Cefas FHI introduced the use of a novel non-destructive method that involves the immersion of fish in a weak hydrogen peroxide solution (560 ppm for 3 minutes) which removes the gyrodactylids whilst leaving the fish unharmed. The parasites can then be recovered for analysis whilst the live fish are returned to the river; increasing the number of fish that can be sampled from each river catchment and increasing the harvest of gyrodactylids that can be screened. The technique was incorporated into Defra's (England and Wales) national aquatic animal disease contingency plans.

Molecular speciation

From 2017-2019, individual gyrodactylids collected using the non-destructive sampling method were identified by ITS sequence analysis.

DNA was extracted from individual specimens in a 96 well format using either the DNA investigator kit (Qiagen) and the BioRobot Universal or the Qiacube HT DNA tissue kit and the Qiacube HT BioRobot according to the manufacturers protocol. Conventional PCR was performed using the *Gyrodactylus*- specific ITS primers described in the OIE diagnostic manual. After purification using a MinElute 96 UF PCR purification kit (Qiagen), PCR products were sequenced in both directions using an ABI Prism BigDye v 3.1 Terminator Cycle Sequencing kit (Applied Biosystems) and the same primers as used for the amplification. Sequence data were analysed on a ABI Prism 3500xl genetic analyser. The species were then

identified for each individual gyrodactylid specimen by comparing the consensus sequence to the published sequences on GenBank/EMBL sequence data base using the Basic Local Alignment Search Tool (BLAST). Where the ITS sequence indicated a G. salaris/ G. thymalli parasite, confirmation of the *G.salaris/G. thymalli* lineage was determined by amplification and sequencing of an informative region of the COI gene. (Table 1)

Due to the Covid-19 restrictions the sample programme was suspended during 2020.

Table 1 Species of Gyrodactylids found during FHI sampling 2017-2019

Year	Catchment	Species sampled			Gyrodactylids identified
		Atlantic salmon	Grayling	Brown Trout	
2017	Taw	23			*G. derjavinoides (141)*
	Ure	30			*-ve*
	Calder	30			*G. derjavinoides*
	Derwent	30			*G. derjavinoides (10)* *G. macronychus (2)* *G. truttae (17)*
	Coquet	30			*G. derjavinoides (7)* *G. truttae (1)* *G. gasterostei (1)* *G. prostae/G. elegans (1)*
2018	River Taff 35485	10		30	*G. truttae (33)* *G. derjavinoides (8)*
	Wear River 35750	30			*G. derjavinoides (7)*
	Tyne River 35719	30			*G. derjavinoides (9)* *G. truttae (2)* *G. jiroveci (1)*
	Lune River 35723	9		21	*G. truttae (1)* *G. derjavinoides (39)*
	Ogwen River 35486	30			*G. truttae (1)*
	Seiont River 35487	30			*G. derjavinoides (48)*
	Glaslyn River 35488	30			*G. derjavinoides (3)*
	Thames River 36062		22	8	*G. thymalli (6)* *G. truttae (31)* *G. derjavinoides (15)* *G. rogatensis (1)*
	Itchen River 36191	2	8	28	*G. truttae (22)* *G. derjavinoides (1)* *G. thymalli (27)* *ND (36)*
	Test River 36004	20	10		*G. thymalli (33)* *G. derjavinoides (16)* *G. cernuae (1)*

Year	Catchment	Species sampled			Gyrodactylids identified
		Atlantic salmon	**Grayling**	**Brown Trout**	
					G. albolacustris (1)
2019	Medway River 37916		16	16	*G. thymalli (7)* *G. truttae (18)* *G. derjavinoides (47)* *G. Gracilihamatus (1)* *G. Gasterostei (1)* *ND (17)*
	Tamar River 38286	12		18	*G. truttae (36)* *G. derjavinoides (39)* *ND (21)*
	Lynher River 38306			30	*G. truttae (86)* *G. derjavinoides (6)*
	Plym River 38287	25		5	*G. truttae (13)* *G. derjavinoides (48)* *ND (35)*
	Trent River 38288		30		*G. thymalli (82)* *ND (14)*
	Piddle River 38359	12		18	*G. truttae (65)* *G. derjavinoides (20)* *G. albolacustris (1)* *G. rogatensis (1)*
	Wye River 38382	5		8	*No gyrodactylids?*

Annex 11

GSWG(21)13

Surveillance for Gyrodactylus salaris in England and Wales

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Gyrodactylus salaris is a freshwater parasite that can cause high levels of infection and mortality in Atlantic salmon. Currently, the UK is one of only a few countries to have a declared free status for *G. salaris*. The potentially catastrophic impact of this parasite makes it the most important disease threat to UK wild Atlantic salmon populations. In general countries free of listed diseases rely on passive surveillance, notably farmer reporting of disease, for early detection of disease incursion. In England and Wales (E&W), Atlantic salmon are farmed in only a small number of catchments (and in low numbers). Early detection of *G. salaris*, if introduced, relies on active surveillance in wild populations and reporting by declining salmon populations or observations of morbidity or mortality.

ctive surveillance of wild salmonid populations for *G. salaris* has been made considerably easier by recent work at Cefas on the development and validation of a non-lethal hydrogen peroxide bath and filtration method for collecting gryodactylid parasistes from live fish (Thrush *et al*., 2019). This work represents an important step forward in surveillance of both wild and farmed fish populations for *G. salaris* as it removes the need for destructive testing of juvenile salmon, and importantly, increases parasite recovery rate compared to whole body examination of killed fish (84.6% and 51.9%, respectively). The approach increases the rate at which samples can be processed, potentially reducing the scope of a national surveillance programme from months to weeks). By allowing more samples to be analysed, the sensitivity of surveillance activities increases and our confidence in freedom from *G. salaris* increases. Non-lethal sampling applied in surveillance programmes, following detection of the parasite, allows uninfected river catchments to be rapidly released from controls, thus easing their economic impact. Although the method has not yet been used on fish infected with *G. salaris,* it is likely to be effective and is described in the updated chapter of OIE manual of diagnostic tests for aquatic animals for *G. salaris* (proposed for adoption at the OIE General Session, May 2021). This work underpins a robust and defensible *G. salaris* strategy for the UK and has been incorporated into Defra's (E&W) national aquatic animal disease contingency plan.

Allied to the non-destructive methods of sampling Cefas has also been investigating more robust and efficient molecular diagnostic methods to reduce our reliance on labour-intensive morphometric techniques to distinguish pathogenic *G. salaris* from endemically occurring non-pathogenic gyrodactylid species (e.g. *G. truttae, G. derjavinoides*); reducing the laboratory effort required to undertake surveillance work by more than 50% and also improving accuracy of detection. These include the development of diagnostic pipeline required to screen large numbers of parasites during a disease outbreak and subsequent outbreak tracing. Cefas is currently using a 96 well format for extraction, amplification and sequencing of the internal transcribed spacer (ITS) region that allow for the discrimination of the three species commonly found on salmonids species native to the UK. The updated OIE manual chapter for *G. salaris* provides tools to discriminate between the different *G. salaris/G. thymalli* lineages based on partial CO1 gene sequencing. Cefas has successfully applied this approach to the identification of gyrodactylids isolated from Atlantic salmon, grayling and brown trout on UK river

catchments in 2018 and 2019. The CO1 sequence analysis of samples from three catchments where Atlantic salmon and grayling cohabit has shown that the gyrodactylids found on grayling are assigned to lineages distinct from those containing the *G. salaris found* on the salmon in *G.salaris* positive countries.

An evaluation of the suitability of real-time qPCR methods to screen for *G thymalli* in pooled individuals is ongoing, however, initial indications are that an individual *G thymalli* can be readily identified in a pool of 12 *G. truttae* and *D. derjavinoides*. Further, there is also good evidence that low numbers (≤5 individuals) of *G.thymalli* can be detected directly in the ethanol fixative without the need to isolate the individual parasites. This would allow for an initial screen of large numbers of samples from across a catchment and determine if further work is required to discriminate between *G. salaris* or the *G. thymalli* lineages in the sample by CO1 amplification and sequencing. Further work is still required on the potential cross reactivity with the ITS sequences of other non-salmonid gyrodactylids occasionally found when sampling Atlantic salmon and brown trout; *G. macronychus, G. gasterostei, G.prostae/G. elegans, G. jiroveci* an *G. rogatensis*

The updated OIE diagnostic manual for *G. salaris* also proposes the use of a real-time PCR on environmental (i.e. water) samples for surveillance of *G. salaris* – an eDNA method. A positive result would require confirmation using gyrodactylid samples obtained from a fish host and sequencing of the CO1 gene (a positive result using the proposed eDNA method does not distinguish between *G. salaris* and *G. thymalli*). If the revised chapter is adopted, it will be the first application of eDNA method in the OIE manual. Sampling water in place of fish can considerably reduce the time and resources needed to undertake surveillance. However, additional further work is required to fully validate the sensitivity of the method. eDNA water samples should be analysed not only for the presence of *G. salaris*, but simultaneously for host species for *G. salaris* and *G. thymalli*: Atlantic salmon, rainbow trout, brown trout and grayling. In the UK grayling are sympatric with Atlantic salmon in many rivers, which will limit the application of the current eDNA method.

Early detection of *G. salaris* if introduced is critical to a rapid, effective response, aimed at minimising spread to uninfected populations. The use of a non-lethal method for collecting *G. salaris* from both hatchery and wild Atlantic salmon populations removes many of the barriers to sampling (resistance by riparian owners, impact on threatened salmon populations). Work to determine the range of CO1 sequences from *G. thymalli* in E&W will improve the accuracy and speed of the interpretation of surveillance results in the event of an outbreak. Research to determine the level of gyrodactylid pooling that can be safely applied without loss of sensitivity further supports more extensive active surveillance. The application of eDNA methods also has the potential to further reduce the time and cost of surveillance for *G. salaris*.