North-East Atlantic Commission

NEA(17)4

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

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1. In 2004, NASCO's North-East Atlantic Commission organised a Workshop to discuss the need to minimise the threat posed by *Gyrodactylus salaris* to Atlantic salmon. 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. The 'Road Map' includes recommendations on:

   - opportunities to enhance co-operation on monitoring, research and exchange of information;
   - the need for revisions to international guidelines and other measures to prevent the further spread of the parasite; and
   - strengthening of national and regional legislation and measures to prevent the spread of the parasite.

2. In view of the serious threat posed by this parasite, the North-East Atlantic Commission established a Working Group on *G. salaris* and meetings were held in both 2006 and 2007. In 2008, the North-East Atlantic Commission decided not to convene further meetings of the Working Group but to retain an item on its Annual Meeting agenda to allow developments in relation to the parasite to be monitored. 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'. There have, of course, been significant developments over the last ten years or so, not least in relation to international guidelines and other measures to prevent the spread of the parasite and in its eradication.

3. Last year, the North-East Atlantic Commission agreed to reconvene the Working Group and asked that it undertake the following tasks:

   - provide a forum for exchange of information among the Parties/jurisdictions on research on, and monitoring and control programmes for, the parasite *G. salaris*;
   - review progress in relation to the Commission's 'Road Map' and advise of any changes required;
   - 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; and
   - develop recommendations for future research.

4. The Working Group met in London during 7 and 8 March under the Chairmanship of Mr Stian Johnsen (OIE). Its report is attached. Annex 12 contains a revised 'Road Map' which the Working Group recommends is adopted by the North-East Atlantic Commission given the potentially devastating impacts of this parasite on wild salmon stocks. This revised 'Road Map' has been considerably simplified to remove duplication and reflect changes in EC fish health legislation and it has been re-formatted without reference to the original source of the recommendations, responsibilities and timeframe for action which should be clear from the text.

5. The Working Group stressed the importance of ensuring that adequate measures are in place to prevent the introduction of the parasite and it was recommended that publicity material highlighting the risks posed by the parasite be disseminated by the competent authorities and made available on the NASCO website. The Secretariat might be asked to develop standard text for use in such publicity material. The Working Group noted that legislation should recognise different strains and their pathogenicity. In the event that *G. salaris* and *G. thymalli* were synonymised there could be serious consequences for the protection afforded by Additional Guarantees. Emerging risk factors for the spread of *G. salaris* include a changing climate, which could result in reduced salinities, and changes in migration patterns with smolts entering the sea but then migrating into other rivers. In this regard, the Working Group noted with concern the continuing spread of *G. salaris* along the west coast of Sweden and it was suggested that salinity levels in the Skagerrak may not always be at levels that would prevent the further spread of the parasite.

6. The Working Group has recommended that the North-East Atlantic Commission retain an item on its agenda to allow for an exchange of information on *G. salaris* and that to facilitate this there be a further meeting of the Working Group in 2018 but, thereafter, only every three years. The importance of developing and testing contingency plans was highlighted and it was noted that these are at different stages of development in different countries. The Working Group recommends that the North-East Atlantic Commission request that contingency plans be made available through the Secretariat in advance of the Working Group meeting in 2018 and that those countries without plans be encouraged to develop them as a matter of urgency.

7. The North-East Atlantic Commission is asked to consider the recommendations in the attached report and decide on appropriate actions. If it agrees to proceed with a further meeting of the Working Group in 2018, the Terms of Reference might be as follows:

   - 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;
   - 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.

Stian Johnsen
Working Group Chairman

Peter Hutchinson
Secretary

Edinburgh
7 April 2017

GSWG(17)15

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

Rydges Kensington Hotel, London, UK

7 and 8 March 2017

1. Opening of the Meeting

1.1 The Chairman, Mr Stian Johnsen (OIE), opened the meeting and welcomed participants to London. He noted that in 2004, NASCO's North-East Atlantic Commission had organised a Workshop to discuss the need to: minimise the threat posed by *Gyrodactylus salaris* to Atlantic salmon; enhance cooperation on monitoring, research and dissemination of information on the parasite; strengthen national and regional legislation to prevent further spread of the parasite; and consider revisions to the international guidelines relevant to preventing its spread. He indicated that the Workshop had developed many recommendations and, following further work, these were collated into a 'Road Map' outlining responsibilities and a timeframe for action. The 'Road Map' includes recommendations for enhanced cooperation on monitoring, research and exchange of information and revisions to national, regional and international guidelines and other measures to prevent the further spread of the parasite. He recalled that the North-East Atlantic Commission had established a Working Group on *G. salaris* and that meetings of this Working Group were held in both 2006 and 2007. However, the North-East-Atlantic Commission had decided not to convene meetings of the Working Group since 2007 although it had retained an item on its agenda to allow developments in relation to the parasite to be monitored. Limited time is, however, available at these meetings and there had been limited exchange of information on the parasite and consideration of progress with the recommendations in the 'Road Map' or their continuing relevance. He noted that under NASCO's Strategic Approach, the parasite *G. salaris* is identified as one of six primary challenges facing the conservation and management of wild Atlantic salmon and, at its 2016 Annual Meeting, the Commission had agreed to reconvene its Working Group with the intention of providing a forum for a more detailed exchange of information and development of recommendations on measures needed to prevent the spread of the parasite, for its eradication where introduced and for future research. He wished participants a successful meeting and an enjoyable stay in London.

1.2 A list of participants is contained in Annex 1. There were no representatives at the meeting from Sweden (although a paper on monitoring and management of *G. salaris* in Sweden has been provided), Denmark, France, Spain, Germany or Portugal.

2. Adoption of the Agenda

2.1 The Working Group adopted its Agenda, GSWG(17)12 (Annex 2), but decided that item 6 of the Draft Agenda entitled 'Development of recommendations for future research on *G. salaris*' would be covered under item 5 'Development of recommendations for updating the 'Road Map''.

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, GSWG(17)2. These request that the Working Group undertake the following tasks:

- provide a forum for exchange of information among the Parties/jurisdictions on research on, and monitoring and control programmes for, the parasite *G. salaris*;
- review progress in relation to the Commission's 'Road Map' and advise of any changes required;
- 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; and
- develop recommendations for future research.

3.2 The Working Group agreed that after presentation of reports by each Party/jurisdiction (see paragraph 4.2 below) it would review each element of the 'Road Map' and propose changes where required. The Chairman advised the Working Group that its recommendations will be considered by the North-East Atlantic Commission of NASCO at its Thirty-Fourth (2017) Annual Meeting in Varberg, Sweden, in June. The importance of preventing the further spread of the parasite and to be able to respond rapidly with mitigation measures in the event of its introduction were highlighted.

4. Review of progress in implementing the Commission's *G. salaris* 'Road Map', NEA(06)9

4.1 The 'Road Map', NEA(06)9, contains recommendations concerning the following:

- opportunities to enhance co-operation on monitoring research and exchange of information;
- the need for revisions to international guidelines and other measures to prevent the further spread of *G. salaris; and*
- strengthened national and regional legislation and measures to prevent the further spread of *G. salaris.*

4.2 In preparation for the meeting, each Party/jurisdiction had been asked to prepare a brief paper updating the reports that were made at the Working Group's last meeting in 2007, including details on:

- monitoring and control programmes for, and distribution of, the parasite;
- on-going and planned research; and
- measures being taken to prevent the spread of the parasite and eradicate it where it has been introduced.

4.3 The following reports had been received and distributed to all participants:

- Eradication measures in Norwegian Rivers, GSWG(17)3, (Annex 3);
- *Gyrodactylus salaris* in Sweden; management and monitoring, GSWG(17)4, (Annex 4);

- Monitoring and control programmes and measures being taken to prevent the spread of the parasite and eradicate it where it has been introduced (Tabled by Norway), GSWG(17)5, (Annex 5);
- *Gyrodactylus salaris* monitoring in Northern Ireland (Update February 2017), GSWG(17)6, (Annex 6);
- *Gyrodactylus salaris* update paper - contribution from Marine Scotland, GSWG(17)7, (Annex 7);
- Briefing Paper on *Gyrodactylus salaris* (Tabled by EU Ireland), GSWG(17)8, (Annex 8);
- *Gyrodactylus salaris* update paper - contribution from Finland, GSWG(17)9, (Annex 9);
- *Gyrodactylus salaris* monitoring programme in the Russian Federation. Status of index salmon rivers, GSWG(17)10, (Annex 10);
- Briefing Paper on *Gyrodactylus salaris* (Tabled by EU England and Wales), GSWG(17)11, (Annex 11).

Sweden

4.4 *G. salaris* was first detected on the west coast of Sweden in 1989 and at present only 7 of the 23 salmon rivers are uninfected. The majority of uninfected rivers are in the north i.e. in the Skagerrak Sea where saline ocean water occurs. In Sweden, although mortality of individual fish attributable to the parasite has been recorded, there is no significant evidence of large-scale effects on salmon production in infected rivers. In 2001, an annual *G. salaris* monitoring programme was implemented with identification of species and clades carried out by Norwegian scientists. The Swedish authorities consider *G. salaris* to be a serious threat to remaining uninfected salmon stocks, and also to neighbouring stocks in Norway. Protective measures have been introduced to avoid spreading the parasite including a ban on stocking or rearing salmonid fish in the catchments of uninfected rivers. Eradication programmes have not been undertaken and the intensity of infection has been found to decrease over time even in the absence of treatment. An information leaflet has been produced describing the problem and containing recommendations for anglers to avoid accidental spread of the parasite with fishing gear and there is a good level of awareness of the risks among the angling community in Sweden. There is also good co-operation and data exchange with Norway and the data have been used in developing risk analyses regarding the possible spread of the parasite from Sweden to Norway.

Ireland

4.5 *G. salaris* is listed as a notifiable disease in Ireland and legislation is in place to prevent 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 but 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. Since 2005, wild salmon parr from selected river systems in Ireland have been examined annually for the presence of *G. salaris* by the Fish Health Unit of the Marine Institute. This monitoring is undertaken in conjunction with the catchment-wide electrofishing programme managed by Inland Fisheries Ireland. In a more general context, the Marine Institute is responsible for investigating unexplained abnormal or significant fish mortalities encountered in Ireland

which may be a result of fish disease, while Inland Fisheries Ireland have statutory responsibility for the management of wild salmonid fisheries in Ireland. The Marine Institute is the Competent Authority for the Fish Health Directive. *G. salaris* has not been recorded on the island of Ireland to date. There is presently no on-going or planned research on *G. salaris* in Ireland. A detailed contingency plan for dealing with any outbreak of *G. salaris* in Ireland has been drafted by the Marine Institute, in consultation with relevant stakeholders including Inland Fisheries Ireland, and is likely to be published in advance of the Thirty-Fourth Annual Meeting of NASCO in June 2017. The plan will set out in detail the operational responsibilities and actions to be taken in the event of a suspected outbreak. In addition to the contingency plan, literature to highlight the issue of *Gyrodactylus* and advise on biosecurity measures that can be taken to minimise the risk of introduction of the parasite to Ireland has been developed and widely circulated among stakeholders. It includes a *Guide to Protecting Freshwater Fish Stocks in Ireland from the Parasite Gyrodactylus salaris* (https://goo.gl/NRgVY0) and, in addition, both state agencies host information about *G. salaris* on their websites.

Russian Federation

4.6 In Russia, *G. salaris* was first recorded in the Keret River (Republic of Karelia, White Sea basin) in 1992, probably following introduction into the river through aquaculture activities. Parasitological surveys to monitor for *G. salaris* have been carried out since 1993 in five index rivers of the Murmansk region (Pecha, Pack, Kola, Kovda and Kanda) and in the Keret River of the Republic of Karelia. To date, the parasite has not been found in the salmon rivers of the Murmansk region (either the Barents Sea or the White Sea basins). The infestation of juvenile Atlantic salmon with *G. salaris* was studied in the Keret River in 2016. The parasite was found on all fish sampled (n = 12) with the number of parasites per fish varying from 17 to 1,083 and an abundance rate of 164 parasite per fish. Salmon catches in the Keret River in the early 1980s varied from 2 to 3 tonnes and annual adult returns never fell below 2,700 salmon until the early 1990s. The maximum number of salmon counted at the barrier fence in the Keret River was 4,660 salmon in 1983, but in the period 2008 - 2015 the wild salmon count varied from 43 - 223 fish. In the light of recent aquaculture developments in the Murmansk region and Karelia, transfers of rainbow trout from areas with *G. salaris* (e.g. the Leningrad region and parts of Karelia) represent a high risk of further spreading the parasite into Atlantic salmon rivers. The parasite may also be transferred with fishing equipment in recreational fishing widely practiced in the Kola Peninsula.

Finland

4.7 The results of monitoring in the catchments of rivers in Finland draining into the Barents Sea have been negative for *G. salaris*. The rivers Tenojoki and Näätämöjoki both have free status for *G. salaris*. There were two fish farms in the River Paatsjoki catchment area in 2006 but only one from 2011 onwards. There has been no fish farming activity in other catchments during the monitoring period, although in some years, local brown trout eggs have been incubated in a miniature hatchery in the River Näätämöjoki catchment during winter and spring. In recent years, scientific research on *G. salaris* at the University of Oulu has focused on the molecular ecology and evolution of the parasite but it is expected that the amount of research on this parasite will now decline following retirement of the lead researcher. In Finland, the goal is to prevent the spread of *G. salaris* to the rivers of the Barents Sea catchment area but the parasite is widely distributed in rivers and fish farms in other catchment areas in Finland and eradication of the parasite from its natural distribution areas has been considered to be impossible in

Finland. Measures to prevent spread of *G. salaris* to Barents Sea catchment areas include restrictions of fish movements, prohibition of the use of baitfish, requirements concerning drying or disinfection of fishing equipment, boats *etc*. and these have not changed since 2007. During the period 2006 - 2016, publicity material related to preventing the spread of the parasite has been developed with stakeholders and disseminated mainly through the internet. Leaflets on preventing the spread of the parasite were updated in 2014 and published in Finnish, Swedish, Samish, English and Russian. The leaflet is issued to every fisherman purchasing a fishing license for the River Tenojoki. *G. salaris* has also been on the agenda of the Finnish-Norwegian Transboundary Water Commission and in the negotiations of the new agreement for the Tenojoki between Finland and Norway during the last few years. In the event of a *G. salaris* outbreak in the River Tenojoki, there will not be possibilities to totally eradicate it. The preliminary work in developing a contingency plan for the rivers Tenojoki and Näätämöjoki was published in 2013. Measures to be considered in the event of the parasite being introduced include live gene banking and maintaining some areas free of the parasite. Contingency planning with Norway was proposed in the report of the preliminary study.

United Kingdom

4.8 The consequences of *G. salaris* introduction into the United Kingdom would be severe for salmonid stocks with potential for riverine stock losses of up to 98%. The economic consequences of such losses would also be severe. Three main categories and respective introduction pathways have been identified and analysed for the level of risk they pose. These are with live fish and gametes (e.g. imports of live fish and rainbow trout eggs); fish carcasses; and mechanical transmission (in ships' ballast water, in well boats and fishing gear and with lumber imports). The UK is one of the few areas within the EU that is recognised free from the parasite, along with the Republic of Ireland and two river catchments in Finland, and is able to restrict imports of live salmonids to countries that have an equivalent health status, i.e. demonstrated freedom from *G. salaris* and are approved as such by that country's competent authority.

4.9 To satisfy Article 43 of Directive 2006/88/EC, sampling of species susceptible to *G. salaris* is required as part of the criteria to maintain national control measures for the freedom of the parasite in England and Wales. Due to the low number of salmon farms in England and Wales, samples are obtained from wild salmonid populations. Monitoring for *G. salaris* in England and Wales is conducted through a rolling programme of sampling covering all river catchments which contain salmon. Within England and Wales, there are seventy-eight rivers that support salmon, although not all currently host large populations. Each of the catchments is sampled approximately every five years where possible. Since 2007, fifty-four sites on forty-three catchments have been sampled. In this time, *G. salaris* has not been found in any of the samples. However, several other gyrodactylid species native to the UK have been identified: *G. derjavininoides* (host is brown trout but also found on rainbow trout); *G. thymalli (h*ost is grayling) and *G. truttae* (host is brown trout and Atlantic salmon). In 2016, a novel non-destructive method for sampling wild salmonids was introduced and a request will be made that is included in the OIE manual of diagnostic tests for aquatic animals.

4.10 Yearly (2007 to 2016) sampling data for gyrodactylid parasites in Scotland was presented. In summary, the surveillance undertaken continues to support Scotland's disease free status with respect to *G. salaris*. No evidence of the parasite has been detected over the sampling period from 1 January 2007 to 31 December 2016. Targeted

surveillance on fish farms and within wild fisheries was undertaken up until 2010. However, the introduction of Council Directive 2006/88/EC instigated a change from targeted surveillance towards risk based surveillance (both active and passive initiatives) with the aim of increasing the frequency of surveillance in areas which presented a greater risk of contracting and spreading disease. Across all freshwater fish farm sites in Scotland, which hold susceptible species and life stages, active surveillance for *G. salaris* remains in place. Fisheries, including wild and put and take, are covered through a passive surveillance programme. Passive surveillance involves communicating and informing relevant stakeholders about various listed disease and associated clinical signs and ensuring notification systems are in place for any case of suspicion together with the appropriate response by the competent authority. Following the reduction in sample throughput after 2010/2011, and with the development of the Q-PCR method, morphological assessment is now not routinely undertaken and diagnosis relies solely upon molecular methods.

4.11 At present Marine Scotland Science is not actively involved in any scientific research work concerning *G. salaris* but since the last meeting of the Working Group it has carried out research to improve approaches to screening for, and identification of, the parasite. Scotland (as part of the GB health zone), has recognised disease freedom with respect to *Gs*; as a consequence, 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 salt water for a designated period; or in the case of eggs they have been disinfected prior to dispatch. In 2007, the 'Home and Dry' campaign was launched in order to raise awareness of the potential risks to Scotland from *G. salaris* being introduced on fishing tackle and with associated water sports. Preventive treatment including disinfection of equipment are advocated. Many wild fishery stakeholders have taken measures at the local level to help prevent the introduction of *G. salaris* including ensuring equipment is disinfected, educating anglers, developing catchment contingency plans and mapping catchments to facilitate eradication. Marine Scotland maintains contingency plans (currently in their fourth edition) to deal with an outbreak of *G. salaris* which include an MoU with Norway for assistance in the event of an outbreak. Exercises to test Scotland's response to an outbreak of *G. salaris* (including Exercise Alpheus) have been conducted on a GB-wide basis.

4.12 In Northern Ireland, a rolling regime of testing for *G. salaris* has taken place since 2007 on both operational fin fish farms and in wild catchment areas (by electrofishing) with 10 - 12 sites each for both farmed and wild stock areas being monitored each year and, subject to confirmation, this monitoring is expected to continue in 2017/18. Northern Ireland has continued freedom from *G. salaris*. There is no research currently ongoing or planned into *G. salaris*. Both published information leaflets and the internet are used to inform anglers and stakeholders of the risks associated with the parasite and disinfection of fishing gear is recommended where anglers have been fishing in other areas. With the re-organisation and reduction in the number of Government Departments in 2016 there is a need to review and update the current Northern Ireland and cross-border contingency plans. It is hoped that this work will be taken forward in 2017/18. There has been no testing of the plan to date.

Norway

4.13 Monitoring for *G. salaris* has been conducted in Norwegian rivers since the late 1970s. In 2015, 106 farms (3,651 fish) and 69 rivers (2,320 fish) were sampled with a similar

programme in 2016. To ensure adequate sampling, a risk-based programme has been developed and involves sampling: rivers declared free after treatment; the 30 rivers with the largest salmon stocks; rivers with a high risk of infection from migrating fish; and other rivers at risk e.g. because of proximity to infected rivers. Moreover, Norway has an epidemiological surveillance programme in newly infected rivers and a post-treatment control programme. The use of eDNA and electrofishing can provide information on the presence of rainbow trout which can be vectors spreading the parasite. Project Gyrofri seeks to assess the risk of *G. salaris* from rivers in the Drammen area infecting other rivers draining into the Oslofjord given increased freshwater runoff and declining salinity. The findings have been used in decisions concerning stocking. This project will start investigating the migration patterns of salmon in the Oslofjord using an acoustic method.

4.14 In Norway, control and eradication has used chemical treatment and fish barriers (e.g. closed fish ladders or specially constructed barriers) to reduce the scale and complexity of the treatments and the amount of chemical and resources required. Juvenile salmon in the area above the barrier will either die or migrate to sea and, if migrants are excluded, the parasite will eventually disappear from the area if there are other long-term susceptible hosts e.g. brown trout. Rotenone, first used to eradicate *G. salaris* in 1981, has been the most important chemical treatment but more recently acid aluminium has also been used. Acid aluminium targets the parasite not the host so, with the exception of acid-sensitive species, it does not kill fish and other aquatic life. It is used to treat free-flowing areas whereas rotenone is used in backwater areas. Changes to the treatment methods have been implemented since 2003 which have improved the success rate. They include increasing the concentration of rotenone and use of heavy rotenone in upwelling areas, improved planning, timing of treatment with regard to water temperature and discharge, and double treatments. By 1 January 2017, *G. salaris* had been successfully eradicated from 22 rivers and a further 21 rivers have been treated and are being monitored (there must be a period of 5 years following treatment without detection of the parasite before the treatment is considered to be successful). If these treatments are successful, the number of infected rivers will have been reduced from 50 to 7. Treatment has commenced in the Driva region, including construction of a barrier in the River Driva, and a Working Group has been established to assess options for treating the Drammen River. There are currently no infected fish farms in Norway. It was noted that it is difficult to obtain funding for research on *G. salaris* in Norway although some research has been funded by the management agencies including studies on Arctic char. Work has also been undertaken on the development of an eDNA probe for *G. salaris* but this has not yet proved successful as it is difficult to prove absence rather than presence of the parasite. New treatment methods are also being considered including the use of chloride but as this is toxic to fish the concentration used needs to be very carefully controlled. Levels lower than chloride levels in drinking water are toxic to *G. salaris.*

Working Group Recommendations

4.15 The Working Group noted with concern the continuing spread of *G. salaris* along the west coast of Sweden and it was suggested that salinity levels in the Skagerrak may not always be at levels that would prevent the further spread of the parasite.

4.16 The Working Group noted that very little research is currently ongoing with regard to *G. salaris* and that availability of funding was a major factor. The 'Road Map' contains recommendations for research. These remain valid but in addition the Working Group noted the need for research on differentiating pathogenic and non-pathogenic forms of

the parasite and on the effects of environmental factors on pathogenicity. The Working Group recognised that it could play an important role in providing a forum for exchange of information on on-going and planned research, measures to prevent the spread of the parasite and techniques to contain and eradicate it if introduced. The Working Group recommends that, in future, it should meet every 3 years commencing in 2018. The Working Group noted that Implementation Plans currently seek information on measures to prevent the introduction and further spread of *G. salaris* and that some Parties/jurisdictions had identified the parasite as a threat/challenge to management and had included an action related to this. However, not all NEAC Parties/jurisdictions had done so and it considered that, given the threat posed, an exchange of information and consideration of best practice would be best facilitated through periodic meetings of the Working Group.

4.17 The Working Group discussed changes to approaches to monitoring. Under EC Directive 2006/88, where a country is free of the parasite, it can adopt a passive approach to monitoring wild fish. While many countries still undertake targeted surveillance, which has the benefit of maintaining skill levels which would be important in the event of an outbreak of the parasite, it was recognised that such sampling is very demanding of resources, and would require escalation in some situations, if it was to be at a level that would give confidence of early detection. The importance of ensuring that adequate measures are in place to prevent the introduction of the parasite was stressed.

4.18 The importance of developing and testing contingency plans was highlighted and it was noted that these are at different stages of development in different countries. The Working Group recommends that the North-East Atlantic Commission should request that contingency plans be made available through the Secretariat and that those countries without plans be encouraged to develop them as a matter of urgency. The Working Group had previously developed guidelines on the elements to be included in contingency plans which are as follows:

Legal aspects

1. There should be a legal basis which describes what powers the authorities have or do not have to deal with an outbreak of *G. salaris*. A clear statement should be prepared in advance of the policy that will be followed concerning eradication or containment of the parasite.

Publicity

2. As a precautionary measure the public should be advised in advance of what actions they should take in the event of an outbreak of the parasite.

Movement restrictions

3. In the case of a suspected outbreak, movements of live fish and equipment from the suspect area should immediately be regulated.

Strategy Groups

4. Each Party or relevant jurisdiction should establish a Disease Strategy Group to manage the response to the outbreak. The contingency plan should contain a list of factors to be considered by this group in deciding upon an eradication or containment policy. If necessary, local disease control centres could also be established.

5. An expert scientific group should be established to ensure that up-to-date scientific knowledge is available to the Disease Strategy Group.

6. The role of these groups should be clearly established in advance, together with contact details.

Review

7. The plan should be reviewed annually in January and updated in the light of new information. A test run of these arrangements should be conducted periodically.

Investigations

8. Epidemiological and other appropriate investigations should start immediately an outbreak is suspected.

4.19 The Working Group noted the importance of developing publicity material related to the risks posed to wild salmon stocks by *G. salaris* and noted that this had been done in a number of countries. The need to increase public awareness was noted and it is recommended that such publicity material be widely disseminated by the competent authorities and made available on the NASCO website. The Working Group recommends that the NASCO Secretariat develop standard text as a basis for publicity material.

4.20 The Working Group discussed the risks of transfer of the parasite on fishing gear and on boats and canoes. It was noted that there was only one known case where spread of the parasite was believed to have occurred on fishing gear and that involved a poaching incident in an infected river in Norway in which the net was subsequently used in an uninfected river. Concern was expressed that canoeists may inadvertently transfer the parasite on their canoes. At its last meeting, the findings of a risk assessment conducted in Norway had been presented. This study suggested that such transmission was unlikely because even during an epidemic there is less than one parasite per ten cubic meters of water and they are distributed close to the river bottom. Nonetheless, the Working Group recognised that although the risk of transmission with movements of canoes may be low, as with the risk of transmission on fishing equipment, the consequences could be very severe. It would be consistent with the requirements on anglers if efforts were made to ensure that canoeists and other boat users are aware of the need to take precautions to prevent the spread of the parasite. This may also offer broader biosecurity benefits.

4.21 The Working Group recognised that emerging risk factors for the spread of *G. salaris* include a changing climate which could result in reduced salinities and changes in migration patterns with smolts entering the sea but then migrating into other rivers.

4.22 The Working Group was advised that in Norway, in response to an outbreak of the parasite, the immediate response is to close the river given that planning for an eradication programme is a long process. The Working Group recognised the enormous progress made by Norway in eradicating the parasite from infected rivers and the increased success of the methods used following development of procedures in the light of experience. This expertise would be invaluable to other countries in the event of an outbreak.

5. Development of recommendations for updating of the 'Road Map'

5.1 The Working Group noted that when the 'Road Map' was developed in 2004 and updated in 2006, there was considerable uncertainty about new EU fish health legislation which was under review at that time. Many of the recommendations for revisions to international guidelines contained in the 'Road Map' related to the replacement of EC

Directive 91/67 which was subsequently replaced by a new Directive, 2006/88/EC. This will be replaced shortly by a new Commission regulation (2016/429) that will cover both terrestrial and aquatic animal health but the provisions relating to aquatic animals remain unchanged. The Working Group agreed that the 'Road Map' could be simplified considerably to remove duplication and reflect changes in the EC fish health legislation and re-formatted without reference to the original source of the recommendations, responsibilities and timeframe for action.

5.2 A revised 'Road Map', GSWG(17)13, is contained in Annex 12 and the Working Group recommends that the North-East Atlantic Commission consider adopting this document given the potentially devastating impacts of this parasite on wild salmon stocks if introduced.

6. Other Business

6.1 At its last meeting in 2007, the Working Group had discussed the implications of the so-called EU 'Biocides Directive' for the continuing use of rotenone. The representative of Norway indicated that the process for registering rotenone is ongoing and is being led by the UK. He indicated that this process is now not expected to be concluded before 2023 and that in the meantime continuing use of rotenone is permitted. This use will continue to be permitted if the registration is successful but if not an application for use would need to be made and this could delay the initiation of treatment in the case of an outbreak. The Working Group had also previously noted that in the event of a major demand for rotenone there could be a delay depending on the existing demand for the product. The Working Group welcomed the efforts to develop new, environmentally-friendly treatment methods.

6.2 At the Working Group's last meeting the findings of a number of cost-benefit analyses were presented. A new study has commenced in Norway and is expected to report in two or three years' time. The project is being coordinated by NINA. To date, approximately NOK1 billion has been spent on the Norwegian *G. salaris* programme. The value of recreational fishing in Ireland has been estimated to be Euro836 million annually, of which about Euro210 million is associated with salmonid fisheries.

6.3 The Working Group noted that legislation should recognise different strains and their pathogenicity. In the event that *G. salaris* and *G. thymalli* were synonymised there could be serious consequences for the protection afforded by Additional Guarantees.

7. Report of the Meeting

7.1 The Working Group agreed a report of its meeting.

8. Close of the Meeting

8.1 The Chairman thanked all participants for their contributions, wished them a safe journey home and closed the meeting.

Annex 1

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

Participants

Ciaran Byrne, Inland Fisheries Ireland, Ireland

Seamus Connor, Department of Agriculture, Environment and Rural Affairs, UK

Peter Hutchinson, NASCO Secretariat

Geir Jakobsen, Norwegian Food Safety Authority, Norway

Stian Johnsen (Chair), OIE, France

Paul Knight, NGO Co-Chair

Perttu Koski, Finnish Food Safety Authority EVIRA, Finland

Michael Millane, Inland Fisheries Ireland, Ireland

Tor Atle Mo, NINA, Norway

Edward Peeler, Cefas, UK

Sergey Prusov, PINRO, Russian Federation

Neil Purves, Marine Scotland, UK

Jarle Skeinkjer, Directorate for Nature Management, Norway

David Stone, Cefas, UK

Annex 2

GSWG(17)12

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

Agenda

1. Opening of the Meeting
2. Adoption of the Agenda
3. Consideration of the Terms of Reference
4. Review of progress in implementing the Commission's *G. salaris* 'Road Map', NEA(06)9
   (a) Monitoring and control programmes for, and update on the distribution of, *G. salaris;*
   (b) On-going and planned research concerning *G. salaris* and future research requirements;
   (c) Measures to prevent the spread of the parasite and to eradicate it where it has been introduced:
      (i) international initiatives;
      (ii) national and regional initiatives, including progress in developing contingency plans
5. Development of recommendations for updating of the 'Road Map'
6. Other Business
7. Report of the Meeting
8. Close of the Meeting

GSWG(17)3

Eradication measures in Norwegian rivers

In recent years, control and eradication efforts have focused on a combination of fish barriers and chemical treatments.

1. Fish barriers

1.1. Long term barriers

Artificial barriers (fig.1) prevent Atlantic salmon from migrating upstream, which can reduce the amount of infested drainage. Barrier construction thus reduces the size and complexity of the treatments and the amount of chemical and other resources needed while increasing the chance of success. The young Atlantic salmon already present in the newly excluded area will either die or migrate out to sea, and the parasite will eventually disappear from the area if migrants are excluded for 4 to 6 years and there are no non-migratory hosts. The presence of non-migratory hosts such as rainbow trout (*Oncorhynchus mykiss*) and arctic char (*Salvelinus*

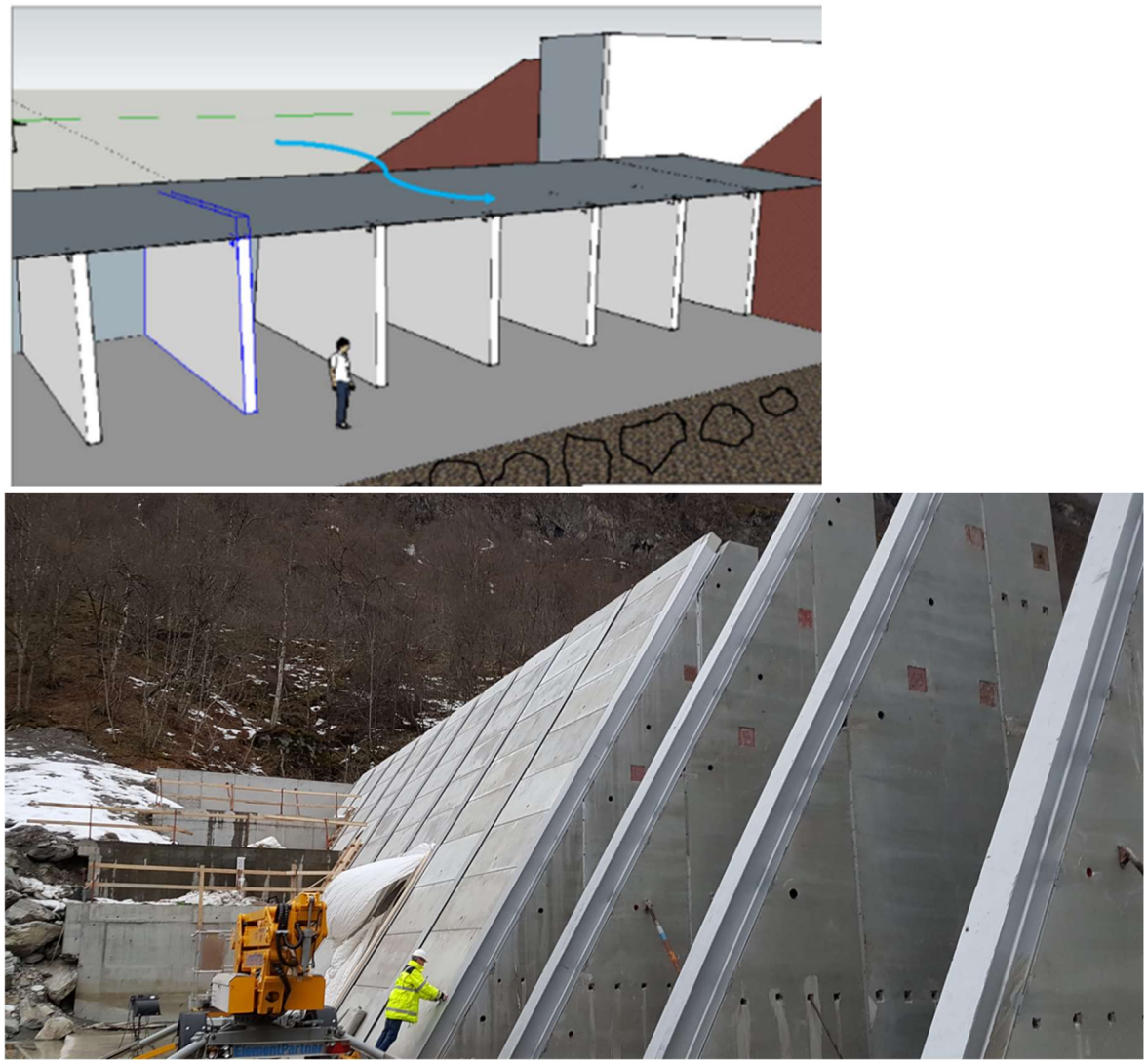

Fig.1 *A big long term barrier is now under construction in the river Driva. The barrier should be completed by spring 2017.*

alpinus) are contradictive to excluding migratory hosts. Closed fish ladders on the Vefsna River and the Rana River significantly reduced the required treatment area from 126 to 28 km and from 66 to 13 km, respectively. Closed fish ladders are the most common form of permanent barriers, but barriers have been constructed exclusively for eradication and control efforts.

1.2 Short term barriers

Temporary barriers (fig. 2) have been constructed for the purpose of optimizing a chemical treatment by isolating a tributary and allowing for its treatment independent of the main watercourse thus, dividing the drainage into smaller segments that reduces treatment complexity and opportunities for human error and increases the likelihood of success.

Fig. 2 *Temporary barrier in a tributary of the River Ogna*

2. Chemical treatments

There has been significant activity in combating the parasite since last meeting in NASCOs Working Group on *G. salaris* in the North-East Atlantic Commission Area in October 2007 (tab. 1).

2.1 Rotenone

Rotenone has been the most important tool for combating *G. salaris* by killing the host. Rotenone is a phosphorylation inhibitor. Rotenone was first used to eradicate *G. salaris* in 1981. Since then, a number of eradication projects have been completed in Norwegian rivers.

2.2 Acid aluminum

Use of acidic aluminum is a newly developed method. It is used in a manner similar to rotenone except that the parasite, not the host, is targeted. The method was developed through laboratory experiments and then refined during field trials. If correctly applied, the aluminum cations kill the parasite while fish and other animal life, with the exception of acid-sensitive species, are not significantly affected. Aluminum sulfate ($Al_2(SO_4)_3$) is dissolved in sulfuric acid (10–30% H_2SO_4). Low pH (<5.5) must be maintained for aluminum to exist as cations in the water. In neutral waters (pH 6.5–7.5), the concentration of cations is low. The parasite must be exposed

continuously for 7–12 days for the treatment to be effective. Acid-aluminum has been used in combination with rotenone in *G. salaris* eradication attempts. Acid-aluminum is applied to the free-flowing portion of the waterway where the majority of the fish reside, and rotenone is used in the backwater areas where aluminum hardly can be used effectively.

Tab 1. *Chemical treatment of infected rivers to eradicate* G. salaris *during the period 2009-2016*

Region	River	Year	Method used	Current status
Steinkjer	Steinkjervassdraget	2008/2009	Rotenone	Declared parasite free
	Figga	2008/2009	Rotenone	Declared parasite free
	Lundselva	2008/2009	Rotenone	Declared parasite free
Vefsna	Vefsna	2011/2012	Rotenone	Monitored for 4 years
	Fusta	2011/2012	Rotenone	Monitored for 4 years
	Drevja	2011/2012	Rotenone	Monitored for 4 years
	Hundåla	2011/2012	Rotenone	Monitored for 4 years
	Leirelva	2011/2012	Rotenone	Monitored for 4 years
	Ranelva	2011/2012	Rotenone	Monitored for 4 years
	Dagsvikelva	2011/2012	Rotenone	Monitored for 4 years
	Nylandselva	2011/2012	Rotenone	Monitored for 4 years
	Halsanelva	2010/2011	Rotenone	Monitored for 4 years
	Hestdalselva	2010/2011	Rotenone	Monitored for 4 years
Lærdal	Lærdalselva	2011/2012	Acid aluminum	Monitored for 4 years
Rauma	Rauma	2013/2014	Rotenone	Monitored for 2 years
	Hensvassdraget	2013/2014	Rotenone	Monitored for 2 years
	Breidvikelva	2013/2014	Rotenone	Monitored for 2 years
	Skorga	2013/2014	Rotenone	Monitored for 2 years
	Innfjordelva	2013/2014	Rotenone	Monitored for 2 years
	Måna	2013/2014	Rotenone	Monitored for 2 years
Rana	Rana	2014/2015	Rotenone	Monitored for 1 years
Skibotn	Skibotnelva	2015/2016	Rotenone	Monitoring starts in 2017
	Signaldalselva	2015/2016	Rotenone	Monitoring starts in 2017
	Kitdalselva	2015/2016	Rotenone	Monitoring starts in 2017

3. Assessment of the total eradication project

From 1975 to today, *G. salaris* have been detected on Atlantic salmon in 50 rivers. By January 1, 2017, it has been successfully eradicated from 22 rivers, and eradication programs are completed but still not confirmed in 21 rivers (fig 3). There must be 5 consecutive years after eradication where the parasite is not detected before a river is considered parasite-free. Presently, if all the eradication measures implemented are successful, the number of infected rivers are reduced from 50 to 7.

In the nineties, we experienced that many rotenone treatments were unsuccessful. Significant changes in the way to conduct treatments was completed. The main changes were:

(1) Sufficiently high concentration of rotenone
(2) Improving mapping and planning, including simulated treatments
(3) Increased focus on seeps and upwelling water
(4) Timing of treatment in relation to water temperature and discharge
(5) Double treatments (one treatment the first year, a new treatment the next year)
(6) Increased expertise due more experience with major treatments and international cooperation
(7) New methods for treating upwelling water and other complicated areas
The results from these changes, which were implemented for the first time in 2003, shows that we are now conducting treatments with great success. We are able to eradicate the parasite from big and complicated rivers, and hopefully from the whole country.

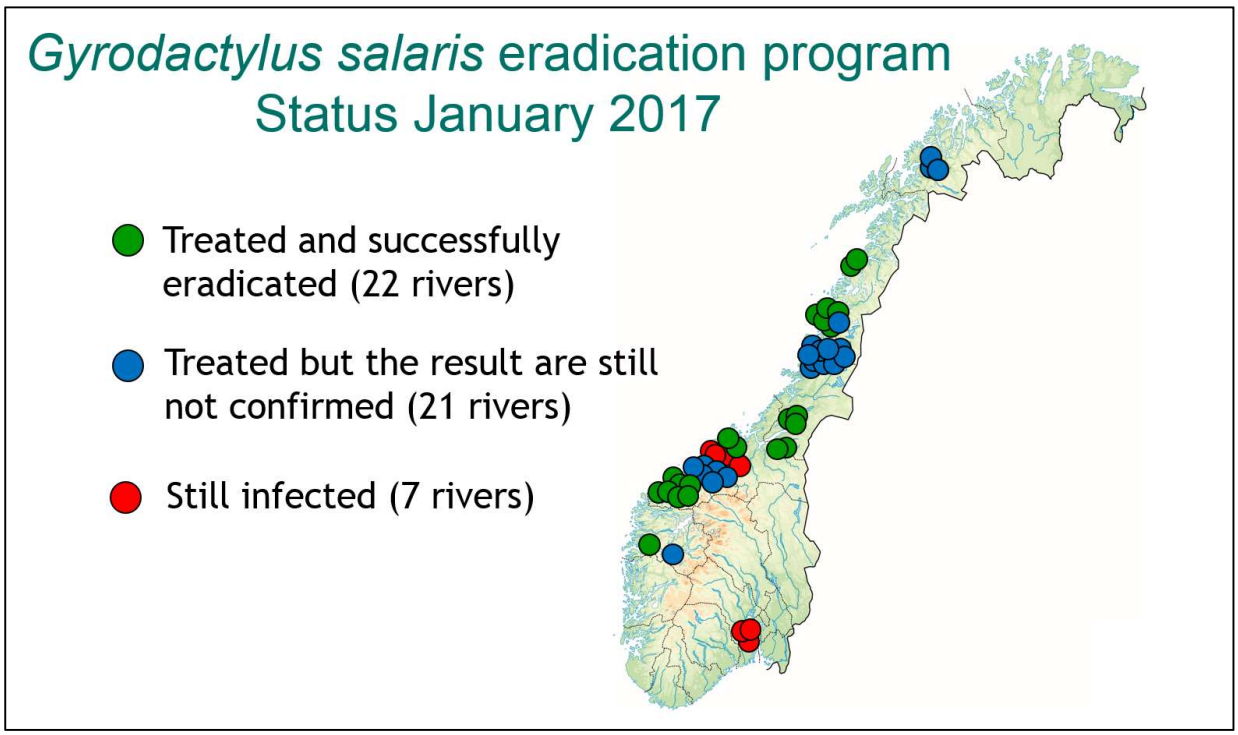

Fig 3. *Result from the eradication program*

Annex 4

GSWG(17)4

Gyrodactylus salaris in Sweden; management and monitoring

Summary

- *Gyrodactylus salaris* is considered endemic to the Baltic Sea area. It was first detected on the Swedish west coast (salmon stocks migrating to the Atlantic Ocean) in 1989. At present only seven out of 23 salmon rivers on the Swedish west coast are uninfected. The majority of uninfected rivers are in the northern part of the Swedish west coast, i.e. in the Skagerrak Sea with saline ocean water.
- The effect of *Gyrodactylus salaris* on salmon stocks has not been significant as compared to uninfected rivers. Mortality of individual fish has been registered, but there is no significant evidence of large scale effects on salmon production in infected rivers.
- Sweden in 2001 implemented an annual monitoring programme of *Gyrodactylus salaris* in salmon rivers on the west coast.
- Screening of salmon fry and parr is done in Sweden but microscopic and molecular methods of identification of species and clads are carried out by Norwegian expertise.
- The Swedish authorities consider G. salaris to be a serious threat to remaining uninfected stocks, and also to nearby Norwegian stocks. The monitoring programme has been run annually since 2001.
- Protective measures have been undertaken to avoid spreading the parasite, e.g. ban on stocking or rearing salmonid fish in the whole catchment of not infected rivers with salmonid fish.
- Eradication of GS in recently infected rivers has not been an issue as infected stocks have not decreased and the intensity of infection has decreased over time. Further, measures as treatment with rotenone is not carried out in Sweden.
- An information leaflet has been produced describing the problem with recommendations for anglers to avoid accidental spread via fishing gear. There is a good general awareness in anglers of the risks.
- Cooperation and exchange of data with Norwegian colleagues is encouraged and Swedish data has been part of different Norwegian risk analyses regarding spread to Norway via waterways.

Background

The ectoparasite Gyrodactylus salaris (GS) was first identified by Dr Göran Malmberg in 1952 in a fish hatchery at Swedish River Indalsälven (Baltic Sea basin). GS is naturally distributed throughout the Baltic Sea and has no drastic effect on survival of Baltic salmon, but infected salmon can show increased mortality (Bakke et al. 1990, 2004, Rintamaeki-Kinnunen & Valtonen 1996, Cable et al. 2000, Dalgaard et al. 2003, Dalgaard et al. 2004, Anttila et al. 2008). The Baltic Sea has a salinity range from 1 to 15 PSU. GS can tolerate up to 5-10 PSU for an extended time (e.g. Johnsen et al. 2008, Peeler et al. 2006). Baltic salmon normally do not migrate outside of the Baltic Sea, and has only rarely been found on the Swedish west coast.

The parasite was observed in Norway in 1975, probably transported with reared salmon from Sweden (the Baltic Sea area). GS has since had devastating effects on several Norwegian wild salmon stocks.

In 1989 the parasite was first discovered on the Swedish west coast (Degerman et al. 2012a), an area with Atlantic salmon (i.e. migrating to the Atlantic Ocean). This is in the Kattegat area, southern part of the Swedish west coast, with salinities of 10-20 PSU. In the Skagerrak area, northern coast with salinities above 20 PSU, no parasites have been detected on salmon parr in spite of investigations for 17 years. In this area no stocking of salmon parr has been conducted, at least since 1970 (Degerman et al. 1999). This means that the parasite has to be transferred with live fish entering from the sea. This scenario seems less probable (Peeler et al. 2006), due to the long distance between salmon rivers and the higher salinity in the sea. But *Gyrodactylus derjavini*, with brown trout (*Salmo trutta*) as primary host, may occasionally be found on salmon parr in this area.

The spread of GS from the Baltic Sea to the Kattegatt area may have been natural with migrating salmon, but also transport of salmon between different hatcheries has been suggested as the cause.

At present only seven out of 23 salmon rivers on the Swedish west coast are uninfected. The majority of uninfected rivers are in the northern part of the Swedish west coast, i.e. in the Skagerrak Sea close to Norway (Figure 1). It is suggested that northern stocks may be more sensitive to GS as they are isolated from southern stocks (and the Baltic) by high saline ocean waters (Degerman et al. 2012a), but tolerance test are generally lacking.

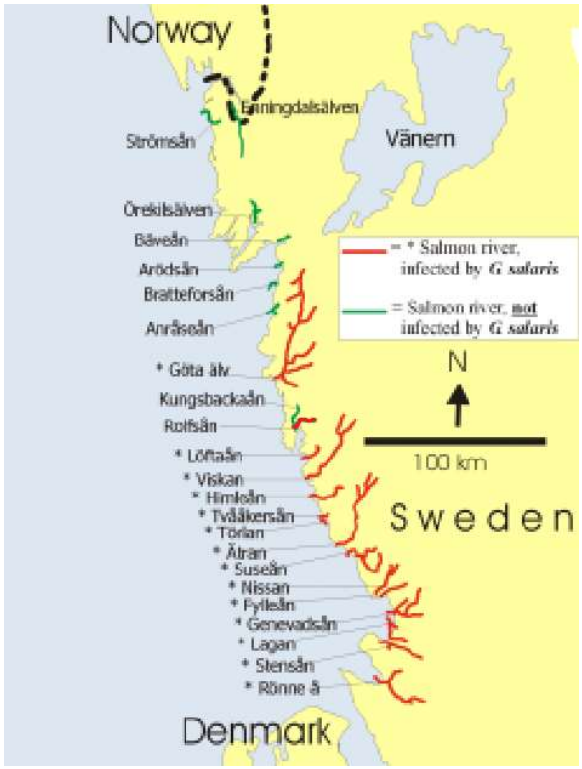

Figure 1. Map of salmon rivers on the Swedish west coast. Infected rivers in red. Green rivers are uninfected.

Different clades of GS

By analysing mitochondrial DNA sequences, GS has been divided into different clades or haplotypes (Hansen *et al*. 2003, 2004, Meinilä *et al*. 2004). Some are considered more harmful than others, but the results vary.

Haplotype A is the most common found in Norwegian rivers and has caused the decline of several salmon populations. In Sweden it has been found in River Ätran-Högvadsån and Surtan (tributary to River Viskan).
Haplotype B has been found in River Torneälven and R. Vindelälven.
Haplotype C is found in most infected rivers on the Swedish west coast.
Haplotype E was found in Säveån, which is a tributary to the large River Göta älv. It has also been found in the salmon hatchery in Laholm at the river Lagan (Malmberg & Malmberg 1991, Karlsson *et al*. 2003b).
*Haplotype F i*s common in rainbow trout farms in Sweden and neighbouring countries.

The effect of GS on stocks of the Swedish west coast

There has been much debate of the actual effect of GS on salmon populations on the west coast. The first years after infection the prevalence and number of GS per individual fish may be high. Mortality of individual fish has been registered, but there is no significant evidence of large scale effects on salmon production in infected rivers (Degerman et al. 2012a). Lowered abundance of the salmon population in River Ätran coincided with the first detection of the parasite in the river system (Alenäs et al. 1998), but there has been a general decline of salmon along the Swedish west coast (e.g. Degerman et al. 2015).

The Gyro-monitoring programme (see below) initiated in 2001 was evaluated in 2012. The results showed that although individual parr with many parasites will have impaired growth and eventually die; no effects can be seen at the population level according to our large scale electrofishing surveys (Degerman et al. 2012a). Comparing the parr abundance before infection with *G. salaris* with after and comparing with the abundance of reference sites in uninfected rivers showed no significant differences. The trend (Pearson r) in parr abundance over time was compared with Meta-analysis between infected rivers and reference rivers, again without differences.

After initial high infection rates the first years after *G. salaris* has been established in a river, the infection rate generally declines (example in Figure 2). The previous evaluation has shown that the infection rates theoretically would be at low levels after approximately 40 years after the establishment of G. salaris (op. cit.).

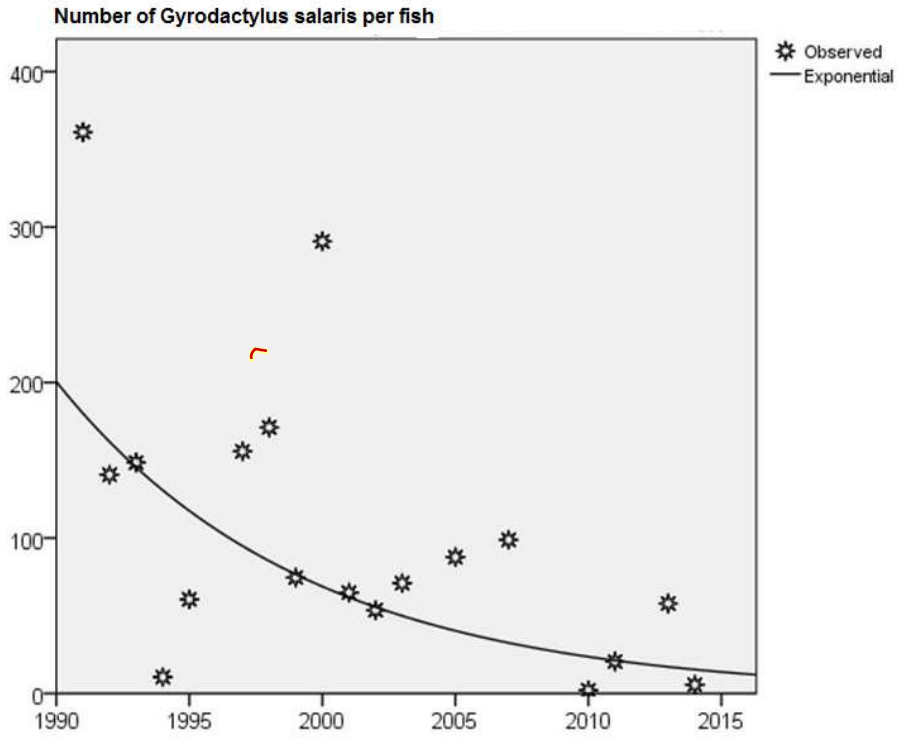

Figure 2. Ätran average number of Gyrodactylus salaris per examined salmon fry & parr (0+ and 1+) in the River Ätran system.

As an example of the effects of GS on a salmon population the monitoring of fry and parr in River Himleån is shown. The river was infected with GS in 2005. The mean density of young salmon (0+ & 1+) was 44 per 100 m^2 in 1990-2004 and 55 in 2005 to 2016 (Figure 3). The difference was not significant (Anova, p=0.3).

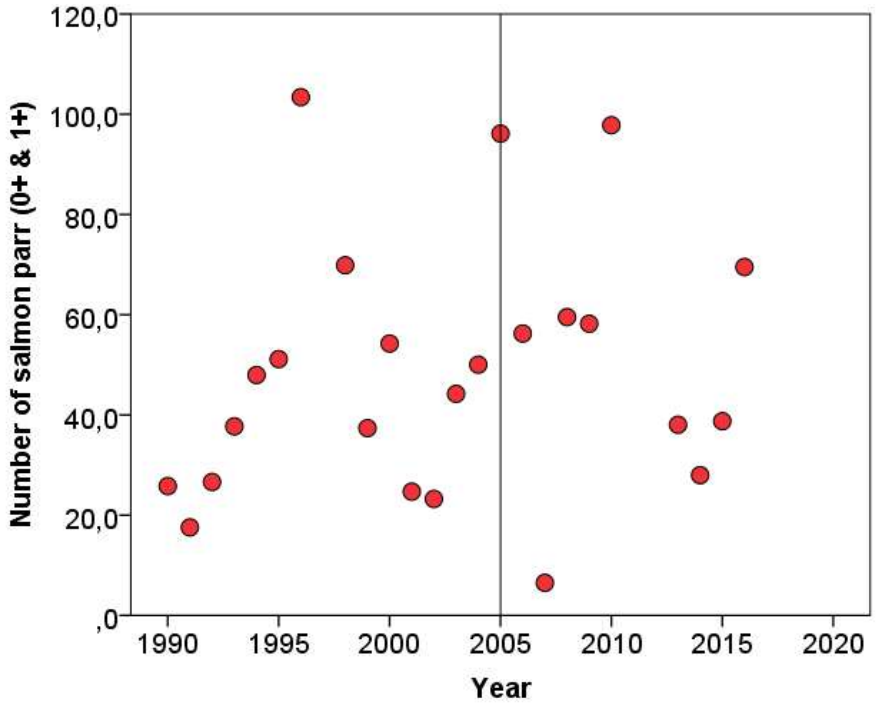

Figure 3. Mean density of fry and parr (0+ and 1+) young salmon per 100 m^2 in River Himleån. Gyrodactylus salaris was detected in the river in 2005.

Monitoring program

In 2001 a monitoring program was established for the Swedish west coast (Degerman et al. 2012b), although screening for GS had been going on since 1989. Today monitoring is done in selected infected rivers to follow the development of GS and in all uninfected salmon rivers annually.

Salmon parr are caught with electrofishing. The fish may either be screened in situ and put back alive or preserved in ethanol (96%). The direct screening can be done in water or in air (sedated fish). For preserved fish the ethanol content of the sample must not fall below 70% as the skin of the fish may wrinkle causing the parasites to fall off.

The number of GS is counted using a stereo microscope at 20 times enlargement. Fiber optic (Euromex EK-1) is generally used as light source.

During 1991-2000 *Gyrodactylus* spp. were counted separately on the body, the head, and all fins (pectoral, pelvic, dorsal, anal, caudal and adipose). From 2001 only the dorsal fin and both the pectoral fins are screened. There is a good correlation between the total number of GS on the fish and the number of the selected fins (Figure 4).

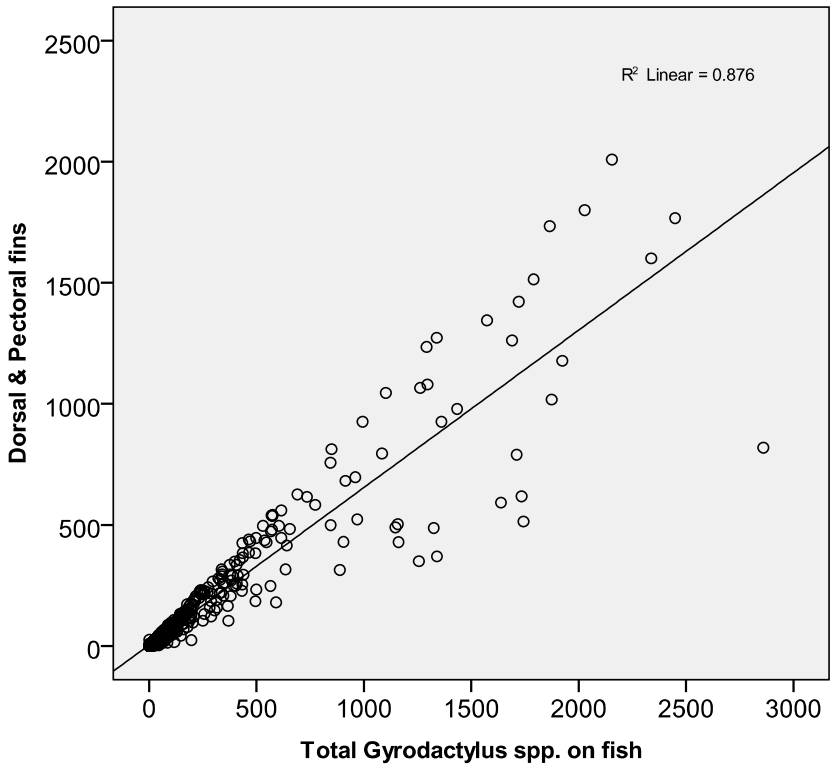

Figure 4. Scatterplot between number of Gyrodactylus spp. on the whole fish versus the number found on dorsal and pectoral fins. R^2=0.876. (Degerman et al. 2012b).

This screening in-situ takes on average 3 minutes per uninfected fish and the double time for infected fish, depending on the number of parasites found.

Studies in infected rivers showed that the prevalence (number of infected fish) was higher in spring (April-May; 85%±SD23, n=20), with water temperatures of 10-13 ºC at sampling, than in summer (June-July; 64%±SD28, n=15) with 14-18 ºC at sampling). In late summer – autumn (August-October) the prevalence was again higher; 71%±SD28, n=41), when the water temperature was 9-13 ºC. At temperatures above 14 ºC the prevalence tended to be lower (Figure 5). Sampling is therefore carried out at water temperatures of approximately 10 ºC in April/May and October.

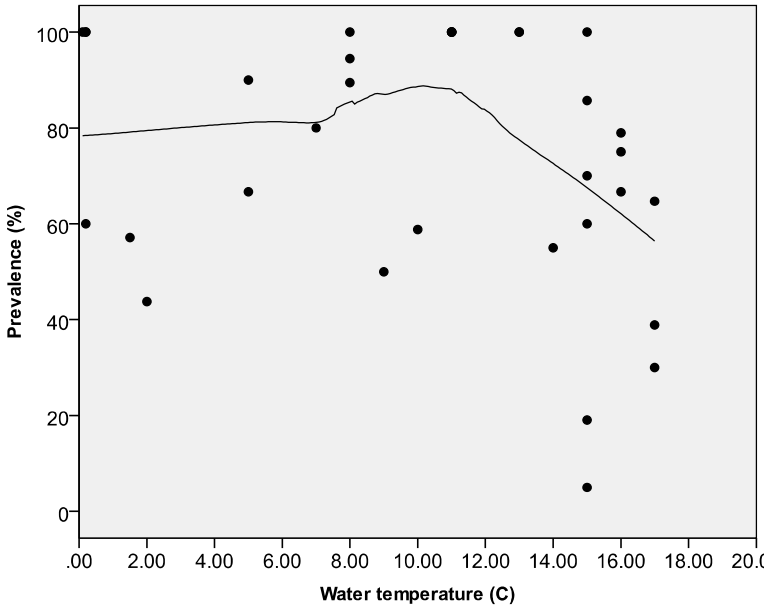

Figure 5. Prevalence (%) of GS in infected rivers versus water temperature (°C) at sampling. Loess Gaussian regression shown. (Degerman et al. 2012b).

The prevalence in the Swedish data in 1999-2001 was high, average 74% when infected fish was present. What is the risk of missing the occurrence of *Gyrodactylus spp.* in an infected population? If the prevalence is 74% (0.74) the number of uninfected fish is 26% (0.26). Sampling one fish the probability (risk) of not detecting the parasite is $(0.26)^1$=0.26. For a sample of five fish the risk would be $(0.26)^5$=0.002, i.e. insignificant. At a prevalence of 10% at least 30 fishes would be necessary to screen in order to have a probability <0.05 of not detecting the parasite (Table 1). From earlier experience it is quite probable that fish will have high prevalence when they first encounter *Gyrodactylus salaris*, this indicates that less than 30 fishes in a sample is normally required for a screening programme. In the Swedish programme we aim at 20 fishes in order to be able to follow changes in prevalence with sufficient accuracy.

Table 1. Probability/risk (p) of not detecting Gyrodactylus spp. at different prevalence (%) depending on sample size.

Sample size	Prevalence 1%	5%	10%	25%	50%
5	0,95	0,77	0,59	0,24	0,03
10	0,90	0,60	0,35	0,06	0,001
15	0,86	0,46	0,21	0,01	0,000
20	0,82	0,36	0,12	0,003	0,000
30	0,74	0,21	0,04	0,000	0,000
50	0,61	0,08	0,01	0,000	0,000

Generally all Gyrodactylus specimens found in infected rivers are considered as and counted as *Gyrodactylus salaris*, whereas all found *Gyrodactylus spp*. in uninfected rivers are sent to the Norwegian National Veterinary Institute for species identification and genetic characterization (e.g. Hansen et al. 2003, 2006). The samples are mainly sent as whole fish preserved in ethanol.

Data from the monitoring programme is quality controlled and stored in a database at the Swedish University of Agricultural sciences. The status of stocks with respect to GS is reported to ICES (WGNAS, Working group on Atlantic Salmon) (e.g. Degerman et al. 2013, 2015, 2016).

Management

The Swedish authorities consider *G. salaris* to be a serious threat to remaining uninfected stocks, and also to nearby Norwegian stocks. The monitoring programme has been run annually since 2001.

Protective measures have been undertaken to avoid spreading the parasite, e.g. ban on stocking or rearing salmonid fish in the whole catchment of not infected rivers with salmonid fish.

There is no culture of salmonid fish in cages in the Swedish part of the Skagerrak area.

Eradication of GS in recently infected rivers has not been an issue as infected stocks have not decreased (Figure 3) and the intensity of infection has decreased (Figure 2). Further, measures as treatment with rotenone is not carried out in Sweden.

An information leaflet has been produced describing the problem with recommendations for anglers to avoid accidental spread via fishing gear. There is a good general awareness in anglers of the risks.

Cooperation and exchange of data with Norwegian colleagues is encouraged and Swedish data has been part of different Norwegian risk analyses regarding spread to Norway via waterways.

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Annex 5

GSWG(17)5

Monitoring and control programmes and measures being taken to prevent the spread of the parasite and eradicate it where it has been introduced (Tabled by Norway)

The Norwegian National surveillance program for *Gyrodactylus salaris* in Atlantic salmon

Surveillance of *G. salaris* has been performed in Norwegian salmon rivers since late 1970s.

The Norwegian Veterinary Institute (NVI) coordinates the surveillance program and publishes the overall results in monthly and annual reports. Surveillance is not performed in infected rivers or farms.

Farms:
The Norwegian Food Safety Authority is responsible for the sampling in hatcheries/fish farms. Our inspectors visit the farms every second year.

Rivers:
NVI is responsible for the sampling in the rivers but County Environmental Departments and other institutions/companies are commissioned to do the actual sampling. We regard the whole Norwegian territory except those defined areas which are positive, as free of the *G.salaris*. There are appr. 400 rivers with salmon stocks and 1135 rivers with stocks of carrier species throughout the country. To ensure adequate surveillance NVI has designed a risk based program founded on experience and scientific knowledge. The following rivers are part of the program:

1) Rivers declared free after treatment
2) The 30 rivers with largest stocks of Atlantic salmon
3) Rivers that have high risk of being infected by migrating fish
4) Rivers of other risk values with geographical proximity to infested rivers and/or rivers where there are activities that have the potential to spread the parasite, i.e. rafting.

NVI is responsible for examination of all the fish samples and the species identification of the parasites if *Gyrodactylusspp.* is detected.

The surveillance program aims to document the freedom of *G. salaris* in Norwegian farms and rivers, and to detect and trace any spread of the parasite to new river systems or fish farms (or to rivers and farms declared free from infection).

In 2015 the surveillance program for *G.salaris* examined

- 69 rivers and 2.320 fishes
- 106 farms and 3.651 fishes

In 2016 we examined almost the same number of rivers, farms and fishes.

The post-treatment control program to ascertain freedom from infection with *Gyrodactylus salaris* in Atlantic salmon

Surveillance of *G. salaris* aiming to declare freedom from the parasite in treated rivers has been performed in Norway since early 1980s. NVI coordinates the surveillance program and publishes the overall results in monthly and annual reports.

An adequate surveillance, in space and time, is required to ascertain freedom from infection with *G. salaris* in the treated rivers. Declaring freedom from the parasite requires examination of salmon juveniles sampled over a time period of a minimum of five years after an eradication measure is completed. This time frame is based on a smolt age of four years, adding one year safety margin. In rivers with higher smolt age, the time to ascertain freedom from infection is increased proportionally.

NVI is responsible for the sampling in the rivers, but County Environmental Departments and other institutions/companies are commissioned to carry out the actual sampling. NVI is responsible for both examination of the fish and subsequent species identification of the parasites if *Gyrodactylus* spp. is detected.

The post-treatment control program to ascertain freedom from infection with *G. salaris*, aims to document freedom of the parasite in previously infested rivers after implementation of eradication measures. The documentation provides the basis for declaring the salmon populations free from infection. Freedom from infection is declared by the Norwegian Food Safety Authority.

Epidemiological survey

When a river is infected, we start an epidemiological survey program in order to find out more about how the river could have been infected and what to do with the situation.

The project Gyrofri

The Norwegian Food Safety Authority contributes to this **project.**

They are monitoring salinity different places in the Oslofjord. They will also start working with telemetry surveillance to find out more about how the fish swim and disperse in the Oslofjord.

Both salinity and wandering patterns are important for how and how much *G. salaris* can be spread in this fjord system.

Data from Gyrofri was used in the last risk analysis from NVI. They concluded that there is higher risk for spreading of *G. salaris* in the Oslofjord than earlier estimated.

The Norwegian Food Safety Authority recently used the information from Gyrofri and NVI when making legal decisions on how to regulate stock enhancement.

Monitoring environmental DNA and electric fishing in Begna, part of the river Drammenselva

Monitoring of E-DNA and electric fishing can give indications of the presence of rainbow trout, which can be infection spreaders.

There are some rainbow trout-farms on the shores of Begna. The important aspect of this monitoring is to find out if some of the fish from the farms have escaped.

Distribution of the parasite

22 rivers are declared free from *G. salaris* after treatment.

21 rivers are treated, but still not declared free from *G. salaris.*

- These rivers have been treated and are now undergoing the post treatment control program:
    - The Skibotn region. Consists of the rivers Skibotnelva, Signaldalselva and Kitdalselva. They were treated in 2015 and 2016.
    - The following rivers were treated earlier than 2016. All samples in the post-treatment control program were negative for *G. salaris.*
        - The river Lærdalselva. Treated in 2011 and 2012.
        - The Vefsna region. Consists of 10 rivers and 3 lakes. Treated in 2011 and 2012.
        - The Rauma region. Consists of 6 rivers. Treated in 2013 and 2014.
    - The region of Rana was treated in 2004, and declared free for *G. salaris* in 2009. Unfortunately, the river was reinfected in 2014. An epidemiological survey program was started and the river was treated the same year.
    - If the surveillance samples during 2017 are all negative for *G. salaris*, The Norwegian Food Safety Authority will probably declare the river Lærdalselva and 9 of the rivers of the Vefsna region free from infection with *G. salaris.*

7 rivers are infected, but not treated

- The Driva region (with the rivers Driva, Litledalselva, Usma and Batnfjordselva)
- The Drammen region (with the rivers Drammenselva, Sandeelva and Lierelva)

Annex 6

GSWG(17)6

Gyrodactylus salaris monitoring in Northern Ireland (Update February 2017)

GS monitoring is carried out as part of DAERA Fish Health's disease testing regime. A rolling regime of testing takes place across both operational fin fish farms and wild catchment areas (by electrofishing). This equates to between 10 – 12 sites each for both farmed and wild stock areas being monitored each year. The testing work is carried out by AFBI on our behalf as a part of their Annual Work Program and the SLA with the Fish Health section.

We have continued freedom from GS - the records go back to 2007 for GS monitoring and all results have been negative since then.

Subject to confirmation of the 2017/18 AWP and the DAERA Fish Health unit/AFBI SLA, monitoring will continue at previous levels for the next year (2017/18).

There is no research currently or planned into GS by DAERA.

Anglers / Stakeholders are educated on the potential harm should using both published information on leaflets etc and digital information on the Internet to avoid the spread by taking effective disinfectant procedures if fishing in others areas or importing fish from elsewhere.

With the reorganisation and reduction in the number of Government Departments in 2016 there is a need to review and update the current NI and the Cross Border GS contingency Plans. This work will hopefully be taken forward in 2017_18 year.

Annex 7

GSWG(17)7

Gyrodactylus salaris update paper - contribution from Marine Scotland

1. Monitoring and distribution of gyrodactylids

1.1 Annex 1 provides yearly sampling data from 2007 to 2016 (years inclusive) on activity undertaken by the Competent Authority[1] in relation to sampling for and confirming the presence of gyrodactylid parasites in Scotland. For each year an overview is provided, together with a breakdown of sampling at the farm and fishery[2] level where appropriate. The structure of these reports is based upon previous contributions made from Scotland.

1.2 In summary, the surveillance undertaken continues to support Scotland's disease free status with respect to *Gyrodactylus salaris* (Gs). No evidence of the parasite has been detected over the sampling period from 01 January 2007 to 31 December 2016.

Changes to surveillance activity

1.3 Targeted surveillance on fish farms and within wild fisheries was undertaken up until 2010 to screen for the presence of Gs in addition to other listed and notifiable diseases. Samples were taken from 50% of Scottish freshwater fish farms, holding susceptible species on an annual basis. Sampling was also conducted from 20% of Scotland's District Salmon Fishery Board (DSFB) areas (generally one sample water was chosen per location area, with the 54 areas being covered over a 5 year period).

1.4 The introduction of Council Directive 2006/88/EC, implemented in Scotland through The Aquatic Animal (Health) Scotland Regulations 2009, instigated a change in general health surveillance within aquatic animals with a move from targeted surveillance towards risk based surveillance inclusive of both active and passive surveillance initiatives. The aim behind this new strategy was to increase the frequency of surveillance in areas which presented a greater risk of contracting and spreading disease.

1.5 As a component of this risk based approach additional resource has been invested into promoting passive surveillance. Passive surveillance involves communicating and informing relevant stakeholders about various listed disease and associated clinical signs and ensuring notification systems are in place for any case of suspicion together with the appropriate response undertaken by the Competent Authority. Intelligence led initiatives also feed into the surveillance activity, all of which is undertaken by Marine Scotland's Fish Health Inspectorate (FHI).

1.6 With the introduction of new regulations, no legislative basis remained for a targeted sampling programme aimed at detecting diseases for which disease freedom had been granted. This was the case for viral haemorrhagic septicaemia (VHS), infectious

[1] The role of Scotland's Competent Authority in this regard was fulfilled by Fisheries Research Services prior to 1st April 2010 and after this date by Marine Scotland Science

[2] Fishery in this context refers to both wild fish populations and put-and-take / sport fisheries and these are differentiated where required

haematopoietic necrosis (IHN) as well as Gs. As a result, from 2010 / 2011 onwards, targeted surveillance for Gs ceased. However, across all freshwater fish farm sites in Scotland which hold susceptible species and life stages, active surveillance for Gs remains in place. Fisheries are covered through a passive surveillance programme. Sampling is still undertaken to detect the presence of Gs in accordance with the FHIs standard diagnostic practices.

1.7 Before the cessation of targeted surveillance, careful consideration was given to continuing the programme and indeed modifying the same to include a risk based initiative in line with other disease surveillance. Several conclusions were drawn surrounding the existing surveillance programme for Gs and any future proposed programme. These conclusions were based upon scientific and epidemiological expertise within Marine Scotland Science, and included:

- the sampling level being applied to sites, where rainbow trout populations were the target species, meant it was unlikely to detect Gs through existing targeted surveillance

- despite targeted surveillance for Gs appearing more effective at the river level (sampling wild salmonids) it was concluded that the level being applied was insufficient to provide a meaningful output and chance of early detection if the parasite was present

- the benefit of targeted surveillance for Gs was considered to be marginal and to make this more effective in terms of detection it would require a significant level of additional resource and activity

- it was considered that the detection of an outbreak of Gs would most likely result through some form of third party notification

1.8 At the time of this consideration and through the points identified above, targeted sampling for Gs did not qualify as a sufficiently high priority given a) the other legislative requirements facing Marine Scotland and b) the level of funding available with respect to Marine Scotland's operations.

Population surveys

1.9 One of the harbingers of the potential presence of Gs in any given river system may be the lack of juvenile salmon populations in areas where they were previously plentiful. In addition to the disease surveillance conducted by Marine Scotland's Fish Health Inspectorate, population surveys are undertaken across Scotland by fishery boards and fishery trusts as well as the Marine Scotland Science freshwater laboratory. These surveys vary locally from ad hoc to regular structured repeat site visits to assess stock strength. Hence, only in some cases would such surveys provide a reliable indicator of a problem.

1.10 Whilst this activity is not actively searching for the presence of Gs, it does make an assessment to some extent of the ecological health of wild salmonid populations in any given area. Identifying declines or absences in certain populations acts as an indicator for further investigations conducted by Marine Scotland's FHI to determine the potential presence of Gs and other diseases.

1.11 New structures are being developed for coordinated local sampling of fish to support the salmon conservation regulations[3]. This programme may provide more generally structured and robust warning system with respect to the presence of Gs.

Diagnostic capability and activity

1.12 The diagnostic methodology, as detailed within the 2007 report and as relevant to Scotland remains in place and has been modified in relation to both the molecular and morphological components.

1.13 A Q-PCR multiplex assay has been developed to detect Gs, *Gyrodactylus derjavinoides* (Gd) & *Gyrodactylus truttae* (Gt). This originates from research work[4] undertaken by Marine Scotland Science (MSS). The process is then followed by sequencing. This represents the standard diagnostic practice in relation to the diagnosis of gyrodactylids by MSS.

1.14 Since 2007 FRS / MSS has increased its morphological capability, with respect to the diagnosis of gyrodactylids, through collaboration with other scientific institutions and national reference laboratories. Following the reduction in sample throughput after 2010 / 2011, and with the development of the Q-PCR method, morphological assessment is now not routinely undertaken. Diagnosis relies solely upon molecular methods. All gyrodactylid parasites are removed from the samples taken and analysed by Q-PCR and sequenced where necessary.

1.15 Despite this change in diagnostic procedure, morphological capability has been maintained and can be reintroduced at a future point should the need arise.

1.16 With regards to the detection of Gs, the diagnostic methods employed by MSS satisfies the recommended methodology detailed within the OiE Manual of Diagnostic Tests for Aquatic Animals (2016).

2. On-going, planned and completed research

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.

2.2 Since the last NEAC workshop in 2007, MSS has carried out research to improve approaches for Gs screening and identification, and has incorporated the outcomes for *Gyrodactylus* species identification in its laboratory procedures.

2.3 A multi-centre comparison of the most commonly employed methods (morphological, morphometric and molecular) available for *Gyrodactylus* screening and identification was performed, led by the University of Stirling. The aim was to determine best practice for processing samples and decision-making to allow maximal throughput and accuracy of identification. The approaches tested related to analysis of individual parasites. After accounting for potential risk of specimen loss, the probabilities of a specimen being

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

[4] Collins, C.M., Kerr, R., McIntosh, R., Snow, M. (2010). Development of a real-time PCR assay for the identification of *Gyrodactylus* parasites infecting salmonids in northern Europe. Diseases of Aquatic Organisms, Vol. 90: 135–142, 2010

accurately identified were 95%, 87% and 92% for visual, morphometric and molecular techniques, respectively, and the probabilities of correctly identifying a specimen of Gs by each method were 81%, 58% and 92%. Staff resources and time required for identification for each method were also taken into consideration. The results indicated that during routine surveillance/low numbers of specimens, RFLP (restriction fragment length polymorphism) analysis of the ITS rDNA, followed by sequencing of the COI mitochondrial DNA was most appropriate. During suspected outbreaks with high volume of samples, then initial visual identification, followed by molecular-based techniques of Gs like specimens, would offer greatest processing capacity (Shinn et al., 2010[5]).

2.4 If a pooling approach to analysing specimens was adopted, then molecular based techniques may be suitable, assuming can confirm presence of Gs at low numbers if required.

2.5 A multiplex TaqMan real-time PCR for identification of Gd and Gt, most commonly found on salmonids in the UK, and Gs was developed at MSS. The real-time PCR assay proved to be much faster than ITS rDNA PCR amplification followed by RFLP as an initial screening method. However, as with ITS RFLP, the real-time method does not distinguish between Gs and the non-pathogenic Gt, and further sequencing of COI mtDNA is required. The assay was validated against specimens used in the multi-method comparison above, and achieved a 100% agreement with previous ITS rDNA RFLP results. In relation to limits of detection, the real-time PCR assay was also found to be able to detect 10 to 100 fold less Gs DNA that traditional ITS PCR. This may prove useful if pooled samples to be analysed (Collins et al., 2010[4]).

2.6 MSS have collaborated on the modelling of disease transmission pathways in the UK. This work is not specific to Gs but relevant to a number of aquatic animal pathogens and diseases. A high degree of connectivity has been identified through transmission pathways across Great Britain. Although there is some separation between trout and salmon aquaculture sectors. This work helps to demonstrate the likely rapid spread of some pathogens following introduction, and is evidence which supports the decisions made with respect to changes in surveillance for Gs. It also emphasises the need to prevent the introduction of pathogens in first place, through risk assessment, best practice and complying with legal requirements[6,7].

[5] Shinn, A,P., Collins, C., García-Vásquez, A., Snow, M., Mateˇjusová, I., Paladini, G., Longshaw, M., Lindenstrøm, T., Stone, D.M., Turnbull, J.F., Picon-Camacho, S.M., Vázquez Rivera, C., Duguid, R.A., Mo, T.A., Hansen, H., Olstad, K., Cable, J., Harris, P.D., Kerr, R., Graham, D., Monaghan, S.J., Yoon, G.H., Buchmann, K., Taylor, N.G.H., Bakke, T.A., Raynard, R., Irving, S., Bron, J.E.(2010). Multi-centre testing and validation of current protocols for the identification of *Gyrodactylus salaris* (Monogenea). International Journal for Parasitology, Vol. 40: 1455–1467, 2010

[6] Green, D.M., Werkman, M., Munro, L.A. (2011). The potential for targeted surveillance of live fish movements in Scotland. 2011. Journal of Fish Diseases, Vol. 35: 29-37, 2011

[7] Munro, L.A., Wallace, I.S. (2012). Analysis of farmed fish movements between catchments identifies a simple compartmentalised management strategy for bacterial kidney disease in Scottish aquaculture. Aquaculture, Vol. 338-341: 300-303, 2012

3. Measures taken to prevent spread and to eradicate

Trade restrictions

3.1 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[8],
or
c) in the case eggs they have been disinfected prior to dispatch

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

'Home and Dry' campaign

3.3 In 2007 Scottish Government introduced the 'Home & Dry' campaign. This was focused on raising the profile of Gs and its potential risk to Scotland by raising awareness around the risks of introduction through the use of fishing tackle and equipment associated with water sports and leisure pursuits. Preventative measures including the treatment and disinfection of equipment are advocated. This campaign continues to help disseminate the message concerning the potential risks posed by Gs and the actions which can be taken to mitigate those risks. This includes annual advertisement in Fish in Scotland magazine, which included an article on Gs in 2017.

3.4 Gs is also recognised through the GB non-native species secretariat and the check-clean-dry campaign aimed at preventing the spread of invasive non-native species.

Actions taken by wild fishery stakeholders

3.5 Many wild fishery stakeholders including riparian owners, fishery boards and trusts as well as angling associations and clubs have taken measures at the local level to help prevent the introduction of Gs. These measures can 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

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

Contingency Planning

3.6 Marine Scotland maintains contingency plans to deal with an outbreak of Gs in Scotland. These plans are currently in their 4th edition (last revised March 2011) and are currently subject to further review. The bulk of the contingency procedures have been detailed within the 2007 report. These contingency procedures include a memorandum of understanding with Norway for assistance in dealing with an outbreak in particular with respect to any attempts to eradicate the parasite. Officials within Scotland maintain links with colleagues in Norway through regular communications concerning Gs.

3.7 Exercises to test Scotland's response to an outbreak of Gs have been conducted in 2010 and 2015 – Exercise Alpheus. The exercise in 2010 was an internal table top event involving Marine Scotland staff from scientific, operational and policy disciplines. This was primarily undertaken to emphasise the roles and responsibilities of policy colleagues following some recent staff changes at that time, but also served as a useful training exercise for all staff involved.

3.8 Exercise Alpheus was conducted on a GB wide basis and was developed in partnership between Defra, Cefas and Marine Scotland. This was a table top exercise involving policy and operational aspects of UK and Scottish Governments, government agencies and involved participation from external stakeholders. The aim of the exercise was to test and improve the Government's Contingency Plans, procedures and established policy for the control of a cross border outbreak of Gs in the UK.

Annex 1 of GSWG(17)7- Yearly sampling data from 2007 to 2016 conducted by MSS

With reference to this section the following codes apply:

G. species:	*Gyrodactylus* species (confirmed as not being *Gyrodactylus salaris*)
Gd:	*Gyrodactylus derjavinoides*
Gt:	*Gyrodactylus truttae*
Ga:	*Gyrodactylus arcuatus*

Gyrodactylid sampling in Scotland 2007

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*.

Total no. of cases: 106
No. of farm cases: 88
No. wild cases: 18
Total No. of fisheries[9] sampled: 0 sites

Total No. of fish examined: 2729
Total No. of farmed fish examined: 2380
Total No. of wild fish examined: 349
Total No. of fishery fish examined: 0

No. of +ve farm cases: 14
No. of +ve wild fish cases: 3
No. of +ve fisheries: 0

Breakdown of sampling for gyrodactylids

Farmed fish samples (≥30 fish per case):

Species	Cases	No. fish examined	Results (cases)	Species
Rainbow trout	28	840	7 Positive	Gd & G. species
Atlantic salmon	45	1350	4 Positive	Gd
Brown / sea trout	2	60	1 Positive	Gd
Total	75	2250	12 Positive	Gd & G. species

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

Farmed fish sampling (<30 fish per case):

Species	Cases	No. sampled per case	Results	Species
Rainbow trout	7	10	-ve	
		1	-ve	
		5	-ve	
		1	-ve	
		25	Positive	Gd & G. species
		5	-ve	
		5	-ve	
Atlantic salmon	6	2	-ve	
		10	-ve	
		25	Positive	Gd
		4	-ve	
		20	-ve	
		2	-ve	
Brown / sea trout	2	5	-ve	
		5	-ve	
Arctic charr	1	5	-ve	
Total	16	130	2 Positive	Gd & G. species

N.B. one case may represent more than one species

Wild fish sampling

Species	Cases	No. sampled	Results (cases)	Species
A. salmon	15	248	3 Positive	Gd & Gt
Trout	5	100	-ve	
Minnow	1	1	-ve	
Total	21	349	3 Positive	Gd & G species

N.B. one case may represent more than one species

Regional breakdown farmed fish (≥30 fish per case):

Region	Cases	Results (cases)	Species
Borders	1	-ve	
Central	3	1 Positive	Gd
Dumfries and Galloway	5	1 Positive	Gd
Grampian	2	-ve	
Highland	20	3 Positive	Gd
Lothian	1	-ve	
Shetland	3	1 Positive	Gd
Strathclyde	22	4 Positive	Gd & G. species
Tayside	7	2 Positive	Gd & G. species
Western Isles	11	-ve	

Regional breakdown farmed fish (<30 fish per case):

Region	Cases	Results (cases)	Species
Borders	1	-ve	
Central	1	-ve	
Dumfries and Galloway	2	1 Positive	Gd & G. species
Fife	1	-ve	
Highland	4	-ve	
Orkney	1	1 Positive	Gd
Strathclyde	1	-ve	
Tayside	2	-ve	

Regional breakdown wild fish

Region	Cases	Results (cases)	Species
Borders	1	1 Positive	Gd
Grampian	6	1 Positive	Gd & Gt
Highland	7	1 Positive	Gd
Orkney	1	-ve	
Shetland	1	-ve	
Strathclyde	1	-ve	
Tayside	1	-ve	

Gyrodactylid sampling in Scotland 2008

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*

Total no. of cases: 93
No. of farm cases: 75
No. wild cases: 16
Total No. of fisheries[10] sampled: 2 fisheries

Total No. of fish examined: 2435
Total No. of farmed fish examined: 2033
Total No. of wild fish examined: 394
Total No. of fishery / estuary fish examined: 8

No. of +ve farm cases: 13
No. of +ve wild fish cases: 5
No. of +ve fishery cases: 0

Breakdown of sampling for gyrodactylids

Farmed fish samples (≥30 fish per case):

Fish species	Cases	No fish examined	Result (cases)	Parasite species
Rainbow trout	15	450	4 Positive	Gd & G. species
Atlantic salmon	45	1350	4 Positive	Gd & G. species
Brown / sea trout	4	120	1 Positive	Gd
Arctic charr	1	30	1 Positive	G. species
Total	65	1950	10 Positive	Gd & G. species

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

Farmed fish samples (<30 fish per case):

Fish species	Cases	No. sampled per case	Result	Parasite species
Rainbow trout	8	5	-ve	
		1	-ve	
		2	-ve	
		1	-ve	
		1	-ve	
		2	-ve	
		1	Positive	Gd & G. species
		5	-ve	
Atlantic salmon	1	10	-ve	
Brown / sea trout	3	25	Positive	G. species, Gd & Gt
		20	-ve	
		10	Positive	Gd & G. species
Total	12	83	3 Positive	Gd, Gt & G. species

N.B. one case may include more than one fish species

Wild fish sampling:

Fish Species	Cases	No sampled (total)	Result (cases)	Parasite species
Atlantic salmon	13	325	4 Positive	Gd & Gt
Brown / sea trout	6	69	2 Positive	Gd & Gt
Total	19	394	6 Positive	Gd, Gt & G. species

N.B. one case may represent more than one species

Fishery sampling:

Fish species	Cases	No sampled (total)	Result (cases)	Parasite species
Rainbow trout	2[11]	8	-ve	
Total	2	8	-ve	

Regional breakdown farmed fish sampling (≥30 fish per case):

Region	Cases	Result (cases)	Parasite species
Borders	2	1 Positive	Gd & G. species
Central	5	1 Positive	Gd
Dumfries and Galloway	7	1 Positive	Gd
Highland	18	2 Positive	Gd & G. species
Orkney	3	1 Positive	G. species
Shetland	6	1 Positive	Gd
Strathclyde	10	2 Positive	Gd
Tayside	4	1 Positive	Gd
Western Isles	10	-ve	

Regional breakdown farmed fish sampling (<30 fish per case):

Region	Cases	Results (cases)	Species
Central	2	1 Positive	Gd, Gt & G. species
Dumfries and Galloway	4	-ve	
Highland	2	1 Positive	Gd & G. species
Strathclyde	2	1 Positive	Gd & G. species

Regional breakdown wild fish sampling:

Region	Cases	Results (cases)	Species
Dumfries and Galloway	1	-ve	
Grampian	6	2 Positive	Gd & Gt
Highland	5	2 Positive	Gd
Strathclyde	3	1 Positive	Gd & Gt
Tayside	1	-ve	

[11] Regions are Strathclyde and Grampian

Gyrodactylid sampling in Scotland 2009

Overview

No G. salaris were identified. Positive results below are for species of Gyrodactylids confirmed as not being *G. salaris*.

Total No. of cases: 108
No. of farm cases: 88
No. of wild cases: 19
Total No. of fisheries[12] sampled: 1

Total No. of fish examined: 2778
Total No. of farmed fish examined: 2421
Total No. of wild fish examined: 356
Total No. of fishery / estuary fish examined: 1

No. of +ve farm cases: 8
No. of +ve wild cases: 4
No. of +ve fishery cases: 0

Breakdown of sampling for gyrodactylids

Farmed fish samples (≥30 fish per case):

Fish species	Cases	No. fish examined	Result (cases)	Parasite species
Rainbow trout	25	750	4 Positive	Gd & G. species
Atlantic salmon	46	1380	1 Positive	Gd
Brown / sea trout	4	120	1 Positive	Gd & G. species
Arctic charr	1	30	1 Positive	G. species
Total	76	2280	7 Positive	Gd & G. species

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

Farmed fish samples (<30 fish per case):

Fish species	Cases	No. sampled per case	Result	Parasite species
Rainbow trout	9	28	-ve	
		6	-ve	
		10	Positive	Gd
		10	-ve	
		20	-ve	
		4	-ve	
		5	-ve	
		1	-ve	
		3	-ve	
Atlantic salmon	2	25	-ve	
		5	-ve	
Brown / sea trout	5	5	-ve	
		1	-ve	
		1	-ve	
		10	-ve	
		7	-ve	
Total	16	141	1 Positive	Gd

N.B. one case may represent more than one species

Wild fish sampling

Fish species	Cases	No. sampled	Result (cases)	Parasite species
Atlantic salmon	18	319	4 Positive	Gd
Trout	4	37	2 Positive	Gd
Total	22	356	6 Positive	Gd

N.B. One case may represent more than one species

Fishery sampling

Fish species	Cases	No. sampled	Result (cases)	Parasite species
Rainbow trout	1[13]	1	-ve	
Trout	1	1	-ve	

Regional breakdown farmed fish sampling (≥30 fish per case):

Region	Cases	Results (cases)	Parasite species
Borders	1	-ve	
Central	2	-ve	
Dumfries and Galloway	7	1 Positive	Gd & G. species
Grampian	2	-ve	
Highland	28	-ve	
Lothian	1	-ve	
Orkney	1	1 Positive	G. species
Shetland	4	1 Positive	Gd & G. species
Strathclyde	12	3 Positive	Gd & G. species
Tayside	4	1 Positive	Gd & G. species
Western Isles	14	-ve	

Regional breakdown farmed fish sampling (<30 fish per case):

Region	Cases	Results (cases)	Parasite species
Borders	1	-ve	
Central	1	-ve	
Dumfries and Galloway	2	-ve	
Lothian	1	-ve	
Shetland	1	-ve	
Strathclyde	6	1 Positive	Gd

Regional breakdown wild fish sampling:

Region	Cases	Results	Parasite species
Dumfries and Galloway	4	1 Positive	Gd
Grampian	10	1 Positive	Gd
Highland	2	-ve	
Shetland	1	1 Positive	Gd
Strathclyde	2	1 Positive	Gd

[13] Fishery region - Grampian

Gyrodactylid sampling in Scotland 2010

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*.

Total No. of cases: 81
No. of farm cases: 68
No. of wild cases: 13
Total No. of fisheries[14] sampled: 0

Total No. of fish examined: 2189
Total No. of farmed fish examined: 1851
Total No. of wild fish examined: 338
Total No. of fishery fish examined: 0

No. of +ve farm cases: 9
No. of +ve wild cases: 0
No. of +ve fisheries: 0

Breakdown of sampling for gyrodactylids

Farmed fish samples (≥30 fish per case):

Fish species	Cases	No. fish examined	Result (cases)	Parasite species
Rainbow trout	13	390	5 Positive	Gd & G. species
Atlantic salmon	43	1290	3 Positive	1 Gd & G. species
Brown / sea trout	3	90	-ve	
Total	59	1770	8 Positive	Gd & G. species

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

Farmed fish sampling (<30 fish per case):

Species	Cases	No. sampled per case	Result	Species
Rainbow trout	5	5	-ve	
		5	-ve	
		5	-ve	
		20	Positive	Gd
		1	-ve	
Atlantic salmon	4	5	-ve	
		5	-ve	
		25	-ve	
		5	-ve	
Brown / sea trout	1	5	-ve	
Total	10	81	1 Positive	Gd

N.B. One case may represent more than one species

Wild fish sampling

Species	Cases	No. sampled	Result (cases)	Species
A. salmon	11	260	-ve	
Trout	5	78	-ve	
Total	16	338	-ve	

N.B. One case may represent more than one species

Regional breakdown farmed fish sampling (≥30 fish per case):

Region	Cases	Results (cases)	Species
Borders	2	-ve	
Central	6	1 Positive	Gd & G. species
Dumfries and Galloway	5	2 Positive	Gd & G. species
Highland	15	1 Positive	Gd
Lothian	1	-ve	
Orkney	1	-ve	
Shetland	4	-ve	
Strathclyde	11	2 Positive	Gd & G. species
Tayside	4	1 Positive	G. species
Western Isles	10	1 Positive	Gd

Regional breakdown farmed fish (<30 fish per case):

Region	Cases	Results (cases)	Species
Central	1	-ve	
Highland	3	-ve	
Lothian	1	-ve	
Strathclyde	1	-ve	
Tayside	2	1 Positive	Gd
Western Isles	1	-ve	

Regional breakdown wild fish sampling

Region	Cases	Results (cases)	Species
Dumfries and Galloway	1	-ve	
Grampian	2	-ve	
Highland	7	-ve	
Strathclyde	1	-ve	
Tayside	1	-ve	
Western Isles	1	-ve	

Gyrodactylid sampling in Scotland 2011

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*.

Total No. of cases: 17
No. of farm cases: 5
No. of wild cases: 12
Total No. of fisheries[15] sampled: 0

Total No. of fish examined: 124
Total No. of farmed fish examined: 17
Total No. of wild fish examined: 107
Total No. of fishery fish examined: 0

No. of +ve farm cases: 0
No. of +ve wild cases: 1
No. of +ve fisheries: 0

Breakdown of sampling for gyrodactylids

Farmed fish sampling

Species	Cases	No. sampled per case	Region	Result	Species
Atlantic salmon	2	3	Highland	-ve	
		3	Highland	-ve	
Rainbow trout	3	5	Dumfries & Galloway	-ve	
		5	Dumfries & Galloway	-ve	
		1	Tayside	-ve	

Wild fish sampling

Species	Cases	No. sampled per case	Region	Result	Species
Atlantic salmon	12	2	Highland	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		35	Dumfries & Galloway	Positive	Gd
		1	Grampian	-ve	
		30	Grampian	-ve	
		2	Grampian	-ve	
		31	Highland	-ve	

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

Gyrodactylid sampling in Scotland 2012

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*.

Total No. of cases: 11
No. of farm cases: 4
No. of wild cases: 6
Total No. of fisheries[16] sampled: 1

Total No. of fish examined: 23
Total No. of farmed fish examined: 15
Total No. of wild fish examined: 7
Total No. of fishery fish examined: 1

No. of +ve farm cases: 0
No. of +ve fisheries: 1
No. of +ve wild cases: 0

Breakdown of sampling for gyrodactylids

Farmed fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Atlantic salmon	2	5	Strathclyde	-ve	
		3	Strathclyde	-ve	
Rainbow trout	2	2	Central	-ve	
		5	Tayside	-ve	

Fishery sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Common carp	1	1	Strathclyde	Positive	G. species

Wild fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Atlantic salmon	6	2	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	

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

Gyrodactylid sampling in Scotland 2013

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*.

Total No. of cases: 8
No. of farm cases: 6
No. of wild cases: 1
Total No. of fisheries[17] sampled: 1

Total No. of fish examined: 31
Total No. of farmed fish examined: 26
Total No. of wild fish examined: 4
Total No. of fishery fish examined: 1

No. of +ve farm cases: 1
No. of +ve wild cases: 0
No. of +ve fisheries: 0

Breakdown of sampling for gyrodactylids

Farmed fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Atlantic salmon	3	5	Western Isles	-ve	
		5	Highland	-ve	
		1	Shetland	-ve	
Rainbow trout	3	5	Tayside	-ve	
		5	Strathclyde	Positive	Gd
		5	Strathclyde	-ve	

Fishery sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Rainbow trout	1	1	Dumfries & Galloway	-ve	

Wild fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Trout	1	4	Highland	-ve	

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

Gyrodactylid sampling in Scotland 2014

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*.

Total No. of cases: 22
No. of farm cases: 17
No. of wild cases: 4
Total No. of fisheries[18] sampled: 1

Total No. of fish examined: 79
Total No. of farmed fish examined: 62
Total No. of wild fish examined: 12
Total No. of fishery fish examined: 5

No. of +ve farm cases: 1
No. of +ve wild cases: 0
No. of +ve fishery cases: 1

Breakdown of sampling for gyrodactylids

Farmed fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Atlantic salmon	9	2	Strathclyde	-ve	
		5	Dumfries & Galloway	-ve	
		9	Shetland	-ve	
		5	Shetland	-ve	
		5	Shetland	-ve	
		4	Strathclyde	-ve	
		1	Highland	-ve	
		1	Highland	-ve	
		1	Highland	-ve	
Rainbow trout	8	4	Borders	-ve	
		1	Dumfries & Galloway	-ve	
		5	Tayside	-ve	
		5	Tayside	-ve	
		3	Tayside	-ve	
		1	Tayside	-ve	
		5	Tayside	-ve	
		5	Tayside	Positive	Gd

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

Fishery sampling

Species	Cases	No. sampled per case	Region	Result	Species
Stickleback	1	5	Dumfries & Galloway	Positive	Ga

Wild fish sampling

Species	Cases	No. sampled per case	Region	Result	Species
Atlantic salmon	3	1	Grampian	-ve	
		3	Strathclyde	-ve	
		1	Borders	-ve	
Trout	1	7	Strathclyde	-ve	

Gyrodactylid sampling in Scotland 2015

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*.

Total No. of cases: 24
No. of farm cases: 8
No. of wild cases: 13
Total No. of fisheries[19] sampled: 3

Total No. of fish examined: 60
Total No. of farmed fish examined: 29
Total No. of wild fish examined: 26
Total No. of fishery fish examined: 5

No. of +ve farm cases: 0
No. of +ve wild cases: 0
No. of +ve fisheries: 0

Breakdown of sampling for gyrodactylids

Farmed fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Atlantic salmon	3	5	Highland	-ve	
		1	Shetland	-ve	
		5	Highland	-ve	
Rainbow trout	4	1	Dumfries & Galloway	-ve	
		5	Tayside	-ve	
		3	Dumfries & Galloway	-ve	
		4	Lothian	-ve	
Trout	1	5	Western Isles	-ve	

Fishery sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Rainbow trout	2	2	Dumfries & Galloway	-ve	
		2	Shetland	-ve	
Tench	1	1	Strathclyde	-ve	

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

Wild fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Atlantic salmon	3	5	Strathclyde	-ve	
		1	Central	-ve	
		5	Highland	-ve	
Trout	1	4	Grampian	-ve	
Eel	9	1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	
		2	Grampian	-ve	
		1	Grampian	-ve	
		2	Grampian	-ve	
		1	Grampian	-ve	
		1	Grampian	-ve	

Gyrodactylid sampling in Scotland 2016

Overview

No *G. salaris* were identified. Positive results below are for species of gyrodactylids which are confirmed as not being *G. salaris*.

Total No. of cases: 7
No. of farm cases: 2
No. of wild cases: 4
Total No. of fisheries[20] sampled: 1

Total No. of fish examined: 17
Total No. of farmed fish examined: 2
Total No. of wild fish examined: 14
Total No. of fishery fish examined: 1

No. of +ve farm cases: 1
No. of +ve wild cases: 0
No. of +ve fisheries: 0

Breakdown of sampling for gyrodactylids

Farmed fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Atlantic salmon	1	1	Central	-ve	
Rainbow trout	1	1	Dumfries & Galloway	Positive	Gt and Gd

Fishery sampling

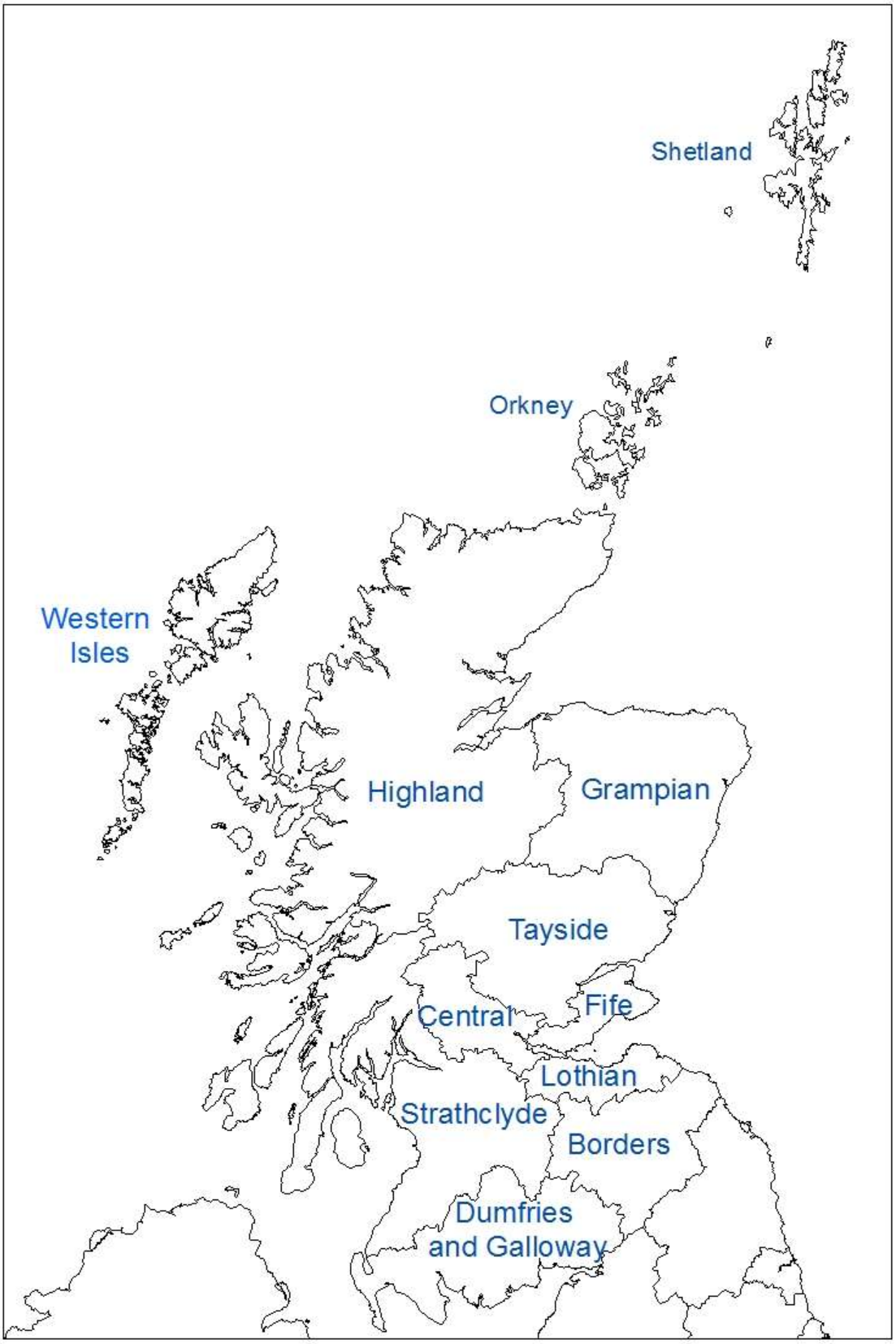
Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Rainbow trout	1	1	Grampian	-ve	

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

Wild fish sampling

Fish species	Cases	No. sampled per case	Region	Result	Parasite species
Atlantic salmon	3	10	Tayside	-ve	
		1	Tayside	-ve	
		1	Highland	-ve	
Eel	1	2	Grampian	-ve	

Annex 2 of GSWG(17)7 - Map identifying the regions of Scotland



Annex 8

GSWG(17)8

Briefing Paper on Gyrodactylus salaris (Tabled by EU Ireland)

Scope

NASCO have requested that Ireland provide a briefing paper for the 2017 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 has been drafted by the FHU with input from IFI and other stakeholders with statutory interests in salmonids. The plan is currently in final revision (February 2017) and is likely to be published in advance of the Thirty-Fourth Annual Meeting of NASCO in June 2017.

The plan will set out in detail the operational responsibilities and actions to be taken in the event of a suspected outbreak of gyrodactylosis. It is envisaged that these will include 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.

The *G. salaris* Working Group and the NASCO Secretariat will be notified when the contingency plan has been finalised and issued.

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://goo.gl/NRgVY0). In addition, both state agencies host information in this regard on their respective websites.

Table 1 Irish river systems sampled for the presence of *G. salaris* (2005 – 2016).

Catchment	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Abbert, Corrib						X		X				
Aherlow	X											
Araglin								X				
Aughnacliffe				X								
Aughrim/Avoca										x		
Bilboa					X							
Boyne trib.									x			
Bride						X						
Brosna			X						x*			
Bunnoe			X									
Burrin			X									
Carrigahorig		X								x		
Cork Blackwater										x	x	x
Derry	X											
Dunkellin						X						
Eanymore						X						
Emlagh							X					
Erne										x		
Erne, Swanlinbar			X									
Erriff						X	X					
Feale					X				x			
Finnow								X				x
Garavogue						X						
Glen							x					
Greese					X							
Laune										x		
Leannon							X				x	
Lee		X										
Little Brosna			X									
Maine											x	
Moy								X				
Owenboliska						X						
Owenmore												
Owenwee							X					
Poulmounty			X							x		
Screebe		X	X					X				
Suir											x	
Tullaghobegley									x			

Annex 9

GSWG(17)9

Gyrodactylus salaris update paper - contribution from Finland

European Union, Finland

Perttu Koski, Finnish Food Safety Authority Evira, Animal Disease Bacteriology and Pathology

1. Monitoring and control programmes for, and update on the distribution of *Gyrodactylus salaris* in Finland in 2006-2016

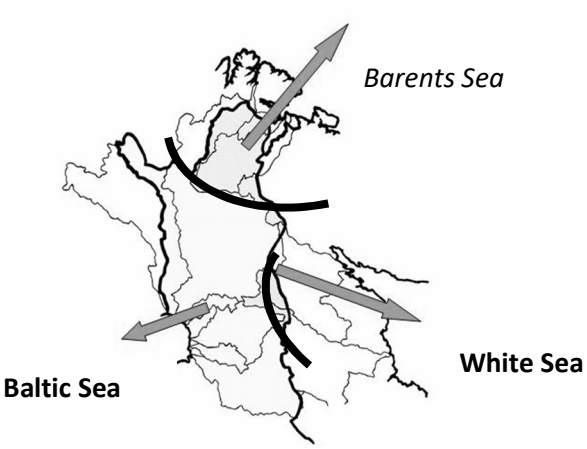


Figure 1: Three main water catchment areas in northern Finland.

The watersheds between the water catchment areas of the Barents Sea, the White Sea and the Baltic Sea are partly situated in the territory of Finland (see Fig. 1).

There is official monitoring and control programme only in the water catchment areas running into the Barents Sea in Finland.

2. Number of examined fish in the monitoring of the catchment areas running into the Barents Sea

Water catchment area	Tenojoki[1)] (Tana)	Näätämöjoki[1)] (Neiden)	Paatsjoki[1)] (Påsvik)	Paatsjoki, farmed fish		Tuulomajoki[1)]
Year	Salmon	Salmon	Grayling	Salmon	Char	Grayling
2006	163	155	8	150	60	25
2007	197	161	14	150	60	
2008	100	120	15	150	60	30
2009	100	122	15	150	60	53
2010	102	173	15		120	30
2011	65	156	15		120	30
2012	100	120	15		100	
2013	100	120	15		120	30
2014	100	120	15		120	30
2015	100	120	15		120	
2016	101	120	15		120	10

[1)] Samples from wild fish

All the examinations have been negative for the presence of *Gyrodactylus salaris* on the examined fish.

There were two fish farms in the River Paatsjoki catchment area in 2006, but only one from 2011 onwards. In other water catchments running into the Barents Sea there has not been fish farming activity during the monitoring period. During some years, there has, however, been incubation of local brown trout eggs in a miniature hatchery in the River Näätämöjoki (Neiden in Norwegian) catchment area during the winter and spring months.

3. Monitoring of the catchment areas running into the Baltic and White Seas

There is no regular official monitoring of *G. salaris* in these areas. On wild salmon, *G. salaris* is common in the river Tornionjoki water catchment area, which situates on the territories of both Finland and Sweden. The epidemiology of the infection in the best wild salmon river of the Baltic Sea has been studied by Anttila *et* al (2008), Kuusela *et* al (2009) and Lumme *et* al (2016).

Rainbow trout farms are considered to be quite often infected with *G. salaris* in both these catchment areas. Only a few farms have, however, been examined for the presence of *G. salaris* in recent years. The information on the present-day situation at the fish farms of Finland is thus poor. The examinations of farmed rainbow trout have been performed in connection with research or live fish export certification. In addition to *G. salaris* also *G. lavareti* has been found at some farms.

4. On-going and planned research concerning G. salaris and future research requirements

Scientific research on *G. salaris* during the recent years has mainly been performed at the University of Oulu, Department of Biology, by a group led by Professor Jaakko Lumme. Their interest has been on the molecular ecology and evolution of the parasite. Much of the work has been done in collaboration with the fish parasitologists in the Russian Karelia and Finnish Food Safety Authority Evira and the University of Turku, Finland. Professor Lumme has retired and the volume of new research on *G. salaris* in Finland might be expected to decline.

5. The publications in peer-reviewed journals by Finnish authors in 2006-2016

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

Ieshko, E., Barskaya, Yu., Parshukov, A., Lumme, J. Khlunov, O. (2016) Occurrence and morphogenetic characteristics of *Gyrodactylus* (Monogenea: Gyrodactylidae) from a rainbow trout farm (Lake Ladoga, Russia). Acta Parasitologica 61: 151-157

Koski, P., Anttila, P., Kuusela, J. (2016): Killing of *Gyrodactylus salaris* by heat and chemical disinfection. Acta Veterinaria Scandinavica, 58, 21, doi 10.1186/s13028-016-0202-y.

Kuusela J, Holopainen R, Meinilä M, Anttila P, Koski P, Ziętara MS, Veselov AJe, Primmer CR, Lumme J (2009) Clonal structure of salmon parasite *Gyrodactylus salaris* on a coevolutionary gradient on Fennoscandian salmon (*Salmo salar*). Ann. Zool. Fenn. 46: 21-33.

Kuusela J, Ziętara MS, Lumme J (2007). Hybrid origin of Baltic salmon-specific parasite *Gyrodactylus salaris*: a model for speciation by host switch for hemiclonal organisms. Molecular Ecology 16: 5234-5245.

Lumme, J., Anttila, P., Rintamäki, P., Koski, P. Romakkaniemi, A. (2016) Genetic gradient of a host-parasite pair persisted ten years against physical mobility: Baltic *Salmo salar* vs. *Gyrodactylus salaris*. Infection, Genetics and Evolution, 45: 33-39. http://www.sciencedirect.com/science/article/pii/S1567134816303434#MMCvFirst

Ozerov M.Yu., Lumme J., Päkk P., Rintamäki P., Ziętara M.S., Barskaya Y., Lebedeva D., Saadre E. Gross R., Primmer C.R., Vasemägi A, (2010) High *Gyrodactylus salaris* infection rate in triploid Atlantic salmon (*Salmo salar* L.). Diseases of Aquatic Organisms 91: 129-136

Rokicka M, Lumme J, Ziętara MS (2007). Identification of *Gyrodactylus* ectoparasites in Polish salmonid farms by PCR-RFLP of the nuclear ITS segment of ribosomal DNA (Monogenea: Gyrodactylidae). Acta Parasitologica 52: 185-195.

Ziętara MS, Kuusela J, Lumme J (2006). Escape from an evolutionary dead-end: a triploid clone of *Gyrodactylus salaris* is able to revert to sex and switch host (Platyhelminthes, Monogenea, Gyrodactylidae). Hereditas 143, 86-92.

Ziętara MS, Rokicka M, Stojanovski S, Lumme J (2010) Introgression of distant mitochondria into the genome of *Gyrodactylus salaris*: Nuclear and mitochondrial markers are necessary to identify parasite strains. Acta Parasitologica 55: 20-28.

There are also other publications on *G. salaris* and other *Gyrodactylus* species of salmon, some of the most interesting for the prevention work of *G. salaris* might be:

Ieshko, E., Lebedeva, D., Lumme, J. (2015) A new *Gyrodactylus* strain on brown trout (*Salmo trutta*) in Jänisjärvi, Russian Karelia, and a literature revision of salmonid parasites of the genus *Gyrodactylus* in North-Western Russia and adjacent areas. Acta Parasitologica 60: 75-84

Ziętara MS, Johnsen, BO, Lumme J (2008) Genetisk analyse av opprinnelsen til *Gyrodactylus salaris*-infeksjonen på laksunger i Laerdalselva. NINA Rapport 371.

Ziętara MS, Kuusela J, Veselov AJe, Lumme J (2008). Molecular faunistics of accidental infections of *Gyrodactylus* Nordmann, 1832 (Monogenea) parasitic on salmon *Salmo salar* L. and brown trout *Salmo trutta* L. in NW Russia. Systematic Parasitology 69: 123-135.

6. Measures to prevent the spread of the parasite and to eradicate it where it has been introduced

In Finland, the purpose is to keep *G. salaris* outside the rivers of the Barents Sea catchment area. The parasite has a wide distribution in the rivers and fish farms in other catchment areas in Finland, there is a common occurrence of potential wild carrier fish in the wild and there are great difficulties in demarcating the possible eradication areas. This is why the eradication of the parasite from its natural distribution areas has considered to be impossible in the territory of Finland. Considering the prevention of *G. salaris* in the Barents Sea catchment area, the restrictions of fish movements, prohibition of the use of baitfish, requirements concerning drying or disinfection of fishing equipment, boats etc. are basically the same as they were in 2007.

During the period 2006-2016 much of the publicity material of the prevention has gone into internet. A large number of players from the local fishing license sellers to central government authorities and scientific research has participated in this prevention work. The leaflets of the

prevention of the spread were updated in 2014 in Evira and published in Finnish, Swedish, Samish, English and Russian. Every fisherman gets an information leaflet made by the Centre for Economic Development, Transport and the Environment of Lapland while buying a fishing license to River Tenojoki (Tana in Norwegian).

The international cooperation between veterinary authorities has been lesser than previously in 2006-2016, but information of the national contingency planning concerning the Rivers Tenojoki and Näätämöjoki has been changed with Norway. The prevention work has also been in the agenda of the Finnish-Norwegian Transboundary Water Commission and in the negotiations of the agreement of Tenojoki between Finland and Norway during the last few years.

In the event of a *G. salaris* infection in the River Tenojoki, there will not be possibilities to the total eradication of the disease. This conclusion was based on the evaluation reports of the treatments of the Norwegian Atlantic salmon rivers and the conditions of the river and biology of River Tenojoki salmon. The preliminary study of a contingency plan for the rivers Tenojoki and Näätämöjoki was published in 2013 (Koski, P. (2013) Teno- ja Näätämöjokien suojelu *Gyrodactylus salaris* -loiselta, https://www.evira.fi/globalassets/tietoa-evirasta/julkaisut/julkaisusarjat/elaimet/eviran_julkaisuja_1_2013.pdf, in Finnish with a summary in Swedish, Samish and English). An attempt to conserve the genetic material to live gene banks would probably be the option of choice in such case. In a contingency plan the possibility of keeping certain parts of the water system free of the infection and compensatory restocking programs should be analyzed. This kind of work could perhaps serve as artificial respiration for the salmon in the river system. In the long run, a more resistant stock of the River Tenojoki salmon would presumably be needed for the restoration of the salmon population and fishing.

The desolate sight of the *G. salaris* infection in River Tenojoki or Näätämöjoki underlines the importance of the prevention work. There is a need to prepare also against the catastrophe scenario, too. The commencement of contingency planning with Norway is, however, hopeful. The contingency planning addressing the infection of *G. salaris* is an extraordinary and extensive task of preparation against an animal disease.

Annex 10

GSWG(17)10

Gyrodactylus salaris monitoring programme in the Russian Federation Status of index salmon rivers

In Atlantic salmon rivers of the Russian Federation the parasite *Gyrodactylus salaris* was for the first time found in 1992 in the Keret River (Republic of Karelia, the White Sea basin). It's believed that the parasite was introduced into the river through aquaculture activities. Therefore, in the light of recent aquaculture developments in the Murmansk region and Karelia transfers of rainbow trout from the Leningrad region and those parts of Karelia, where *Gyrodactylus salaris* is a native species, to these two regions represent a high risk of further spread of *Gyrodactylus salaris* into Atlantic salmon rivers. The parasite may also be transferred with fishing equipment in recreational fishing widely practiced in the Kola Peninsula.

Parasitological surveys to monitor *Gyrodactylus salaris* have been carried out since 1993 in five index rivers of the Murmansk region (Pecha, Pack, Kola, Kovda and Kanda) and in the Keret River of the Republic of Karelia. Until now the parasite has not been found in salmon rivers of the Murmansk region in both the Barents Sea and White Sea basins.

The infestation of juvenile Atlantic salmon with *Gyrodactylus salaris* was studied in 2016. The parasite was found on 100% of the analyzed fish (12 individuals). The number of parasites per fish varied from 17 to 1083 and the abundance rate was 164 parasite per fish (Table).

Salmon catches in the Keret River in the first half of the 1980s varied from 2 to 3 tonnes and annual adult return never fell below 2700 salmon until early 1990s. The maximum number of salmon counted at the barrier fence in the Keret River was 4660 salmon in 1983.

According to counts at the barrier fence the abundance of wild salmon in the Keret River varied from 43 to 223 individuals in 2008-2015, the majority of spawning migrants were of hatchery origin (Figure), their numbers varied from 115 to 507.

Table. Indicators of Atlantic salmon juveniles infestation (n=12 individuals) with *Gyrodactylus salaris* in the Keret River in 2016.

Proportion of infested fish, %	Number of parasite per fish (min – max)	Parasite abundance rate
100.0	17 - 1083	164.1

Parr surveys carried out in 2012-2015 showed that salmon juvenile densities were extremely low and varied from 4.7 individuals/100 m^2 in 2012 to 0.5 individuals/100 m^2 in 2014. In 2016 juveniles occurred in the upper parts of the river only.

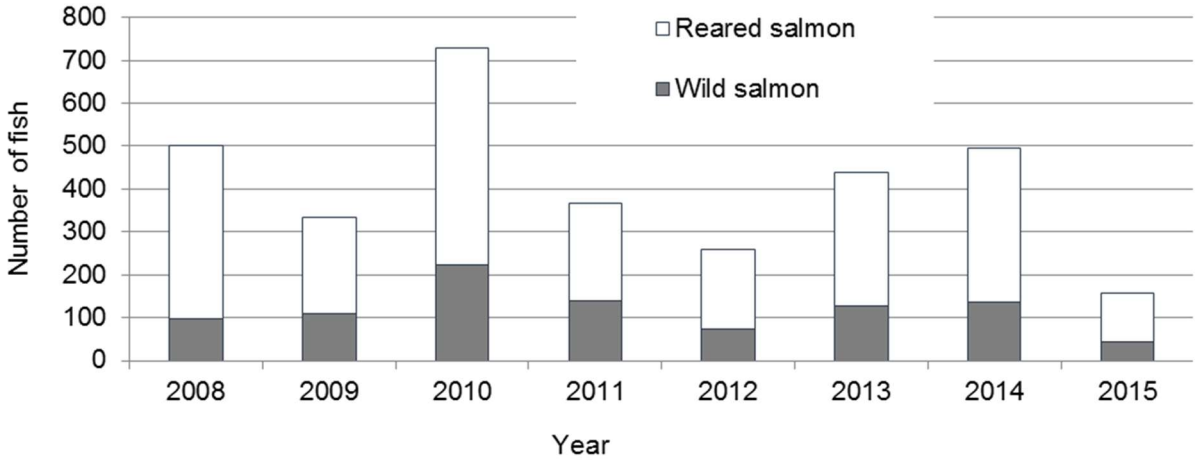


Figure. Adult salmon counts and origin of fish according to data from the barrier fence in the Keret River in 2008-2015.

Annex 11

GSWG(17)11

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

Scope

NASCO have requested that England and Wales provide a briefing paper for the 2017 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. Gyrodactylus salaris and the United Kingdom

The consequences of *G. salaris* introduction into the United Kingdom would be severe for salmonid stocks with potential for riverine stock losses of up to 98%. The economic consequences of such losses would also be severe, with an Environment Agency study in 2001 estimating that the market value of fishing rights for salmon rod fisheries in England and Wales to be £128 million.

2. Routes of Introduction

There is the potential for *G. salaris* to be introduced into the UK by several different pathways. Three main categories and respective introduction pathways have been identified and analysed for the level of risk they pose (Table 1)[(1)].

3. 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 UK is one of the few areas within the EU that is recognised free from the parasite along with the Republic of Ireland and two river catchments in Finland [(25)].

Due to recognised freedom from *G.salaris*, under Council Directive 2006/88/EC, Article 43, the United Kingdom is able to restrict imports of live salmonids to countries that have an equivalent health status i.e. demonstrated freedom from *G. salaris* and are approved as such by that countries competent authority. 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.

Table 1: Pathways of *Gyrodactylus salaris* introduction [(1)]

Category	Pathway
Live fish and gametes	Importation of live salmonids Importation of eels Importation of non-salmonid fish Importation of rainbow trout eggs
Fish carcasses	Fresh or chilled Atlantic salmon from Norway/ Finland/Sweden Fresh or chilled rainbow trout from freshwater production in mainland Europe
Mechanical transmission	Lorries moving live fish Ships' ballast water Well-boats travelling from Norway Freshwater tanks of leisure craft Canoes and angling equipment (especially keep nets) Importation of lumber from Baltic countries Importation of aquatic plants from Baltic Countries

Monitoring Programme

To satisfy Article 43 of the Directive, the Cefas fish health inspectorate (FHI) are required to carry out sampling of species susceptible to *G. salaris* as part of the criteria to maintain national control measures for the freedom of the parasite in England and Wales.

Due to the low number of salmon farms in England and Wales, samples are obtained from wild salmonid populations. This work is carried out in conjunction with the Environment Agency's area fisheries teams during their annual wild fish population surveys.

The Cefas FHI carries out monitoring for *G. salaris* in England and Wales through a rolling programme of sampling covering all river catchment's which contain salmon. Within England and Wales, there are seventy-eight 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

Once collected the fish are euthanized and placed into ethanol before being returned to the Weymouth Cefas laboratory for examination. Handling of the fish during the field sampling is kept to a minimum, to minimise the risk of removing any gyrodactylids that may be present on the fish. The sample, on return to the laboratory, is examined under a light microscope and any gyrodactylid species found are recorded and identified. All sampling carried out in the field and in the laboratory, is undertaken in accordance with the Cefas quality management system and accredited under the international standard ISO17025.

Since 2007, fifty-four sites on forty-three catchments have been sampled. In this time, *G. salaris* has not been found in any of the samples (Table 2). However, several other gyrodactylid species native to the UK have been identified.

- *Gyrodactylus derjavininoides*: Host is brown trout but also found on rainbow trout. Parasitises fins and skin surfaces.
- *Gyrodactylus thymalli:* Host is grayling. Parasitises fins and body surfaces
- *Gyrodactylus truttae*: Host is brown trout and Atlantic salmon. Observed on fins and skin surfaces

In 2016 the Cefas FHI introduced the use of a novel non-destructive method, developed at Cefas Weymouth laboratory, for sampling wild salmonids (Figure 1). This method involves the immersion of fish in a weak hydrogen peroxide solution (560ppm 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. This technique has increased the number of fish sampled from each river catchment, and increased the harvest of gyrodactylids, which improves the statistical confidence in the sampling programme. This method represents an important step forward in surveillance for gyrodactylids in both wild and farmed fish populations as it removes the need for destructive testing of juvenile Atlantic salmon, a species subject to national and international conservation measures. This new technique has been incorporated into Defra's (England and Wales) national aquatic animal disease contingency plans. Cefas will publish the methodology and will then request that it is considered for inclusion in the OIE manual for diagnostic tests for aquatic animals.

Figure 1. Equipment used in a novel non-destructive method for sampling wild salmonids for gyrodactylids

Table 2 Species of Gyrodactylids found during FHI sampling 2007-2016

Year	Catchment	Species sampled			Gyrodactylids identified
		Atlantic salmon	grayling	brown trout	
2007	Avon		17		*G. thymalli*
	Test		12		*G. thymalli*
	Tavy	30			*-ve*
	Plym	30			*G. derjavinoides*
	Inny	30			*-ve*
	Frome	30			*G.. Sp*
	Tawe	30			*-ve*
	Nadder	20			*G. derjavinoides*
	Avon	15			*-ve*
2008	Coquet	30			*-ve*
	Aln			17	*-ve*
	Tyne	30			*-ve*
	Wear	30			*-ve*
	Test		2	1	*-ve*
	Itchen		30		*-ve*
2009	Nidd		21	71	*G. truttae/G. derjavinoides*
	Piddle	30			*G. derjavinoides*
	Usk	30			*G. derjavinoides*
	Wye	30			*G. derjavinoides*
	Severn	30			*G. derjavinoides*
	Tees	30			*-ve*
	Esk	30			*-ve*
2010	Exe	30			*G. derjavinoides/G. sp*
	Torridge	30			*G. derjavinoides*
	Tywi	30			*-ve*
	Afan	20		10	*G. derjavinoides*
	Lugho	28		1	*-ve*
	Lynher	30			*G. derjavinoides*
2011	Camel	30			*-ve*
	Fowey	30			*-ve*
	Teign			30	*-ve*

	Teifi	30			*G. derjavinoides*
	Nevern	30			*G. derjavinoides*
	Gwaun	30			*G. derjavinoides*
	Dee	30			*G. derjavinoides*
	Conwy	30			*G. derjavinoides*
	Lune	30			*-ve*
	Duddon	30			*-ve*
	Esk	30			*G. derjavinoides*
2012	Thames			30	*G. derjavinoides/G.Sp*
	Thames			29	*G. derjavinoides/G.Truttae*
	Avon			30	*G. derjavinoides*
	Stour			30	*G. derjavinoides*
	Taw	15		15	*-ve*
	Tavy	30			*-ve*
	Wey			30	*G. derjavinoides*
2013	Coquet	29		1	*-ve*
	Aln	4		26	*-ve*
	Piddle	1		12	*-ve*
	Tamar	30			*-ve*
	Frome	30			*-ve*
	Ouse			30	*-ve*
	Tyne	30			*-ve*
	Wear	30			*-ve*
2014	Ouse			30	*G. derjavinoides*
	Inny	30			*-ve*
	Plym	30			*G. derjavinoides*
	Usk	30			*G. derjavinoides*
	Wye	33			*G. derjavinoides*
	Severn	30			*G. derjavinoides*
	Test	30			*-ve*
2015	Itchen	30			*G. derjavinoides*
	Esk (Yorkshire)			30	*G. derjavinoides*
	Tees	30			*G. derjavinoides*
	Exe	25		5	*G. derjavinoides*
	Torridge	30			*G. derjavinoides*

	Lynher	30			*G. derjavinoides*
	Tywi	9		21	*G. derjavinoides*
	Afan	23		7	*G. derjavinoides*
	Lughor	6		24	*G. derjavinoides*
	Tawe	10		20	*G. derjavinoides*
	Tamar	6			*-ve*
2016	Ogmore	30			*G. derjavinoides*
	Cleddau	30			*G. derjavinoides*
	Dee	30			*G. derjavinoides*
	Mawddach	30			*G. derjavinoides*
	Fowey	30			*G. derjavinoides*
	Camel	30			*G. derjavinoides*
	Teign	30			*G. derjavinoides*
	Ellen	4		26	*G. derjavinoides/G.Truttae*
	Eden	30			*G. derjavinoides*
	Bela River Kent	5		25	*G. derjavinoides*
	Frome	30			*G. derjavinoides*
	Usk	81		5	*G. derjavinoides/G.Truttae*
	Cynrig Hatchery	170			*-ve*

References

Peeler, E.J., Thrush, M.A., 2004. Qualitative analysis of the risk of introducing *Gyrodactylus salaris* into the United Kingdom. Diseases of Aquatic Organisms. 62, 103-113

'Road Map' to enhance information exchange and co-operation on monitoring, research and measures to prevent the spread of G. salaris and eradicate it if introduced

Recommendation	Proposed Action
1. Preventive measures and contingency planning	a) Appropriate steps should be taken to prevent the spread of *G. salaris* on fishing equipment, boats, *etc*. by use of approved disinfection methods. b) All movements of live fish should be recorded so that movements can be traced in the event of an outbreak of *G. salaris.* c) The risk of *G. salaris* introduction through the processing of fish carcasses should be assessed and, where appropriate, mitigated through control of processing. d) Physical barriers to fish migration should be considered as a measure to prevent the spread of *G. salaris* within a catchment and to uninfected catchments. e) Where possible, routine breaks in production and disinfection on rainbow trout and salmon freshwater aquaculture sites should be implemented as part of a control programme in infected areas. f) Permission to stock fish into infected river catchments should be based on an assessment of the increased risk of transmission of the parasite to non-infected rivers (e.g. through migration and other routes). g) NEAC Parties and their relevant jurisdictions should have contingency plans in place for treatment, containment or eradication. These plans should be developed in consultation with stakeholders. A legal base for the use of rotenone and other treatments, containment and eradication measures should be put in place. Contingency plans should be tested periodically and updated as required. h) NEAC Parties and their relevant jurisdictions should ensure that adequate resources are available for the implementation of measures to contain and eradicate *G. salaris*.
2. Cooperation on management	a) The North-East Atlantic Commission (NEAC) should retain an item on *G. salaris* on the agendas for its Annual Meetings. This would facilitate reports by its Parties and their relevant jurisdictions and by the Working Group on measures to prevent the further spread of the parasite and to eradicate it in areas where it has been introduced and on other aspects of this 'Road Map'. b) 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'.

	c) Contingency plans developed by NEAC Parties and their relevant jurisdictions should be made available to the Working Group at its next meeting with the view to sharing information on approaches and challenges. The plans should be made available on the websites of the Competent Authorities with links to them from the NASCO website.
3. Monitoring methods for use in watercourses, lakes and in aquaculture	The Working Group should review new developments with regard to monitoring for, and detection of, *G. salaris* and develop recommendations for their inclusion in international guidelines.
4. Distribution of *G. salaris* in the NEAC area and adjacent areas	a) Existing monitoring programmes on salmonids in the wild and in aquaculture environments undertaken by NEAC Parties and their relevant jurisdictions should be retained and expanded as necessary. They should provide genetic data for all *Gyrodactylus* species isolated during monitoring. Reports on these programmes should be provided to the Working Group at their next meeting. b) Information should be requested from all NEAC Parties and their relevant jurisdictions which have wild Atlantic salmon but which have not participated in the Working Group to date. c) NEAC Parties and their relevant jurisdictions should identify *G. salaris* as an impact factor in the NASCO Rivers Database for those rivers infected by the parasite. d) The NASCO Secretariat should make a request to the OIE reference laboratory for *G. salaris* seeking information on the distribution of *G. salaris* in countries that have wild and/or farmed susceptible species, but which do not have wild Atlantic salmon.
5. Research to inform the effective management of *G. salaris*	a) The NEAC Parties and their relevant jurisdictions should conduct applied research to inform the effective management of *G. salaris*, particularly the following: - the distribution and genetics of *G. salaris*; - the effects of salmon genetics on susceptibility to *G. salaris*; - the effect of environmental factors on pathogenicity; - to clarify the classification of *G. salaris* and *G. thymalli* and then develop a reliable method to distinguish between pathogenic and non-pathogenic strains; - general biology and mechanisms of spread of the parasite; - effect of environmental parameters and ecology on the distribution of *G. salaris*; - detection and diagnostic methods for *G. salaris;* - new environmental friendly treatment methods in rivers and lakes, e.g. acid aluminum and chloride. b) The Working Group should keep research requirements and monitoring needs under review and report regularly to the NEAC.
6. Classification of *Gyrodactylus* species	NEAC Parties and their relevant jurisdictions should only support any future proposal to synonomise *G. salaris* and *G. thymalli* if, in parallel, OIE standards and national legislation recognise the different pathogenicity and host predilection of these two species.
7. Publicity, education, and awareness	a) NEAC Parties and their relevant jurisdictions should develop publicity material on the threat of the parasite to wild Atlantic salmon and specify measures to prevent its spread; strategies for the effective dissemination of this material should be

	developed particularly with regard to targeting high risk groups. Existing material should be reviewed and updated as appropriate in the light of current knowledge. The NASCO Secretariat should develop standard text as a basis for such publicity material. b) This material should be made available on the web sites and promoted on the social media platforms of the Competent Authorities and NASCO with a view to highlighting the serious risks posed by the spread of the parasite.
8. Continuity of current measures in the EU Animal Health Law	Relevant NEAC Parties and their relevant jurisdictions should seek to ensure continuity in the provisions related to *G. salaris* in current EU animal health legislation (Regulation 2016/429) which should be retained, in particular with regard to Additional Guarantees.
9. Criteria for diagnosis and establishing *G. salaris*-free zones	NEAC Parties and their relevant jurisdictions should implement the diagnostic standards in the OIE Manual of Diagnostic Tests for Aquatic Animals.
10. Trade in live susceptible fish species	a) Trade in disinfected eggs is preferable to trade in live susceptible fish species. However, where movements of live susceptible fish species are approved, NEAC Parties and their relevant jurisdictions should ensure that trade in live susceptible fish species only takes place between areas of equal *G. salaris* status or from a higher to lower status area. b) NEAC Parties and their relevant jurisdictions should ensure the health status of the traded live susceptible fish species and/or their eggs, and the competence of the certifying Authority.
11. Shared catchments	NEAC Parties and their relevant jurisdictions with shared catchments or having catchments in close proximity should implement appropriate mechanisms for co-operation, including the establishment and strengthening of inter-country Working Groups and the development of common contingency plans to control and eradicate *G. salaris*.