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The surveillance programme for *Gyrodactylus salaris* in Atlantic salmon and rainbow trout in Norway 2024

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Summary

In 2024, a total of 2370 specimens of Atlantic salmon from 71 rivers and 3566 specimens of Atlantic salmon and rainbow trout from 97 hatcheries/farms were sampled and examined in the surveillance program for *Gyrodactylus salaris*. The parasite was not detected in any of these samples. However, *G. salaris* was detected in a new water course, Bergerelva (watercourse code 012.3Z), in samples taken outside the surveillance programme. Samples from Bergerelva were examined during an investigation into the infection status in the Drammen region in relation to the upcoming treatment of rivers in this region.

Including the new detection in Bergerelva, a total of 54 rivers have been infected since *G. salaris* was introduced to Norway. As of 31.12.24, *G. salaris* is confirmed present in six Norwegian river systems in the Drammen infection region. These are the rivers Drammenselva, Lierelva, Sandeelva, Selvikvassdraget, Bergerelva and Ebbestadelva. Treatment of five rivers in the Driva infection region, Batnfjordselva, Driva, Litledalselva, Usma and Gylelva in county Møre og Romsdal, was completed in 2024. These rivers are at present part of the declaration of freedom programme, awaiting confirmation of eradication. Altogether 43 rivers have been declared free after treatment.

Introduction

In the period from 1975 until the start of 2024, pathogenic strains of *Gyrodactylus salaris* had been detected on Atlantic salmon (*Salmo salar*) fingerlings/parr in 53 rivers, 13 hatcheries/farms with Atlantic salmon parr/smolts and 26 hatcheries/farms with rainbow trout (*Oncorhynchus mykiss*). In addition, both pathogenic and non-pathogenic strains of *G. salaris* have been found on Arctic char (*Salvelinus alpinus*).

The policy of the Norwegian authorities is to eradicate *G*. *salaris* from infected watersheds and farms (Anon 2014). If *G. salaris* is detected in a farm, eradication is carried out by eliminating the hosts (Atlantic salmon and/or rainbow trout). This also ensures elimination of the parasite since it lacks specialised free-living stages and does not use intermediate hosts in its life cycle. In rivers, the eradication is done by chemical treatment. In most instances rotenone has been the preferred chemical, but one exception to this is the treatment of River Lærdalselva in 2011-2012, where acidified aluminium sulphate was used to eradicate the parasite (Hindar et al., 2015). Recently, a full-scale treatment using chlorine as the main chemical has been completed in river Driva, Møre og Romsdal county (Garvik et al., 2025). In contrast to rotenone treatment, treatment with aluminum sulfate and chlorine will kill the parasite, but not the host.

By the entrance to 2024, *G. salaris* was confirmed eradicated from 42 rivers and from all hatcheries/fish farms. In addition, the declaration of freedom programme for the Vefsna infection region, County Nordland, was finalized with the examination of the samples from the Fusta water course at the end of 2023. All samples were found negative and with this, the whole infection region was free of the parasite, however this was not officially declared before early 2024. *Gyrodactylus salaris* was still present in 10 Norwegian river systems: Drammenselva (012.Z), Lierelva (011.Z), Ebbestadelva (012.2Z) in county Buskerud, Vesleelva (Sandeelva)(013.Z) and Selvikvassdraget (013.1Z) in county Vestfold og Telemark, and Batnfjordselva (108.3Z), Driva (109.Z), Litledalselva (109.5Z), Usma (109.4Z) and Gylelva (109.7Z) in county Møre og Romsdal at the entrance to 2024.

Gyrodactylus salaris is included in the list F of nationally listed and notifiable diseases, and Norway has implemented national measures for the parasite which comply with Regulation (EU) 2016/429, article 226 (3). *Gyrodactylus salaris* is also listed as a notifiable aquatic animal disease by the World Organization for Animal Health (WOAH). Surveillance for *G. salaris*, aiming to declare freedom from the parasite in treated rivers, has been ongoing since the early 1980s. The Norwegian Veterinary Institute (NVI) coordinates the surveillance programme on behalf on the Norwegian Food Safety Authority (NFSA) and publishes the overall results in annual reports available on the NVI website (www.vetinst.no).
NFSA is responsible for the sampling in fish farms. NVI is responsible for the sampling in the rivers, but County Environmental Departments and other institutions/companies are commissioned to do the actual sampling. NVI is responsible for examination of the fish samples and the subsequent species identification, if *Gyrodactylus* is detected.

Aims

The surveillance program aims to document the absence of *G. salaris* in Norwegian farms and rivers, as well as to detect and track any spread of the parasite to new river systems or fish farms.

Materials and methods

The selection of rivers for inclusion in the surveillance programme follow specified criteria which takes into account the risk of infection with *G. salaris* (see text box 1). In general, a total of 30 wild Atlantic salmon juveniles are sampled from each selected river, preferably from three different sites located far apart. To increase the sensitivity of the surveillance for the River Rana (Nordland county), where the source of the infection detected in 2014 remains unknown, an additional sample of 30 fish is taken one month after the first sample. In Tana (Troms

and Finnmark county), 150 salmon are sampled from 15 sites due to the large size of this watercourse. Fingerlings/parr/smolts of an age of 1+ or older (preferred size ranging from 7 - 12 cm) are caught by means of electrofishing. The fish are killed and then preserved whole in 96% ethanol.

In farms and hatcheries, either 30 Atlantic salmon or 60 rainbow trout are sampled by seine net. The fish are killed and all fins (except the adipose fin) are cut off and preserved in 96% ethanol. Each farm/hatchery is examined every second year.

All samples are sent to the NVI for examination under a stereo microscope at 10 - 15 times magnification. For wild Atlantic salmon, the whole surface of the fish, including the skin, head, fins and gills, is examined, while only the fins from farmed fish are examined.

When *Gyrodactylus* specimens are detected, species determination is performed by NVI. NVI is the WOAH reference laboratory for "Infection with *Gyrodactylus salaris*" and the methods used for species identification follow those given by the WOAH Manual of Diagnostic Tests for Aquatic Animals: https://www.woah.org/fileadmin/Home/eng/Health_standards/aahm/current/2.3.03_G_salaris.pdf

Criteria for inclusion of rivers in the surveillance program for *Gyrodactylus salaris* in short*.

1. Rivers declared free from infection after treatment. This criteria states that when a watercourse is declared free from infection with *G. salaris*, it should be included in the surveillance program for a minimum of five (5) years. After five years, a watercourse can be excluded from the surveillance program unless it fulfils other risk factors for their continued inclusion (see below).
2. Large salmon rivers in terms of spawning targets. This criteria states that the 30 largest salmon rivers in terms of spawning targets should be included in the surveillance program.
3. Rivers with a high risk of inter-river dispersal of *G. salaris*. This criteria states that rivers with a high risk of being infected via inter-river (brackish-water) dispersal of *G. salaris* should be included in the surveillance program. Due to the decreasing numbers of infected rivers in Norway, the number of rivers included based on fulfilment of this criteria has decreased, and will continue to decrease, when further rivers are declared free from infection.
4. Rivers with other risk of infection: this criteria overlaps somewhat with criteria 3, but the main focus is on the threat from areas bordering other countries.
5. Geographic coverage: This criteria states that a minimum of two (2) rivers from each county where salmon rivers are present should be included in the surveillance program.

*For further details please consult the following document: Reply from the Norwegian Veterinary Institute (NVI) to the Norwegian Food Safety Authority (NFSA) 5th February 2020: FSA reference number 2020/173134, alt. NVI reference number 20/12419.

Results and discussion

Altogether, 2370 specimens of Atlantic salmon from 71 rivers and 3556 specimens of Atlantic salmon and rainbow trout from 97 farms were examined in 2024. In addition, 10 arctic char. *Salvelinus alpinus*, were examined (See Table 1 and appendix A). No samples from rivers in county Telemark were included in the surveillance program for 2024 (Table 1 and Appendix A). This is due to the fact that these counties were unified (under the name county Vestfold and Telemark) until January 1, 2024 and the selection of rivers for inclusion in the programme was done prior to this. In addition, Buskerud is not represented as all its rivers are part of the Drammen infection region and excluded from the surveillance programme. *Gyrodactylus salaris* was not detected in any of the samples examined in the surveillance programme.

In samples collected outside the surveillance programme in 2024, *G. salaris* was detected in Bergerelva (watercourse code 012.3Z), county Buskerud. Bergerelva was included in an investigation of the infection status in watercourses in the Drammen infection region in relation to the upcoming treatment of rivers in this region. The status at the end of the year 2024 is thus that *G. salaris* is present in six Norwegian river systems. All six rivers; Drammenselva, Lierelva, Sandeelva, Selvikvassdraget, Bergerelva and Ebbestadelva, are part of the

Drammen infection region. The treatment of five rivers in the Driva infection region was completed in 2024, and these rivers are at present part of the declaration of freedom programme, awaiting confirmation of eradication.

Table 1. Number of rivers, farms and fish examined for *Gyrodactylus salaris* in 2024.

County	Rivers		n examined	Positive	Farms/hatcheries		n examined	positive
	n rivers	species[1]			n farms	species[1]		
Innlandet	-	-	-	-	7[2]	RT	481	0
Østfold	2	AS	61	0	1	AS	29	0
Oslo	2	AS	60	0	-	-	-	-
Akershus	5	AS	152	0	-	-	-	-
Buskerud	-	-	-	-	-	-	-	-
Vestfold	2	AS	60	0	-	-	-	-
Telemark	-	-	-	-	2	AS	60	0
Agder	3	AS	91	0	-	-	-	-
Rogaland	3	AS	90	0	7	AS/RT	245	0
Vestland	5	AS	151	0	30	AS/RT	1147	0
Møre og Romsdal	7	AS	211	0	12	AS/RT	414	0
Trøndelag	8	AS	281	0	17	AS/RT	546	0
Nordland	14	AS	450	0	15	AS	462	0
Troms	7	AS	232	0	3	AS	89	0
Finnmark	13	AS	531	0	3	AS	93	0
Total	**71**		**2370**		**97**		**3566**	

[1]AS = Atlantic salmon, RT = rainbow trout. See Appendix B for details). [2] One farm was sampled twice in 2024 (see details in Appendix B).

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Appendix A

Watercourses examined for *Gyrodactylus salaris* in 2024 sorted by watercourse code. Detected, ND = Not detected.

County	Watercourse	Watercourse code	No of Atlantic salmon examined	*G. salaris*
Østfold	Enningdalselva	001.1Z	30	ND
Østfold	Glommavassdraget	002.Z	31	ND
Akershus	Hølenelva	004.Z	30	ND
Akershus	Gjersjøelva	005.4Z	31	ND
Oslo	Nordmarkvassdraget	006.Z	30	ND
Oslo	Lysakerelva	007.Z	30	ND
Akershus	Sandvikselva	008.Z	30	ND
Akershus	Askerelva	009.1Z	31	ND
Akershus	Årosvassdraget	009.Z	30	ND
Vestfold	Aulivassdraget	014.Z	30	ND
Vestfold	Numedalslågen	015.Z	30	ND
Agder	Tovdalselva	020.Z	30	ND
Agder	Otra	021.Z	31	ND
Agder	Mandalselva	022.Z	30	ND
Rogaland	Bjerkreimselva	027.Z	30	ND
Rogaland	Figgjo	028.Z	30	ND
Rogaland	Suldalslågen	036.Z	30	ND
Vestland	Vossovassdraget	062.Z	30	ND
Vestland	Lærdalselva	073.Z	31	ND
Vestland	Gaula	083.Z	30	ND
Vestland	Nausta	084.7Z	30	ND
Vestland	Strynselva	088.Z	30	ND
Møre og Romsdal	Måna	103.1Z	30	ND
Møre og Romsdal	Innfjordselva	103.2Z	30	ND
Møre og Romsdal	Breidvikelva	103.42Z	30	ND
Møre og Romsdal	Glutra	103.4AZ	31	ND
Møre og Romsdal	Skorgeelva	103.5Z	30	ND
Møre og Romsdal	Rauma	103.Z	30	ND

Møre og Romsdal	Surna	112.Z	30	ND
Trøndelag	Orkla	121.Z	31	ND
Trøndelag	Gaula	122.Z	29	ND
Trøndelag	Nidelvvassdraget	123.Z	31	ND
Trøndelag	Stjørdalsvassdraget	124.Z	33	ND
Trøndelag	Verdalsvassdraget	127.Z	32	ND
Trøndelag	Figga/Snåsavassdraget	128.3Z	31	ND
Trøndelag	Stordalselva	135.Z	30	ND
Trøndelag	Årgårdsvassdraget	138.Z	31	ND
Trøndelag	Namsen	139.Z	33	ND
Nordland	Hundåla	151.1Z	30	ND
Nordland	Vefsna	151.Z	30	ND
Nordland	Drevja	152.2Z	24	ND
Nordland	Fusta	152.Z	51	ND
Nordland	Dagsvikelva	153.11Z	30	ND
Nordland	Nylandselva	153.1Z	30	ND
Nordland	Leirelva	153.22Z	30	ND
Nordland	Ranelva	153.3Z	30	ND
Nordland	Bjerka	155.4Z	30	ND
Nordland	Røssåga	155.Z	30	ND
Nordland	Sletterelva	156.4Z	30	ND
Nordland	Ranavassdraget	156.Z	75	ND
Nordland	Saltdalsvassdraget	163.Z	30	ND
Troms	Salangselva	191.Z	33	ND
Troms	Målselvvassdraget	196.Z	34	ND
Troms	Nordkjoselva	198.Z	34	ND
Troms	Signaldalelva	204.Z	30	ND
Troms	Skibotnvassdraget	205.Z	32	ND
Troms	Manndalselva	206.1Z	35	ND
Troms	Reisavassdraget	208.Z	34	ND
Finnmark	Altavassdraget	212.Z	28	ND
Finnmark	Repparfjordvassdraget	213.Z	32	ND

Finnmark	Stabburselva	223.Z	31	ND
Finnmark	Lakselvvassdraget	224.Z	32	ND
Finnmark	Børselvvassdraget	225.Z	32	ND
Finnmark	Storelva	228.Z	32	ND
Finnmark	Tana	234.Z	153	ND
Finnmark	Komagelva	239.Z	32	ND
Finnmark	Vestre jakobselv	240.Z	32	ND
Finnmark	Munkelva	244.4Z	31	ND
Finnmark	Neidenvassdraget	244.Z	30	ND
Finnmark	Karpelva	247.3Z	33	ND
Finnmark	Grense jakobselv	247.Z	33	ND

[3]In addition to the Atlantic salmon, 10 Arctic char, Salvelinus alpinus, from Ytterbekken, a small stream draining into the same estuary as Ranavassdraget and with a previous history of infection were also sampled and examined. All were negative. These are not included in the total in this table.

Appendix B

Farms and hatcheries examined for *Gyrodactylus salaris* in 2024 grouped by county from south to north. AS= Atlantic salmon, RT= Rainbow trout, ND = Not detected, NA = Not Available

County	Farm/Hatchery	Hatchery code	Fish species	No. of AS/RT examined	*G. salaris*
Østfold	Kultiveringsanlegg Glomma	NA	AS	29	ND
Innlandet	Begna (Haadem, Henrik Innlandsoppdrett)	12517	RT	59	ND
Innlandet	Fasle	33977	RT	60	ND
Innlandet	Ferisfjorden (Røn Gard)	13881	RT	121	ND
Innlandet	Lofoss Mølle	12342	RT	62	ND
Innlandet	Lomen Slidrefjorden (Trøsvik Gård	12341	RT	59	ND
Innlandet	Nedre Hande (Hande, Knut)	13716	RT	60	ND
Innlandet	Noraker Gård	10364	RT	60	ND
Telemark	Fossing Storsmolt	38917	AS	30	ND
Telemark	Grenland Sportsfiskere	NA	AS	30	ND
Rogaland	Dirdal	10131	AS	30	ND
Rogaland	Eiane	11894	RT	60	ND
Rogaland	Hognaland	12964	AS	30	ND
Rogaland	IMS II	11954	AS	30	ND
Rogaland	Klybbatårnet SSØ	13819	AS	32	ND
Rogaland	Trovåg	13637	AS	33	ND
Rogaland	Årdal, RHM702	NA	AS	30	ND
Vestland	Alvøen	11579	RT	60	ND
Vestland	Bjørsvik	13653	RT	61	ND
Vestland	Botnane	13152	RT	57	ND
Vestland	Dale klekkeri/Dalekvam	NA	AS	30	ND
Vestland	Drageide	12103	AS	30	ND
Vestland	Eidestø	12041	AS	30	ND
Vestland	Fjon	10060	AS	30	ND
Vestland	Haukå	13486	AS	30	ND
Vestland	Ilsvåg	12116	AS	30	ND
Vestland	Kvinge S	13482	AS	30	ND
Vestland	Lianeset	11745	AS	31	ND
Vestland	Lønningdal III	14556	AS	29	ND

Vestland	Matredal	10156	AS	36	ND
Vestland	Nesfossen	11682	AS	30	ND
Vestland	Norddal	13713	RT	71	ND
Vestland	Nye Årøy Klekkeri	13667	AS	32	ND
Vestland	Ospenes	12096	AS	30	ND
Vestland	Rylandsvåg	10076	AS	36	ND
Vestland	Sima kraftverk	NA	AS	30	ND
Vestland	Skagen	10199	AS	31	ND
Vestland	Skogseidvatnet II	27956	AS	30	ND
Vestland	Skogseidvatnet III	28796	AS	30	ND
Vestland	Skålvik	11636	RT	60	ND
Vestland	Storevatn	13206	AS	30	ND
Vestland	Sørebø	12177	RT	68	ND
Vestland	Trosnavåg	11453	RT	31	ND
Vestland	Tørvikvatnet	13156	AS	30	ND
Vestland	Utlebøen	10145	AS	30	ND
Vestland	Vassbygdi	NA	AS	34	ND
Vestland	Åreneset	12219	RT	60	ND
Møre og Romsdal	Botn	10220	AS	35	ND
Møre og Romsdal	Dravlaus	12214	AS	30	ND
Møre og Romsdal	Driva kultiveringsanlegg	11867	AS	32	ND
Møre og Romsdal	Rossåa Settefiskanlegg	NA	AS	31	ND
Møre og Romsdal	Sagosen	12460	AS	30	ND
Møre og Romsdal	Sagvikvatnet/Norheim	12474	AS	33	ND
Møre og Romsdal	Sjølseng	12917	AS	32	ND
Møre og Romsdal	Standal Y.	12278	AS	31	ND
Møre og Romsdal	Statkraft Eresfjord	NA	AS	33	ND
Møre og Romsdal	Storelva	12986	AS	30	ND
Møre og Romsdal	Tafjord	18355	RT	64	ND
Møre og Romsdal	Vestseøra	24096	AS	33	ND
Trøndelag	Follavatn	45116	AS	30	ND
Trøndelag	Hopla	10385	AS	31	ND
Trøndelag	Kongsmoelva	10265	AS	30	ND

Trøndelag	ASåvatnet	12422	AS	31	ND
Trøndelag	Lauvsnes	12623	AS	30	ND
Trøndelag	Lonet I Naustbukta	12719	AS	30	ND
Trøndelag	Osavatnet	13181	AS	30	ND
Trøndelag	Røyklibotn	10412	AS	30	ND
Trøndelag	Sagelva	12813	AS	34	ND
Trøndelag	Salsbruket	13180	AS	30	ND
Trøndelag	Saltbuodden	13740	AS	30	ND
Trøndelag	Settefiskanlegget Lundamo	NA	AS	30	ND
Trøndelag	Skorstad	13739	AS	30	ND
Trøndelag	Svaberget	39717	AS	30	ND
Trøndelag	Sætran	12639	RT	60	ND
Trøndelag	Tverrvågen	12428	AS	30	ND
Trøndelag	Vikbukta	12595	AS	30	ND
Nordland	Elvenesstrand	13943	AS	37	ND
Nordland	Glomfjord 1 + 3	13188/11127	AS	30	ND
Nordland	Grytåga	10948	AS	30	ND
Nordland	Holmvåg	13935	AS	30	ND
Nordland	Hopen	10484	AS	30	ND
Nordland	Hustadstranda	11313	AS	33	ND
Nordland	Innhavet	11296	AS	30	ND
Nordland	Leirfjord Kultiveringsanlegg (Åselva)	NA	AS	30	ND
Nordland	Mølnarodden	11220	AS	30	ND
Nordland	Nusfjord	11213	AS	30	ND
Nordland	Saglifossen	13183	AS	31	ND
Nordland	Sundsfjord	29316	AS	30	ND
Nordland	Tosbotn	13584	AS	31	ND
Nordland	Trollbukta	11264	AS	30	ND
Nordland	Åmøya	26375	AS	30	ND
Finnmark	Friarfjord	13140	AS	33	ND
Finnmark	Hasvik	32817	AS	30	ND
Finnmark	Neptunbruket	29796	AS	30	ND
Troms	Foldvik	11325	AS	29	ND

Troms	Storelva Elvevollen	10741	AS	30	ND
Troms	Storelva i Berg	11426	AS	30	ND

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