Sea trout populations and rivers in the Baltic Sea

Sea trout (*Salmo trutta*) river and stock status assessment report of the Interreg RETROUT project

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Contents

Executive summary

This report is produced within the Interreg RETROUT project to support management of sea trout populations and rivers in the Baltic sea region. The report is based on existing information on sea trout river populations and river habitats available via project partners and ICES Assessment Working Group on Baltic Salmon and Trout (ICES WGBAST). The aim of this report is to assess the status of sea trout rivers and populations and provide an overview on the impacts on Baltic sea se trout caused by recreational fisheries. The output complements existing sea trout assessments by ICES WGBAST and HELCOM and supports the implementation of national and international policies regarding sea trout, migratory fish and river habitats.

In the Baltic Sea region, the long-term neglect of rivers and their fish have destroyed or degraded most of the original salmonid populations. Degraded and inaccessible river habitats together with pressure from fisheries have had negative consequences on the status of Baltic Sea salmonids. In addition to the ecological effects, these losses also reduce the possibility to use these fish as resources by commercial and recreational fisheries. Sea trout, as one of the two most important salmonids in the Baltic sea, has historically been a common species in the Baltic Sea region, with only around 500 natural populations remaining. Sea trout in the Baltic Sea is classified as vulnerable, and large part of the populations and rivers are in urgent need of recovery measures. The status of the sea trout populations and rivers are to a large extent a result of past management practice and of potential restoration activities if such has been undertaken. To produce information on the sea trout river and stock statuses therefore help understand the current situation, learn from past practice, and plan and identify future needs.

Recreational fishing for sea trout in the Baltic sea is becoming increasingly popular. The current overall yearly catch from recreational sea trout fishing is coarsely around 500 tonnes, and is already at the same level or higher than commercial catches. Thus, recreational fishery should not be neglected when assessing the impact from fisheries on the sea trout stock. How the sea trout stocks endure the fishing pressure, and thus what impact the fishing has on the stocks, depend on the status of the sea trout stocks. To assess the impact of recreational fishing on the natural sea trout stocks can be challenging as a considerable amount of reared sea trout is released to the Baltic Sea or its rivers. Natural production of sea trout in rivers depends on the number of successful spawning fish and on the survival of eggs and juveniles. Hence, the production can be hampered by migration barriers and poor habitat quality, ultimately affecting the stock size. When the stocks are decreasing due to poor reproduction, the relative effect of an unchanged fishing pressure increase. Against this background it might become important to better consider and adapt the level of recreational fishery to the development in sea trout stock sizes. Various regulations and restrictions are already in use in different countries in order to address this. There is also still a considerable uncertainty in the data on recreational fishing effort and catches, and information on these need to improve to better understand the impact from recreational fishing on sea trout.

Sea trout 0+ parr densities are used as the basis for the standard sea trout river status assessments in the Baltic sea region. In the assessment done for this report, sea trout parr densities varied up to over two orders of magnitude between different rivers and monitoring data. Over the assessment period 2010–2018 the sea trout parr densities also varied between years and countries, with an average level being highest in Denmark and lowest in Lithuania. No obvious trend over the assessment period was seen in the parr densities in any country, and the differences between countries partly reflect differences in monitoring sites and river types included.

The index used for evaluation the status of sea trout rivers/populations, *recruitment status RS*, relates the observed parr densities to a habitat-based estimation of the potential maximum parr density that the site could produce. Recruitment status varied considerably both between years and countries and assessment areas. In general, the *RS* was highest in Gulf of Finland and Estonian rivers and lowest in the southern Baltic sea, especially in Germany. Finland and Estonia showed the strongest indications of a positive overall trend over the last decade, while Poland had the only negative trend indication.

The assessed current status of sea trout river populations, taken as an average of the last four years, showed the best status for Estonia and the poorest situation for Germany. The list of rivers with *black* status, that is rivers with dangerously low sea trout production (*RS* ≤ 0.2), contains 67 rivers of which the largest share was found in the southern Baltic sea region. The highest share of rivers belonging to the best status class *green* was found in the Gulf of Finland area. The Baltic sea black list of sea trout rivers is provided in Annex 2.

Although restricted in extent due to data availability, the outcome of this assessment highlights the current situation with a considerably high share of rivers still failing to reach a good status, and also pinpoints those rivers in the poorest condition needing urgent and prioritised recovery measures. At the same time, in certain areas positive development have been witnessed following increased emphasis and better management practices of sea trout populations and their rivers.

1 Introduction

Constantly discharging fresh water to the Baltic Sea, a large number of rivers, streams, and brooks occupy the drainage area of one of world's largest brackish seas. Rivers not only supply fresh water, but also connect the sea with the inland and function as essential habitats for many species, including the migratory fish. One of the most important and iconic migratory fish species in the Baltic Sea is the sea trout (*Salmo trutta*).

The negative impact of human activities on river environments and migratory fish is indisputable. Dams and other construction as well as pollution and eutrophication have deteriorated the hydro-morphological conditions and the water quality of many rivers, while fisheries exploit migratory fish populations both in the sea and in rivers. Migratory fishes use rivers, streams, and brooks as spawning and nursery habitats before migrating to the sea. When access to or conditions within these essential habitats are hampered, fish populations decline and can even face extinction. In the Baltic Sea region, the long-term neglect of rivers and their fish have destroyed or degraded most of the original salmonid populations. Degraded and inaccessible river habitats together with pressure from fisheries have had negative consequences on the status of Baltic Sea salmonids. In addition to the ecological effects, these losses also reduce the possibility to use these fish as resources by commercial and recreational fisheries.

Sea trout has historically been a common species in most of the numerous rivers and streams of the Baltic Sea region. Only around 500 natural populations are estimated to exist today, of which a large part is in urgent need of recovery measures (HELCOM 2011). Overall, the sea trout in the Baltic sea is classified as vulnerable (HELCOM 2013). The status of the sea trout populations and rivers are to a large extent a result of past management practice and of potential restoration activities if such has been undertaken. Therefore, to produce information on the sea trout river and stock statuses help to understand the current situation, learn from past practice, and plan and identify future needs.

This report is produced within the Interreg RETROUT project (Box 1) to support management of sea trout populations and rivers in the Baltic sea region. The report is based on existing information on sea trout river populations and river habitats available via project partners and ICES Assessment Working Group on Baltic Salmon and Trout (ICES WGBAST; see Chapter 3 for more information). The aim of this report is to assess the status of sea trout rivers and populations and provide an overview on the impacts on Baltic sea se trout caused by recreational fisheries. The output complements existing sea trout assessments by ICES WGBAST and HELCOM, and supports the implementation of national and international policies regarding sea trout, migratory fish, and river habitats.

Box 1. Information on the RETROUT project

RETROUT – *Development, promotion, and sustainable management of the Baltic Sea Region as a coastalfishing tourism destination*

With 14 partners from Estonia, Latvia, Lithuania, Poland and Sweden, and including HELCOM, RETROUT is a 3 ½-year Interreg project running until end-March 2021. RETROUT is a flagship project of the EU Strategy for the Baltic Sea Region Policy Area Bioeconomy. It is co-financed by the Interreg Baltic Sea Region Programme under the Natural resources priority field.

Part of the RETROUT project focuses on assessing sea trout stock and river habitat status, and on evaluating river restoration practices to improve trout populations. By improving the environment in riversaround the Baltic Sea and developing destinations and ethical guidelines for fishing tourism, RETROUT promotes healthy environments and development of sustainable fishing tourism.

More information: RETROUT project homepage https://retrout.org/

Baltic Sea Fishing http://balticseafishing.com/

2 Background

2.1 Sea trout biology and ecology

Sea trout is a sea migrating form of brown trout (*Salmo trutta* L.), and it usually occupies the same rivers as non-migrating brown trout for part of their life (Harris and Milner 2007). Sea trout and brown trout can be either genetically isolated from each other or belong to the same population, with populations being partially migratory, i.e., one part (predominantly females) of the population leaves to the sea for feeding (ICES 2012a).

Sea trout need flowing river waters for spawning and as juvenile nursery habitats. The life history and life cycle of sea trout resembles that of salmon (Froese and Pauly 2020). Individuals live their first 1–5 years as parr in the stream, migrating as smolts to the sea for a feeding for up to 5 years, after which they return to their natal stream for spawning (ICES 2012, Froese and Pauly 2020). Spawning takes place in autumn and winter. About 10 000 eggs per female are laid in suitable gravel beds and hatch in spring when water temperature is suitable (HELCOM 2011, Froese and Pauly 2020). Alevins (i.e., the yolk-sac larvae) stay within or in close proximity to the spawning gravel until yolk-sac depletion, whereafter the fry and later the parr inhabit suitable habitats with enough shelter and food (Harris and Milner 2007). For spawning, sea trout prefer smaller rivers and streams with swift current, often the upper reaches or in tributaries, where suitable nursery areas are also found (Armstrong et al. 2003). Juveniles feed mainly on aquatic and terrestrial invertebrates (Froese and Pauly 2020). After 1–4 years the parr smoltify, i.e., attain a silvery colour and begin a physiological adaptation to marine life and migrate to the sea (Harris and Milner 2007). While in the sea, sea trout feeds on predominantly on forage fish (HELCOM 2011). Sea trout mature in the age of 3–4 years, whereafter the first spawning migration to the home river can occur (Froese and Pauly 2020). Sea trout can spawn on several separate occasions, and thus the migration pattern between the river and the sea can be a continuous ongoing element of the sea trout life cycle (Harris and Milner 2007).

Sea trout is naturally distributed along the European coast of the northern Atlantic from northern Spain to the White Sea, including the entire Baltic Sea area (Froese and Pauly 2020). Sea trout reside in coastal waters usually within a few hundred kilometres from their home river, although some specimens and certain populations (e.g., strains in the southern Baltic Sea) migrating longer distances into the open sea (ICES 2020).

More information on sea trout biology, ecology, conservation, and management can be found in the literature (e.g., Harris and Milner 2007).

2.2 Sea trout in the Baltic Sea

In the Baltic Sea, sea trout together with Atlantic salmon, European eel, and migratory whitefish constitute keystone diadromous species, but sea trout inhabit a much larger number of rivers and streams than salmon for instance (ICES 2020). Many of the Baltic Sea sea trout rivers and streams are in lowland areas, often strongly influenced by human activity (ICES 2020). Of the roughly 25000 rivers and streams of the Baltic sea drainage area assessed under the EU Water Framework Directive (WFD) only about 30% has good or high ecological status (European Commission 2000, WISE 2021). Because of this and other pressures such as fishing, many anadromous sea trout populations in the Baltic sea have been degraded. According to the HELCOM Red List for the Baltic Sea, sea trout is classified as vulnerable (HELCOM 2013).

Although there are no firm estimates of the historical numbers of sea trout populations in the Baltic Sea, sea trout has been common in most of the rivers and streams flowing to the Baltic Sea, while currently of the approximately 1000 sea trout populations about 500 are wild and reproduce naturally (HELCOM 2011). Most of the current sea trout rivers flow to the Baltic sea main basin (HELCOM 2011). The latest evaluation of the HELCOM core indicator on sea trout shows that of the 310 evaluated sea trout populations 54% had good status (see section 2.4 for definition), with a status less than good in most of northern Baltic Sea (especially Gulf of Bothnia), but better in parts of the central and southern regions (HELCOM 2018). Comparably, in the latest ICES WGBAST assessment a general slight decline in status was observed in the last years, with the best status in the Gulf of Finland and poorest in the southern Baltic Sea (ICES 2020).

Habitat degradation, migration barriers, and fishing are the main pressures threating sea trout in the Baltic Sea, with habitat destruction affecting more than 40% of reported populations (HELCOM 2013, 2018, ICES 2020). In addition to the hydro-morphological alterations caused by damming and other barriers and constructions, habitat quality has been deteriorated also through channelization, dredging, pollution, acidification, eutrophication, and siltation of rivers, having negative effects on sea trout populations (HELCOM 2018). Both commercial and recreational fishing at sea and in rivers target sea trout (see section 2.3). High fishing pressure is, for instance, the main reason for the poorer status of sea trout populations in the northern areas of the Baltic sea, where particularly by-catch of young fish in the coastal gillnet fishery is severe (HELCOM 2018). Many sea trout populations are also limited by poor habitat conditions and migration obstacles in their natal rivers, whereby the parr densities are too low and exploitation too high to allow effective recovery of the populations (ICES 2019a). Therefore, fishing should be reduced in such areas (namely ICES subdivisions 30 and 31, eastern 26, and the southern parts of subdivisions 22 and 24, see Figure 1 for a map with the subdivisions), and habitat restoration should be promoted where needed, and accessible migration routes should be secured (ICES 2019a).

2.3 Sea trout fisheries in the Baltic Sea

Sea trout is caught both by the commercial and the recreational fishery. A large part of the commercial sea trout catch is taken as by-catch with coastal gillnets, trap nets and longline, while small scale gillnetting and various handheld gear are mostly used in the recreational fishery (HELCOM 2018; ICES 2020). Coarsely around 500–800 tonnes of sea trout are caught yearly of which over 50% by recreational fisheries (ICES 2020). In the 1990s the combined commercial and recreational nominal catches reached above 1300 tonnes in some years but have been decreasing since 2001 to the level of 700–800 tonnes in recent years (ICES 2020). A clear majority of the commercial catch is taken from the sea, with only a minor importance of river catches, while for recreational fishing in some areas the river catches dominate over the catches in the sea (HELCOM 2018).

The nominal commercial catches of sea trout in the Baltic Sea have decreased from about 300 tonnes in 2018 to 169 tonnes in 2019 (ICES 2020). Most of the commercial catch (77%) is taken in the Baltic Sea Main basin where the Polish fishery accounts for the largest share (71%). Reported catches have likely been overestimated due to misreporting of salmon as sea trout in the Polish sea fishery, a problem that, however, has now been solved (ICES 2020). Recreational fishing of sea trout is an increasingly popular activity along most of the coastal Baltic Sea, and catches amount to a considerable share of the total catch. A more detailed account and figures on the Baltic Sea commercial sea trout fishery can be found in ICES 2020, while a thorough review on recreational fishing of sea trout is given in Chapter 4 in this report).

2.4 Monitoring and assessment of Baltic Sea sea trout

To follow the development of sea trout populations and as basis for their assessment, both fishery and biological monitoring of sea trout populations is carried out in all Baltic Sea countries. According to the European Union regulation (2016/1251) on the collection, management and use of data in the fisheries and aquaculture, all EU countries are obliged to collect sea trout catch data. In addition, numbers of released stocked sea trout are recorded and reported. Biological population data have also been gathered in form of parr densities in rivers and to some extent regarding smolt production (ICES 2020). Although all Baltic Sea countries participate in the biological sea trout monitoring, the temporal and spatial extent and intensity varies between countries (ICES 2008a). Monitoring of 0+ parr densities together with habitat data is conducted by means of electrofishing in predefined sea trout juvenile habitats in rivers (in total 598 electrofishing sites in 2019), which is supplemented in most countries with estimation of descending smolts by means of trapping and counting in 12–13 rivers in the entire Baltic area (ICES 2020). Additionally, in 20–30 rivers the numbers of ascending spawners are monitored by trapping or with automatic counters. As a further measure to monitor spawning intensity, counting of redds has also been carried out in a number of streams at least in Poland, Lithuania, and Germany (ICES 2008b). Tagging and marking are used as additional methods for obtaining information on sea trout movements (ICES 2020). The monitoring and data collection for sea trout could be improved e.g., by standardising electrofishing and parr density estimation methods (ICES 2020). Also problematic for the data quality is that many of the sea trout electrofishing sites have originally been established for salmon and may not be optimal for the monitoring of sea trout (ICES 2020).

An international assessment of sea trout populations in the Baltic is carried out by the ICES Assessment Working Group on Baltic Salmon and Trout (WGBAST). The assessment is largely based on an index of sea trout recruitment status (*RS*) and is conducted for different assessment areas, but sometimes also presented on the level of ICES subdivisions or countries. For calculation of RS for sea trout stocks, ICES uses densities of sea trout parr expressed as a percentage of model-predicted potential maximum densities derived from a regression model with habitat predictors (ICES 2011, 2020). The current assessment methodology has been in use since 2012. Theory, method development, and the resultant basic methodology are described in ICES (2011, 2012b), and are briefly summarised in Box 2. The used assessment approach can be further improved, for instance to more adequately reflect interregional differences in productivity when predicting potential maximum parr densities, and hence, an optimal approach for the assessment of sea trout is under continuous development (ICES 2020). The quality of the assessment could be further improved also by incorporating more information from tagging and genetic studies (ICES 2020).

The latest ICES WGBAST assessment (ICES 2020) summarise that there has been a positive development in the status of sea trout in most of the Baltic Sea areas during the years 2015–2017, but that an overall slight decline was observed in the most recent years (2018–2019). A detailed account on the assessment is provided in the original assessment report (ICES 2020).

In addition to the international yearly assessment of Baltic sea sea trout by ICES WGBAST, the status of sea trout is also addressed and assessed by HELCOM in context of the HELCOM core indicator *'Abundance of sea trout spawners and parr'* (HELCOM 2018). The core indicator assessment uses the same data and the same principal assessment index and methodology as in the ICES assessment (Box 2). Status is assessed as the moving average of the last four to five years, and good status is achieved when the ratio of observed parr densities to reference potential maximum parr densities is at least 50% (HELCOM 2018). Recruitment trend over time is calculated by correlation of parr density versus time in years. The reference potential maximum parr density is estimated using the assessment model (Box 2) in the southern Baltic Sea and based on expert evaluation in the northern regions (HELCOM 2013). The status is assessed for coastal areas using HELCOM assessment unit scale 3[1].

[1] HELCOM Sub-basins with coastal and offshore division. Division of the Baltic Sea into 17 sub-basins and further division into coastal and off-shore areas. The assessment units are defined in the HELCOM Monitoring and Assessment Strategy, Appendix 4 (updated 2018).

Box 2. Approach for obtaining sea trout recruitment status index (modified from ICES 2020).

Sea trout recruitment status (*RS*) is defined as the observed 0+ parr densities relative to the potential maximum 0+ parr densities under the given habitat conditions. *RS* is thus calculated on monitoring site level based on the electrofishing and habitat data. To obtain the *RS* for an individual river population, potential multiple monitoring site-specific *RS*-values are averaged. Similarly, for mean *RS* estimates over larger assessment areas, the river-specific *RS* values are averaged. The observed 0+ parr densities are often parr density estimates based on electrofishing, often using some method and calculations of removal sampling (Zippin 1956, Bohlin et al. 1989). Due to large variation in climatic (e.g.,temperature and precipitation), geological features, stream sizes, and other habitat characteristics among the rivers in the Baltic sea area influencing the suitability of the river for the sea trout, these habitat factors are taken into account when predicting the potential maximum 0+ parr densities. To account for the effect of habitat quality on potential parr density, the Trout Habitat Score (THS) sub- model is used (Pedersen et al. 2017). THS is obtained by scoring (0 for poor to 2 for best conditions) the following habitat variables: dominating depth, water velocity, dominating substrate, stream wetted width, shade, and slope if available. The obtained total THS values (0–12) are grouped in four Habitat Classes (HC) from 0 for poorest to 3 for the best (ICES 2011, Pedersen et al. 2017). A multiple linear regression model is developed based on parr density and river habitat data from rivers with expected optimal conditions and trout recruitment. Thus, the potential maximum parr densities are predicted by the regression model using the following equation:

$$Log_{10}(0+\ density) = 0.963 - (0.906 \times log_{10}(width)) + (0.045 \times airtemp.) - (0.037 \times longitude) + (0.027 \times latitude) + (0.033 \times HC)$$

Finally, with the observed 0+ parr density estimate and the predicted potential maximum 0+ parr density available the recruitment status given as a percentage is calculated as:

$$RS = (Observed\ 0+\ density\ /\ Predicted\ maximum\ 0+\ density) \times 100$$

If the observed parr density is higher than the predicted maximum densities, the resulting recruitment status is larger than 100%. This is possible as the individual observations may occasionally exceed the predicted (average) maximum. The applicability of the assessment model is uncertain for the northern parts of the Baltic sea, as the model is developed using data from more southern rivers.

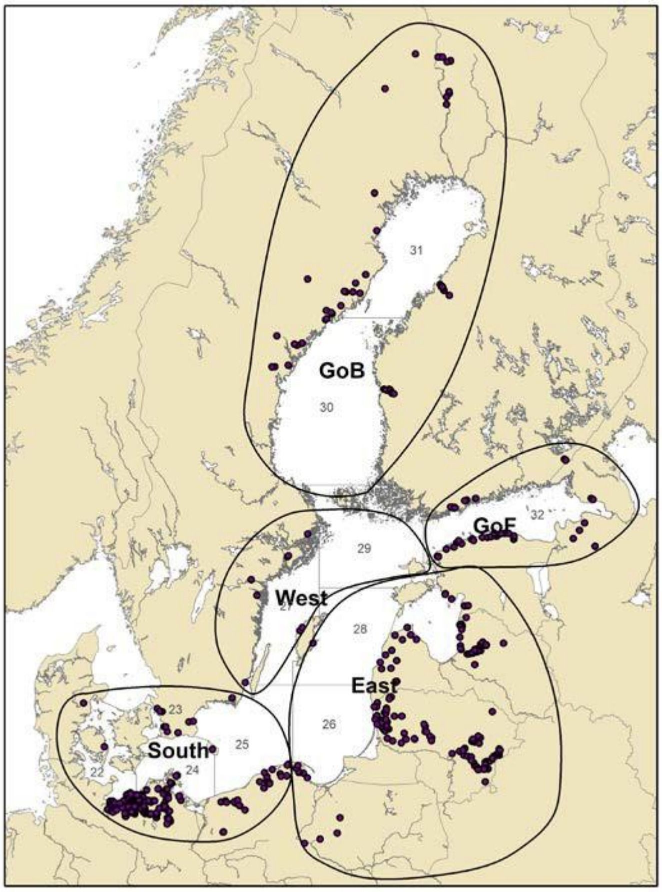

Figure 1. Electrofishing sites as dots and the Baltic sea assessment areas Gulf of Bothnia (GoB), Gulf of Finland (GoF), western Baltic sea (West), eastern Baltic sea (East), and southern Baltic sea (South) marked, as used for the ICES assessment of sea trout recruitment status (Source: ICES 2020).

3 Rationale and approaches

3.1 Rationale for and approaches used in this assessment report

The report is based on existing information on sea trout river populations and river habitats available via project partners, ICES WGBAST, HELCOM, and other reports and documents. The rationale of this report is to provide an overview on the status of sea trout population and the field of recreational fisheries in the Baltic sea, to complement existing status assessments and summarise the current view of the status and role of recreational fishery to the species. Thus, the aim of this report is to assess the status of sea trout rivers and populations and provide a literature overview on the impacts on Baltic sea se trout caused by recreational fisheries. The output complements existing sea trout assessments by ICES WGBAST and HELCOM and provides current information on the recreational fishing and its impact on sea trout in the Baltic sea, to support the management of sea trout populations and give context to the further development of the field of recreational fishing in the Baltic sea.

3.1.1. Recreational fishing overview

The overview on the status and impact of recreational fishery on sea trout in the Baltic sea concerns the different types of recreational fishing activities that catch sea trout in the Baltic Sea region, including fishing in the sea and the rivers. The overview also concerns the current management rules and legislation in force restricting and steering recreational fishing of sea trout in the Baltic Sea region. Further, the overview regards the matter of how information on sea trout recreational fishing is gathered and how the fishing efforts and catches are assessed and estimated. And finally, the estimates of the current impact of recreational fishing on sea trout in the Baltic Sea region is addressed and any trends or signs significant recent changes in this context are reviewed. The overall state as well as geographical and country-specific differences in the recreational fishing features are presented. The overview was compiled based on existing literature as publications and reports, mainly from ICES WGBAST, ICES WGRFS, HELCOM and CCB. References to the sources are provided in the overview chapter.

3.1.2 Sea trout population and river status assessment

A Baltic sea-wide assessment of the status of sea trout rivers and populations is conducted. Beyond the existing current sea trout assessments in form of the annual ICES WGBAST work (e.g., ICES 2020) and the related HELCOM core indicator work (HELCOM 2018), this assessment contributes with higher resolution presenting river-level results, instead of presenting assessment results merely on larger assessment divisions and areas. Although with different basis for the assessment (parr-based vs. smolt based), this assessment attempts to update the HELCOM SALAR assessment (HELCOM 2011) to some extent although considerably fewer rivers are now concerned (346 vs. 572 rivers). Based on the results a river-specific comparison is done to the SALAR red list of sea trout rivers.

The spatial extent of the assessment is the whole Baltic Sea region, i.e., the rivers flowing to the BS as addressed by ICES WGBAST. Within the scope of this report the assessment was restricted to rivers with both available electrofishing-based sea trout parr density data and habitat-based estimates of potential maximum parr densities. All rivers in the available datasets are included in the assessment. The time period chosen to be examined was period 2010–2018. This starting year was based on the notion that the HELCOM SALAR report reached to year 2009 making 2010 the first year not covered by that assessment. The end-year 2018 was determined by the data availability at the time of the data request. The temporal extent what comes to status is the current situation, assessed as the average of the last four years. The trend in the status is assessed by correlating the status indicator with years. Only rivers for which monitoring data was available for at least seven years in the period 2010–2018 was included in the analysis.

The status assessment is principally based on the same method as used in ICES WGBAST and HELCOM core indicator, i.e., Recruitment Status (*RS*) = observed 0+ parr density / potential maximum 0+ parr density (ICES 2011, 2020, HELCOM 2018, this report section 2.4 and Box 2). The observed parr density data are based on electrofishing results from national river monitoring programs of the Baltic sea countries. The potential maximum parr density estimates are based on the Trout Habitat Score and the Baltic sea trout model (ICES 2011, Pedersen et al. 2017). Based on the calculated average *RS* for each river or river system, the results are evaluated for status against pre-chosen thresholds determining four status classes.

The status assessment was conducted based on existing sea trout population and habitat data from monitored rivers in the Baltic sea region. Most of the data was obtained through ICES WGBAST, and additional Latvian data through the Latvian RETROUT project partner BIOR, following a request to the original data providers for permission to access and use the data for the purpose of this assessment. A more detailed description of the data and approaches used for the status assessment is given in Chapter 5.

3.2 Policy relevance

The assessment of status of sea trout rivers and stocks will support existing work on sea trout management and policies by HELCOM and ICES. and provides provide support for the national implementation of HELCOM Recommendation 32-33/1 '*Conservation of Baltic salmon and sea trout populations by the restoration of their river habitats and management of river fisheries*'.

This report addresses several ecological objectives and specific actions related to migratory fish and river habitats in the of the current and updated HELCOM Baltic Sea Action Plan (BSAP; HELCOM 2007, 2020a). The assessment also relates to qualitative descriptors of the EU Marine Strategy Framework Directive and EU Water Framework Directive for determining good environmental status (European Commission 2000, 2008).

4 Recreational fishing and its impact on sea trout in the Baltic Sea region

4.1 Recreational sea trout fishing in the Baltic Sea region

Recreational fisheries include non-commercial fishing activities. According to the definition by the International Council for the Exploration of the Sea (ICES) "*recreational fishing is the capture or attempted capture of living aquatic resources mainly for leisure and/or personal consumption*" (ICES 2013). Food and Agriculture Organization (FAO) defines recreational fishing as "*fishing of aquatic animals (mainly fish) that do not constitute the individual's primary resource to meet basic nutritional needs and are not generally sold or otherwise traded on export, domestic or black markets*" (ICES 2013). Recreational fisheries cover active fishing methods including line, spear, and hand-gathering and passive methods including nets, traps, pots, and set-lines.

Recreational fishing is popular in all countries of the Baltic Sea region. Around 10 million people, or approximately 10% of the population in the Baltic Sea catchment area, fish for recreation (CCB 2017). Recreational fishing is practiced mainly for leisure and/or personal consumption. Sea trout along with salmon are among the most attractive recreational fishing species. Sea trout have a similar anadromous life cycle to salmon, but do not migrate as far, instead reside in coastal waters a few hundred kilometres from their home river (ICES 2019b) Hence, most fishing for sea trout in the Baltic Sea takes place in the coastal zone.

Recreational fishing of sea trout is substantial compared to the commercial fisheries of the species, particularly in the western part of the Baltic Sea. Sea trout recreational catches tend to be even more important than the commercial ones (CCB 2017, ICES 2020). However, estimation of catches is complex as sea trout is fished both in the sea and in rivers. The coverage and data quality of the recreational river catches are relatively good due to obligatory catch reporting in several countries, but the data quality and coverage of marine recreational catches is still underdeveloped. In catch statistics, sea trout is sometimes mistaken for salmon (and salmons misreported as sea trout), which causes further inconsistencies (ICES 2019b). This poses a strong need for improvement in assessing the extent and impact of sea trout recreational fishing in the Baltic Sea more effectively.

Recreational fisheries in the Baltic Sea region, including information about characteristics, efforts and impacts of sea trout recreational fishing, have been addressed and assessed in a few different reports and compilations including work by ICES and HELCOM. In 2017 Coalition Clean Baltic presented "*Recreational fishing in the Baltic region*" Report with detailed country-specific information regarding fishing regulations, limits, and licensing (CCB 2017). Moreover, to better understand the recreational fishing process, HELCOM compiled information on coastal recreational fisheries in all HELCOM States based on questionnaires from 2015 and further updated in 2017 (HELCOM 2019).

4.2 Country specific information

All Baltic Sea countries distinguish between angling/sport fishing and recreational fishing with passive gears. Angling/sport fishing is performed with a rod and line, while fishing with passive gears includes the use of gillnets, traps, longlines and other stationary methods. Angling accounts for the majority of the recreational sea trout catches in the Baltic Sea. Passive gears are common in the northern Baltic Sea, and sea trout are caught as a target species, but often to a high degree as bycatch in other coastal recreational fisheries (CCB 2017). The most common recreational fishing methods are spin and fly fishing from the shore or in rivers and trolling from small boats at sea (ICES

2019b). The recreational fishery along coasts and in rivers is seasonally and geographically variable. In the southern Baltic Sea, recreational fishing for sea trout takes places during the whole year, with distinct high seasons in spring and autumn. In more northern areas of the Baltic Sea, sea trout fishing is more strictly concentrated to the spring and autumn. In rivers, sea trout are fished during their spawning migrations in autumn or during occasional feeding ascensions to river mouths.

4.2.1 Fishing restrictions

Restrictions for sea trout recreational fishing vary between countries. In most Baltic Sea countries passive gears are allowed in recreational fisheries (HELCOM 2019). However, in Poland only angling and spearfishing is allowed. In Germany, only 'hobby fishermen' (having a former job in the fishing sector) are allowed to use passive gears, and anglers are only allowed to use rods and sinking bait nets, the latter being rarely used. In Russia sea trout is protected and all fishing is prohibited. Bag limits (i.e., limiting the daily catch to a certain number of sea trout) are established in Sweden, Latvia, Estonia, Poland and Germany. In Finland, sea trout fishing is allowed only for reared fin-clipped sea trout, as wild sea trout are protected throughout the Finnish coastal areas and Baltic Sea rivers. In most Baltic Sea countries, the minimum allowed gillnet mesh sizes are regulated, and minimum size limits for sea trout are applied. Other management measures include closed areas or seasons, mainly to protect the migration to rivers and the spawning. Additionally, in many countries specific restrictions can be set by water owners.

4.2.2 Fishing licences

Fishing licence is a card, or document mandatory in order to carry out recreational fishing, usually supported with a fee used by some countries as the method of collecting funds for stock conservation and recreational fisheries management. In some Baltic Sea countries angling without reel is free (e.g., Sweden, Finland, Estonia). For other gear types, licenses and permits from water owners are required, and often the license is granted for a restricted number of gear units. In Germany, anglers need to pass an exam to obtain a license. In the Kaliningrad Region in Russia, there is free access for recreational fishermen to common waters without any licenses, however access to private or rented area depends on the owner.

4.2.3 Country-specific information regarding recreational fishing of sea trout

Below, country-specific information regarding recreational fishing of sea trout in the Baltic Sea region is presented based on information predominantly from CCB 2017 and HELCOM 2019.

<u>Finland</u>

Numbers of recreational fishers: 1.5 million

Fishing licensing: Payment of national fisheries management fee intended for stock conservation and management measures are required for all between 18–65 years. No permit required for recreational fishing in public waters in the sea.

Angling and other recreational fishing: Minimum size limits for sea trout: 50 cm for all reared fin-clipped specimens and wild specimens caught in inland waters north of 67° N; 60 cm for wild specimens caught in inland waters between 64° N and 67° N.

There is a fishing ban for wild sea trout, in force since 2019 in the entire Finnish coastal zone. Consequently, one is allowed to retain only fin-clipped specimens. Additionally, there is a seasonal fishing ban for salmonids in rivers and streams from 1 September to 30 November each year.

Recreational sea trout catches fluctuate, with a possibly declining overall trend. Sea trout is a common bycatch in the whitefish fishery (gillnets) and thus there is a further need for restrictions in the whitefish fishery and the gillnetting in general.

Estonia

Numbers of recreational fishers: 0.15 million

Fishing licensing: Fishing with one simple hand line is free and open to everyone; for other gear a fishing licence is required. There is a limited number of licences for gillnets, longlines and other multi-catching gears. Special permits are needed for certain areas.

Angling and other recreational fishing: Minimum size limits for a range of species, such as perch, pike, pikeperch, salmon, and sea trout (50 cm).

Sea trout are caught in gillnets, rod fishing on the coast, and in the rivers. In Estonian rivers fishing salmonids can only be fished by angling, which is greatly restricted and allowed only in certain rivers requiring a special fishing permit. In addition, it is prohibited to catch salmon and sea trout in inland waters from 1 October to 30 November. According to Estonian Fisheries 2014–2015, the total (commercial and recreational gillnets) coastal sea trout catch in 2015 was 22.7 tonnes. According to a fishing survey-based estimate for 2016, the total catch from coastal angling for sea trout was 35 tonnes.

Latvia

Numbers of recreational fishers: 0.12 million

Fishing licensing: For angling, there is a general fishing licence, as well as additional fishing permits for specific water bodies. Gear-specific limited licences are required for other recreational fisheries.

Angling and other recreational fishing: Catch per person and occasion restricted to 1 salmon and/or sea trout. Fishing for sea trout is prohibited in inland waters throughout the year (with some exceptions), and between 1 October and 15 November in coastal waters. The snagging method or use of natural bait when angling for salmon, grayling and sea trout are both prohibited. Catch is limited to a maximum of 5 sea trout. Minimum size for sea trout is 50 cm.

The overall status of sea trout is reasonably good in Latvia, with wild sea trout populations found in about 14 rivers. In 2016, Latvia reported 5.1 tonnes of recreational catches of sea trout, of which 5 tonnes were taken in coastal waters and 1 tonne in the rivers. The commercial catch was 5 tonnes.

Lithuania

Numbers of recreational fishers: 0.12 million

Fishing licensing: A fishing licence is needed for all recreational fishing and in some waters a special fishing permit is required as well. Sea trout fishing requires an amateur fishing permit.

Angling and other recreational fishing: Catch per person and occasion restricted: 1 sea trout. Minimum size limit for sea trout is 60 cm.

Sea trout may not be targeted using natural bait. From 15 August to 31 October, fishing for salmon and sea trout is restricted to outside 500 metres of Klaipėda Straight and the B. Šventoji river mouth.

There are no data on recreational catches of sea trout in Lithuania. ICES WGBAST specifically recommends that data on recreational sea trout catches should be consistently collected, taking into account the potentially high impact of recreational fisheries on sea trout stocks and the lack of these data in several countries.

<u>Russia (Kaliningrad Region)</u>

Numbers of recreational fishers: > 0.1 million

Sea trout is on the Russian Red List and fishing for this species is completely prohibited. However, due to issues in distinguishing between salmon and sea trout, both species are generally labelled as salmon.

<u>Poland</u>

Numbers of recreational fishers: 1.5–2 million

Fishing licensing: For inland waters, a mandatory rod licence as well as an area-specific permit are needed by everyone above 14 years. To acquire the rod licence, a passed exam is required. For the Baltic Sea, a sea fishing permit is required.

Angling and other recreational fishing: There are daily catch limits for a number of species and general rod rules; 1 rod per person when targeting salmonids (using artificial bait or fish as a bait) or spin fishing, other fishing methods allow for 2 rods. Minimum size limit for sea trout is 50 cm. The fishery for salmon and sea trout is closed from 15 September to 30 November out to 4 nautical miles from the coast. Sea trout recreational fishery catches are 2.4 tonnes in 2012.

A study on the recreational fisheries of salmon and sea trout in Polish waters takes place since 2017. The aim of the study is to gather information and identify potential issues in order to devise a more long-term programme for monitoring the catches. Catch and effort data are available since 2019.

<u>Germany</u>

Numbers of recreational fishers: 3.4 million

Fishing licensing: Both a federal fishing rod licence and a coastal fishing permit are required (except in Lower Saxony). German anglers must pass a sport fishing exam to get a licence. In both Baltic coastal States, domestic and foreign tourists can purchase a restricted tourist licence (valid for 28 days) without passing an exam.

A special licence only available to people with a professional education in fisheries (mostly former fishermen) allows limited use of passive gears. Additionally, in Schleswig-Holstein, holders of a rod licence can also apply for an extra licence for minimal use of passive gears.

Angling and other recreational fishing: In Mecklenburg-Western Pomerania, a licence holder may keep up to 3 salmonids (salmon, sea trout). Minimum size limit for sea trout: 40–45 cm depending on the region. There is a seasonal closure in place for salmon and sea trout caught in the sea in Schleswig-Holstein from 1 October to 31 December (with exception of silver fish with loose scales). In Mecklenburg-Western Pomerania, angling for salmon and sea trout is closed from 15 September to 14 December. No detailed data on recreational sea trout catches are available.

<u>Denmark</u>

Numbers of recreational fishers: 0.5 million

Fishing licensing: Anyone between 18 and 65 years needs a licence for angling or other recreational fishing in Danish territorial waters. The recreational fishing licence has higher fee than basic angling license and it also covers angling activities.

Angling and other recreational fishing: There are local regulations and bag limits for sea trout. Sea trout is perhaps the most popular target species in the angling community. Minimum size limit for sea trout is 40 cm. Since 2010, catch estimates for sea trout do exist. The 2011/2012 survey included an estimate of 400 tonnes of sea trout (including freshwater catches), mainly caught by anglers. This accounts for 88% of the total catch.

Sweden

Numbers of recreational fishers: 1.4 million

Fishing licensing: Recreational fishing does not require a licence and fishing with handheld gears is free all around the Swedish Baltic Sea coast. It is also free to use a limited number of passive gears in the coastal areas. Special permits may be required in private waters.

Angling and other recreational fishing: Daily quotas for sea trout in some areas (usually 2 sea trout per day). Size limit for sea trout: 40 cm in ICES sub-division (SD) 29 north of 60° N; 50 cm in rest of the Baltic Sea. Seasonal spawning closures in rivers.

For sea trout 80% of catches are recreational. Catches have declined considerably since the late 1970s and remain low. The commercial catch was 12 tonnes in 2016, the majority of which was taken in the Gulf of Bothnia. In the same year, the estimated recreational catch was 22.1 tonnes (21.7 tonnes from Gulf of Bothnia). Commercial catches were from coastal fisheries, whereas recreational catches were mostly river-based. In 2016, the angling catch of wild sea trout in rivers in SD 31 had increased compared to previous years. Overall, the estimated recreational salmon catches in Sweden are around 20% of total catches, whether in tonnes or numbers. Recreational sea trout catches are around twice the size of the commercial catches, making recreational fishing potentially impactful. Sea trout fishing is not allowed during 15 September – 31 December on the South coast, and from 15 September until 1 April on the West coast.

4.3 Monitoring and data collection on sea trout recreational fishing in the Baltic Sea region

The requirement to conduct pilot studies in the framework of the new EU-Map for EU Aquaculture sector (Commission Decision (EU) 2016/1251) will improve information on the recreational sea trout fishery in the years to come[2]. The ICES Working Group on Recreational Fisheries (WGRFS) points out the urgent need to collect more information (catch, effort, post-release mortality, socio-economic importance) from the recreational sea trout fishery in the Baltic Sea Region (ICES 2018). Moreover, the Group notes that studies of the impacts of catch and release are still lacking for the most common recreational fisheries species.

The monitoring of marine recreational catches has been a legal requirement for all EU Member States since 2002[3]. In the Baltic Sea, this covers cod, salmon, sea trout, and eel. Despite the legal obligation to monitor marine recreational fisheries, the available data is still not complete. Data and information on sea trout recreational fishing are gathered through both national and regional (e.g., EU data Collection Framework for member states) requirements. Recreational efforts and catches

[2] European Commission (access on 15 Dec 2019) https://datacollection.jrc.ec.europa.eu/dc/aqua/eum
[3] see (EC) No 1639/2001 | EU 2008/949 | 2010/93/EU | C(2013) 5243 | (EU) 2016/1251

can be estimated from obligatory reporting or through occasional interview and questionnaire surveys.

The methods used for monitoring recreational fisheries differ among the Baltic Sea countries. In Estonia, catch reporting has been mandatory since 2005. The data are reported to and stored in the Estonian Fisheries Information System (EFIS) for passive gears (gillnets, longlines) and salmon and sea trout rod-and-line fishing in rivers. The most recent recreational fishery survey was carried out in 2016, based on direct phone call surveys.

In Sweden, data on recreational sea trout river fisheries are collected mostly in the larger salmon rivers, and therefore river catch statistics are not complete. Currently, information on recreational fishery originates from a national mail survey conducted by the Swedish Agency for Marine and Water Management (SwAM). The survey is sent to about 17 000 randomly selected persons each year, and it collects statistics on general aspects of recreational fishing (catches, costs, fishing trips etc.).

In Finland, since 2002, the official catch estimates of the recreational sea trout fishery are based on a national recreational fisheries survey. This biannual survey is conducted to estimate participation, fishing effort and catches of the recreational fishery[4]. Obtained through a stratified sample, about 7500 households are contacted. The last survey covering year 2016 took place in 2017.

In Germany, a nationwide phone call survey with quarterly follow-ups was conducted in 2014/2015, contacting 50 000 households to collect representative data on recreational fish catches, including sea trout. Currently, a more detailed literature study is being prepared, also covering rivers fisheries.

In Lithuania**,** since 2015, recreational (anglers) sea trout catches are estimated by an online survey, a face-to-face interview survey, and individual interviews and catch reporting with diaries of selected anglers and experts. Catch per unit effort (CPUE) is estimated from survey data and combined with number of licences sold to anglers to calculate the total angling catch.

In Latvia, the first attempt to estimate total sea trout catches from angling was done in 2018 using Internet surveys. Monitoring of salmon/sea trout trolling has started in 2019 and is being continued in 2020.

In Denmark, there is no coastal fish monitoring programme and the data provided relies on voluntary catch registration by recreational fishermen through the "key-fishermen" project, which has no long-term secured funding (initiated in 2005; HELCOM 2018). Since 2009, recreational catches of sea trout in Denmark have been estimated based on an interview-based recall survey, which is conducted by DTU Aqua in cooperation with Statistics Denmark.

In Poland**,** since 2017, the National Marine Fisheries Institute in Gdynia (MIR) is carrying out a board observer programme (Multi-Annual Programme of Fishery Data Collection, responding to the requirements of the EU Data Collection Framework - DCF). Its aim is to test methods for monitoring of recreational fisheries in Polish marine waters, identify fishing areas and potential issues and analyse former laws and procedures (Lejk and Dziemian 2019). Salmon/sea trout/eel recreational fisheries monitoring is carried under EU MAP since 2020 (2017–2019 pilot study), including on-site questionnaire interviews, off-site questionnaire interviews, on-board observations – participation in salmon trolling cruises, annual fishing logbooks for trolling boats skippers/owners, remote CCTV cameras monitoring to provide accurate fishing effort estimates, and trolling boats counting (monthly). In addition, an annual questionnaire interview is conducted (HELCOM 2020b).

[4] Natural Resources Institute Finland website: http://stat.luke.fi/en/recreational-fishing

In Russia, sea trout is a protected species in the Baltic Sea, and recreational fishers are not allowed to target sea trout in the sea nor in rivers. Hence, there is no monitoring or data collection need in Russian waters.

4.4 Impact of recreational fishing on sea trout in the Baltic Sea region

The significance of recreational fisheries has increased, and the catches of most desired species (including sea trout) clearly exceed or at least equal the commercial catches. Assessing trends in sea trout recreational fishing reveals that the development in Sweden and Finland is largely similar. The use of gillnets and other passive gear has become less popular, and rod fishing takes a larger proportion of the catches than before. The equipment for rod fishing is very effective and species-specific methods and lures are available. In Finland, a new Fishing Law came into force in the beginning of the 2016, which caused changes concerning the national fishing license and minimum size limits of some fish species, and fishing bans for some threatened species in the sea area. In Sweden, recreational fishery for sea trout is very common and most catches come from recreational fisheries. A major part of the Swedish recreational catch is taken along the Baltic coast (>2400 km, including Öland and Gotland islands), in particular by angling from shore or small boats, and from use of gillnets (ICES 2019). Offshore recreational fisheries are in most cases done by trolling salmon, with sea trout caught only occasionally. However, trolling closer to the coast for sea trout is starting to be popular in some Swedish areas. In Denmark, the recreational catches are visibly smaller than the commercial fisheries, although there is large variation between areas.

Availability of specialised equipment and fishing methods has largely increased. There are also visible conflicts between anglers and commercial fishermen. In Lithuania, salmon and sea trout fishing in marine waters has become more popular which will further negatively influence the sea trout stocks (HELCOM 2019, 2020).

In 2016, the total recreational sea trout catch Baltic Sea Region was 743 tonnes, compared to 481 tonnes in 2017, 427 tonnes in 2018, and 318 tonnes in 2019 (ICES 2018, 2020). Most of the recreational sea trout catch in the coastal zones is taken by fishermen from Finland in the Gulf of Bothnia and the Gulf of Finland (232 tonnes in 2018; ICES 2019). Moreover, recreational sea trout river catches in 2018 amounted to 15.5 tonnes and in 2019 to 35 tonnes, and originated mainly from rivers in the Swedish Gulf of Bothnia (ICES 2019, 2020). This is a much smaller river catch than the ten years average (47 tonnes). In the Polish marine waters and rivers rising popularity of recreational fishing is also notable. Average sea trout catches in years 2013–2016 in four Polish rivers were: river Słupia: 132 Rega: 284, Ina: 327 and Parsęta: 599. Results from on-site surveys performed in 2017 and 2018 on those monitors rivers, indicated that anglers reported a total of 774 sea trout: 519 in 2017 and 255 in 2018. The average catch per angler in seasons 2017–2018 was 1.6 sea trout (ICES 2019).

A considerable amount of reared sea trout is released to the Baltic Sea or its rivers on a yearly basis. To assess the impact of recreational fishing on the natural sea trout stocks, the share of reared fish in the catch would be important information. In Sweden, Finland, and Estonia all reared sea trout are mandatorily marked by clipping the adipose fin. The total number of fin-clipped sea trout in the Baltic Sea area was 1 718 891 smolts and 277 741 parr.

Sea trout abundance is affected by commercial and recreational fishing at sea and in rivers. The production of sea trout parr in rivers depends on the number of successful spawners reaching the riverine spawning sites, and on the survival of spawned eggs and juveniles. Hence, the production can be hampered by migration barriers and poor habitat quality. The abundance of spawners returning from feeding migrations in the coastal areas to the rivers is related to the densities of parr in the rivers. The density of sea trout parr also reflects the success of recruitment and depends on other factors such as climate, the size of the river, habitat characteristics and quality and is affected by migration barriers to reproduction areas (ICES 2019).

There is still a lack of reliable recreational fishing data which would allow to assess its further impact on sea trout stocks. Recreational catch figures are often more or less uncertain estimates based on limited information, and, hence, the usefulness of this type of data needs be evaluated and possibilities to establish regional databases should be explored. To progress with this, data on recreational sea trout fisheries need to be routinely collected and the quality of the data need to be improved. Progressing with those elements is important, taking into account the potentially high impact of recreational fisheries on sea trout stocks and the lack of these information in several countries.

Lately, improvements have been noticed in the approaches for inclusion of recreational fisheries data in western Baltic Sea fisheries assessments, and in the estimates of trolling catches of both salmon and sea trout (HELCOM 2019). Studies of the impacts of catch and release are lacking for most common recreational species, including sea trout, but proposals for addressing the issue have been initiated (ICES 2018).

Moreover, the recreational fishing sector needs to be acknowledged in terms of its socio-economic role and has to be given rights, as well as responsibilities, to be a part of management discussions and decisions. Many angler groups also do engage in local habitat restoration activities, supporting development and conservation of sea trout in the Baltic Sea region.

5 Assessment of sea trout river and stock statuses

5.1 Data and approaches

For the assessment of sea trout river and stock status, existing sea trout population data and data on river habitat characteristics were used. The basis for the biological population data was the estimated sea trout parr densities (number of 0+ individuals per 100 m^2) from electrofishing surveys in monitoring sites. The habitat data consisted of site and river specific environmental factors and qualities, including inter alia, Trout Habitat Score and THS classes (ICES 2011, Pedersen et al. 2017), factors needed for THS (river width, depth, slope, water velocity, substrate and shade), average air temperature, ecological status according to WFD classification, as well as information on migration hindrances. To some extent data was also available on sea trout stocking and possible restoration measures taken. Data was provided as per monitoring occasion and site, and organised under river name, country, and ICES assessment area (for assessment areas see Figure 1). Additional basic information such as site coordinates, distance to sea, and extent of catchment area were also given. All data were organised and included to large parts in the variables shown in the data set structure in Table S1 with the variable headings listed.

Both the estimated parr densities and the corresponding habitat data were obtained from two main sources: centrally from the ICES WGBAST and additional data directly from the Latvian Institute of Food safety, Animal Health and Environment "BIOR". The sea trout river data for the Baltic Sea region is requested by ICES WGBAST work group from all Baltic Sea countries on a yearly basis as part of the sea trout stock status assessment. The data obtained through ICES WGBAST was specifically requested for the purpose of this report from each of the data provider country representatives in the group. Permission to access and use the data was granted from all other countries except Russia. Hence no data from Russian rivers are included here. The additional data from Latvia was submitted by BIOR through an internal RETROUT project data call on the matter, and permission was granted for the data to be used for the purpose of this report. The data obtained through ICES WGBAST spanned the years 1975 to 2018 and consisted of a total of 4360 sea trout river monitoring records. The additional Latvian data covered years 2007–2018 with a total of 276659 monitoring data records. Altogether the data set contained information from 377 unique rivers including separately reported tributaries). In addition, the Water Information System Sweden (WISS) Database was used for information on migration hindrances in the Stockholm area, as detailed in Annex 1 (WISS 2021).

From the full data set a sub-set covering the most recent period, 2010–2018 was selected. Year 2010 was chosen as the first year to be included based on the notion that the assessment of the HELCOM SALAR project (HELCOM 2011) reached up to year 2009. Although different in extent and used approaches, here the choice of the starting year was made as to not overlap with HELCOM 2011 assessment. From the selected data period first descriptive features of the rivers, habitat characteristics and parr densities were explored.

The assessment of the sea trout population status in the rivers was based on the established general approach used by both ICES WGBAST and HELCOM Core indicator. The basic principle is that the estimated real parr densities (obtained from electrofishing monitoring) are related to calculated potential maximum densities that are based on measured habitat characteristics. By this an index of 'recruitment status' RS [0,1] is obtained, functioning as a relative measure of the state of the sea trout river population. A more detailed account of this approach is given in ICES 2011 and Pedersen et al. 2017, and summarised in HELCOM 2018, ICES 2020, and Box 2.

The recruitment status was calculated for each monitoring occasion and annually averaged for every river. For the rivers with *RS* available for more than 7 years, a recruitment trend over time is calculated through linear regression of *RS* against years as the Pearson r correlation coefficient, resulting in values from -1 to +1 (-1 representing a negative development). The assessment of the current status is conducted by calculating an average *RS* over the last four years in the data period (i.e., 2015–2018). The obtained statuses are classified in four colour-coded status categories, where green corresponds to *RS* > 0.8, yellow to 0.8 ≥ *RS* > 0.5, red to 0.5 ≥ *RS* > 0.2, and black to *RS* ≤ 0.2. This classification compares to that used in HELCOM 2011[5], with the difference that the original red class is now further divided in red and black, with black corresponding to dangerously low recruitment status. Further, this classification relates to HELCOM core indicator on sea trout (HELCOM 2018), where 'good environmental status' is achieved when the moving parr density average remains above 50% of the site-specific reference potential parr density (i.e., *RS* > 0.5). The obtained status assessment results were then explored against some available river information (e.g., stocking, migration hindrances, ecological status).

5.2 Results and interpretation

The selected data period 2010–2018 included 3332 monitoring records, 1714 yearly average river values, and a total of 368 rivers. Over the whole period 2010–2018 the highest count of yearly river-specific data was from Sweden (461 records) and the lowest from Poland (73 records; Table 1). The sea trout monitoring sites and rivers included different sort of river waters that varied considerably in characteristics. For instance, the distance to the sea varied between 0.1 and 475 km, and the wetted width of the river sites ranged from <1 m up to 45 m (mean 8.2 m ± 8.7 SD). The THS habitat class (mean 1.9 ± 0.9 SD) summarising the habitat characteristics of monitoring sites was dominated by class 2 (36%) while class 0 had the smallest share (8%), indicating overall good habitat characteristics for sea trout (Pedersen et al. 2017). The shares of the different habitat classes seemed to be fairly stable across years, with a notable decrease in the share of habitat class 3 during 2010 and 2011 (Figure 2), indicating occurred changes in monitoring sites. Regarding the ecological status (WFD) of the monitored rivers (mean 3.5 ± 0.8 SD), there was an overall domination of rivers of *Good* status (51%) while rivers of *Bad* status had the smallest share (1%), indicating overall good ecological conditions in the monitored rivers. The shares of the different ecological status groups seemed to be stable across years (Figure 3). Close to a fourth (24%) of the yearly river-specific records had some sort of an artificial migration hindrance mentioned, affecting adult or juvenile up or down migration. Over the years 2010–2018 the yearly share of the monitored rivers with some migration hindrance varied between 13% and 34%. Of all the assessed rivers over the whole period 2010–2018, 27% had reported migration hindrances. Most (83%) of the yearly river-specific records showed no stocking of sea trout, and of all the assessed rivers over the period 2010–2018 about 23% had been stocked at least once.

The estimated 0+ sea trout parr densities varied between monitoring occasions from 0 up to 584.7 ind. 100 m^{-2}, with a global average of 27.2 ± 49.9 (SD) ind. 100 m^{-2} (N = 3332) and no consistent trend in yearly averages ind. 100 m^{-2} (19.8 ± 36.9 SD – 37.1 ± 59.4 SD; N = 331 and N = 515 respectively) over time during the 2010–2018 period. The record-high parr density was from river Kopparviksbäcken in Sweden year 2017. Over the whole period 2010–2018 the average 0+ parr density was highest in Denmark (61.4 ± 67.3 SD; N = 88) and lowest in Lithuania (5.4 ± 11.2 SD; N = 713). The development of the yearly average parr densities over the period 2010–2018 is shown for each country in Figure 4. The differences seen between countries partly reflect differences in monitoring sites and river type included, and there is each year large variation in the number and identity of sampled sites.

[5] In HELCOM 2011 the assessment was based on an expert evaluated status index measuring the realised smolt production as percentage of potential production capacity.

The overall yearly average *RS* across all monitored rivers varied between 0.54 (± 0.88 SD; N = 190) and 1.16 (± 2.03 SD; N = 226) without any consistent trend over time during the 2010–2018 period. The global average *RS* of all rivers and years was 0.79 (± 1.26 SD; N = 1714). Within the period 2010–2018, the average river *RS* differed between countries and assessment areas (Table 2). The highest average river *RS* was from Estonia (1.77 ± 1.90 SD; N = 197) and the lowest from Germany (0.19 ± 0.21 SD; N = 224). Of the assessment areas, the highest average river *RS* was from GoF (1.54 ± 1.54 SD; N = 200) and the lowest from assessment area South (0.56 ± 0.90 SD; N = 450). The maximum river *RS* value (16.9) was calculated for river Valkeajoki in Finland 2015, resulting from a very high estimated electrofishing-based parr density (231.2 ind. 100 m^{-2}) and a very low THS-based potential maximum parr density (13.7 ind. 100 m^{-2}).

For assessing the possible trends over time in river *RS*, a total of 146 rivers with seven or more yearly *RS* records over the period 2010–2018 were available. Analysing the river-specific data, only very few rivers with indications of a negative or a positive linear trend were found, with only about 9% of the rivers having a Pearson's product moment correlation coefficient r below -0.5 (as an indication for a negative trend over time), and about 14% having a Pearson's r larger than 0.5 (as an indication for a positive trend over time). When analysing the same 146 rivers with seven or more yearly *RS* records over the period 2010–2018, but averaged for countries, mostly positive trend indications were seen (Figure 5). No trend indication from Germany was obtained as there were no rivers matching the requirement of data from seven or more years within the period 2010–2018. Finland and Estonia showed the strongest indications of an increasing trend (Pearson's r 0.80 and 0.58 respectively), while Poland had the only negative trend indication (Pearson's r -0.62).

For assessing the current status of sea trout river populations, an average of river *RS* of the last four years was taken (2015–2018). This subset contained then a total of 346 rivers (Denmark 10, Estonia 23, Finland 13, Germany 94, Latvia 48, Lithuania 75, Poland 16, and Sweden 67 rivers). The mean *RS* was highest for Estonia (2.29) and lowest for Germany (0.12), corresponding to the pattern seen from the whole 2010–2018 data set. The average river *RS* over the assessment period 2015–2018 varied between 0 and 9.21, with a global average river *RS* of 0.75. When divided into the *RS* categories, with *green* corresponding to *RS* > 0.8, *yellow* to 0.8 ≥ *RS* > 0.5, *red* to 0.5 ≥ *RS* > 0.2, and *black* to *RS* ≤ 0.2, the poorest status class, *black*, dominated with 41%, class *red* had 1%, and *yellow* and *green* 21% and 26% respectively. The list of rivers with *black* status class contains 67 rivers. The share of the status categories varied across countries and assessment areas (Figures 6 and 7).

Estonia showed the highest share of class *green* (91%), while Germany had the largest share of class *black* (79%). Regarding the ICES assessment areas, GoF had the largest share of class *green* (87%) and assessment area South the largest share of class *black* (66%). Among the *RS* categories, the average ecological status (WFD; 1-Bad – 4-High) was highest for category *green* (3.7) but did not differ considerably between categories (>3 for all). The prevalence of migration hindrances did not show any consistent pattern across the categories but was highest in category *red* and lowest in categories *black* and *yellow* (green: 33%, yellow: 22%, red: 43%, black: 21%). The prevalence of trout stocking was lowest in category *green* and highest in category *yellow* (green: 12%, yellow: 30%, red: 13%, black: 22%), showing no consistent pattern across the *RS* categories. A full country-wise list of the assessed rivers with statuses and additional information is provided in Annex 1. A list of rivers with sea trout populations of a dangerously low status (Baltic Sea black list) is provided in Annex 2.

Although with status assessed differently (model predicted potential maximum parr densities vs. expert evaluated potential maximum smolt production capacity), in comparison with the sea trout red list rivers (i.e., rivers < 50% of potential maximum smolt production capacity) in the decade old SALAR report (HELCOM 2011), the current comparable list of rivers contains 181 rivers (106 without

Germany) versus 572 rivers in the older assessment (rivers from Russia included, from Germany not). Of the now assessed 346 rivers, 51 were found from the old red list. Of these, about 50% had still a status comparable to the red list criteria (new status class red and black together). Also, of the rivers now assessed to have a status comparable to the old red list, 81 rivers were not included in the old red list. Bearing in mind the differences in methods and uncertainties in such comparison, it however, might indicate that fewer rivers have recovered compared to the one that have degraded.

Table 1. Distribution of river specific data across years and countries within the selected data period 2010–2018

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden	Total
2010	7	23	5	0	8	0	5	51	99
2011	10	23	10	0	11	0	5	49	108
2012	10	23	11	17	14	60	6	46	187
2013	10	21	11	18	15	56	8	51	190
2014	10	23	11	41	15	64	7	55	226
2015	10	21	11	9	21	66	7	50	195
2016	10	23	12	16	15	55	7	50	188
2017	9	20	13	80	18	68	13	45	266
2018	10	20	12	43	29	62	15	64	255
Total	86	197	96	224	146	431	73	461	1714

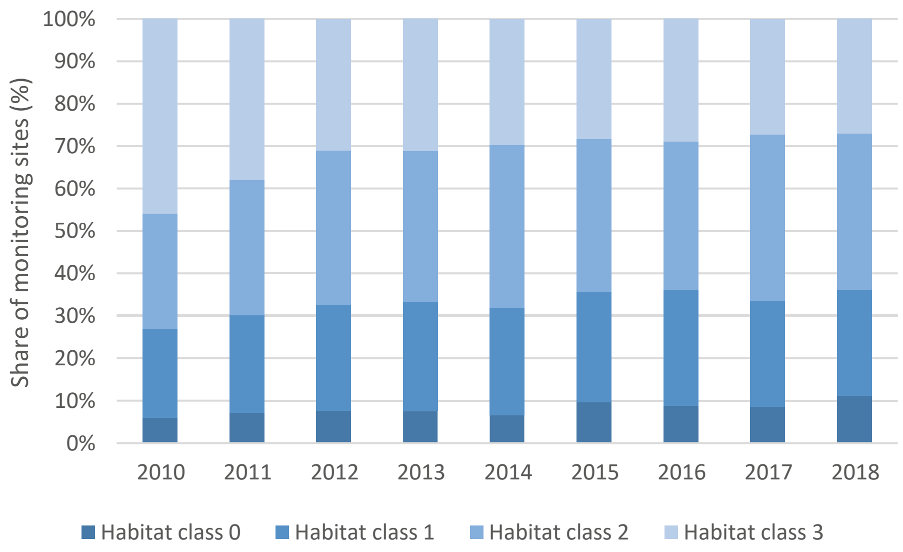

Figure 2. The percentage share of monitoring sites in the 2010–2018 dataset across the four THS habitat classes 0–3.

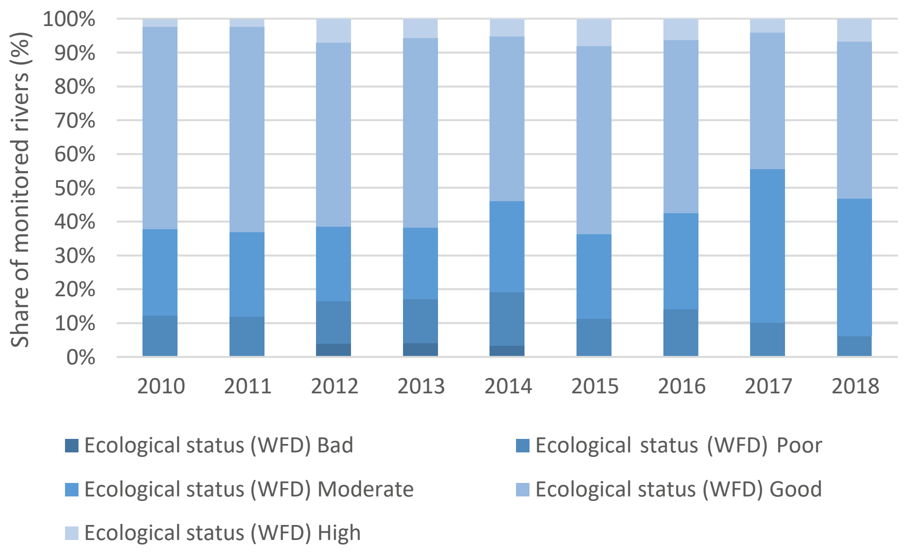

Figure 3. The percentage share of monitored rivers in the 2010–2018 dataset across the five ecological status categories according to the WFD.

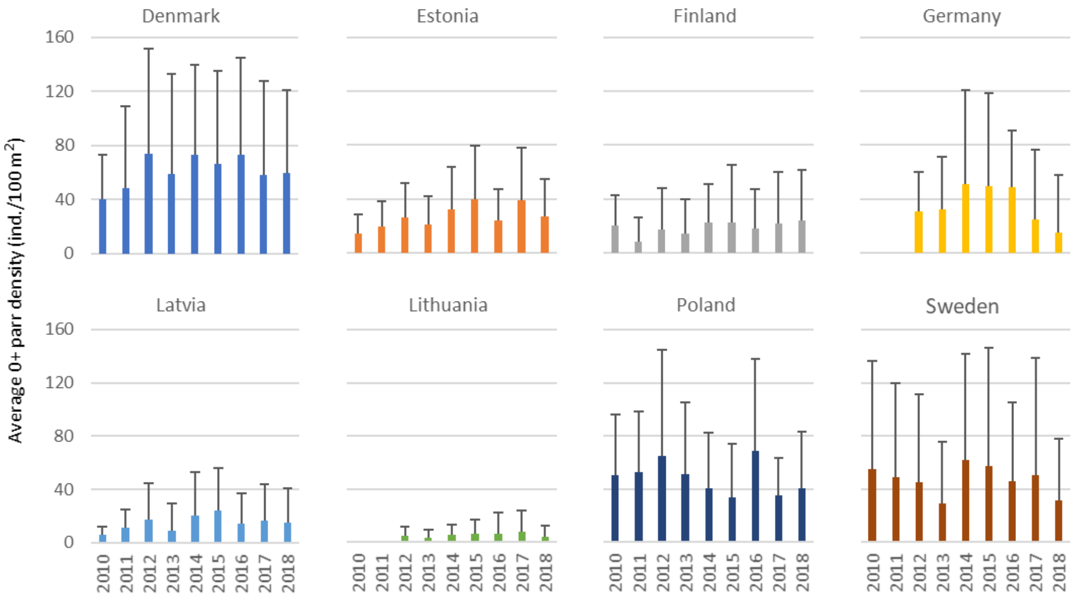

Figure 4. Yearly 2010–2018 mean 0+ parr densities for all Baltic sea countries except Russia. Error bars indicate standard deviation

Table 2. Average and standard deviation of river recruitment status (RS) index values for countries and ICES assessment areas (AU). Assessment area abbreviations as East = eastern Baltic Sea, GoB = Gulf of Bothnia, GoF = Gulf of Finland, and West = western Baltic Sea

Country	**Average of river RS**	**Standard deviation of river RS**
Denmark	0.72	1.29
Estonia	1.77	1.90
Finland	1.19	2.11
Germany	0.19	0.21
Latvia	1.06	1.49
Lithuania	0.34	0.52
Poland	1.00	0.74
Sweden	0.89	1.08
ICES AU		
East	0.63	1.16
GoB	0.91	1.55
GoF	1.54	1.54
South	0.56	0.90
West	0.92	0.92

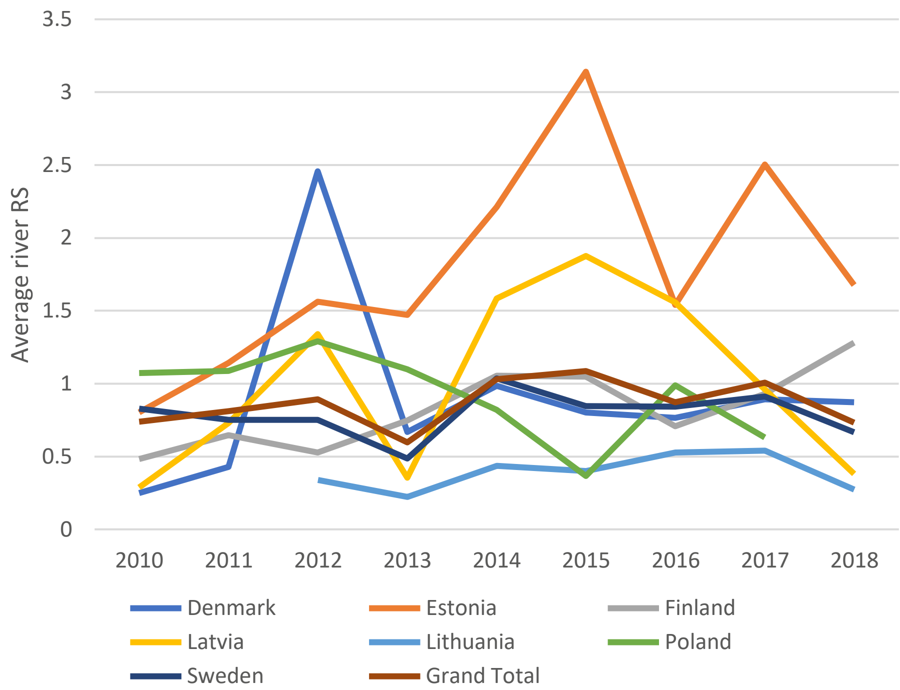

Figure 5. Development of the average river RS over years for different countries. No trend information available for Germany.

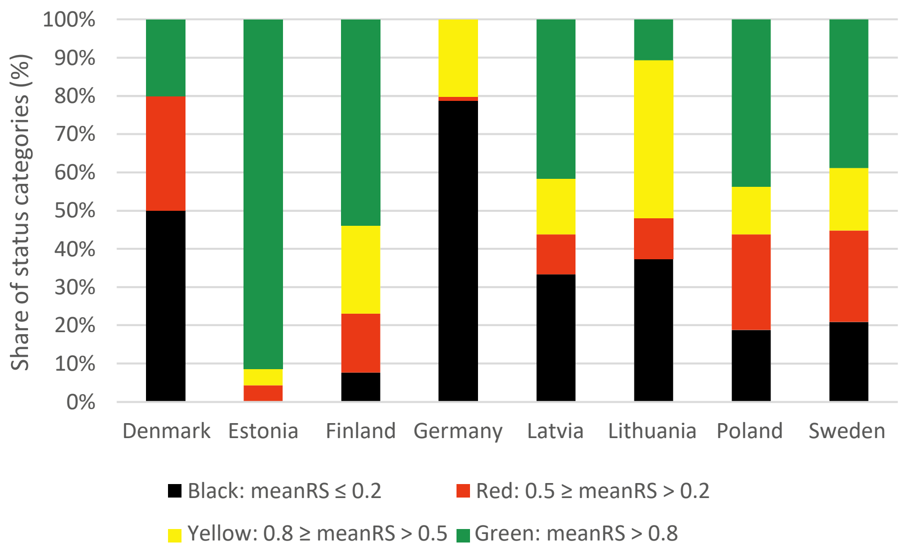

Figure 6. The percentage share of status categories across the Baltic sea countries, based on the average over the last four years.

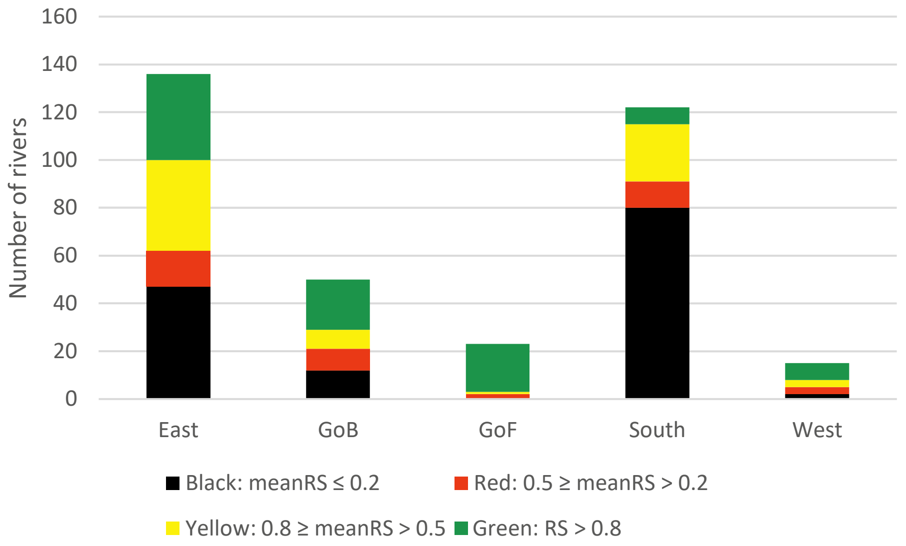

Figure 7. Number of assessed rivers (last four years 2015–2018) divided across the Baltic sea assessment areas.

6 Conclusions

6.1 Recreational sea trout fishery in the Baltic sea

Recreational fishing is increasing in popularity and impact. Rod fishing from the shore or small boats is becoming more important than before to the expense of other methods and gear in recreational sea trout fishing. The current overall yearly catch from recreational sea trout fishing is coarsely around 500 tonnes and is already at the same level or higher than commercial catches. Hence, conflicts between anglers and commercial fishermen are not uncommon.

As the interest in sea trout recreational fishing increases or when the interest towards certain methods or modes change, the impact from the fishing on the stocks also vary. How the sea trout stocks endure the fishing pressure, and thus what impact the fishing absolutely has on the stocks, also depend on the status of the sea trout stocks. To assess the impact of recreational fishing on the natural sea trout stocks can be challenging as a considerable amount of reared sea trout is released to the Baltic Sea or its rivers. However, in many countries reared fish are fin clipped helping to discern them from natural fish. Natural production of sea trout in rivers depends on the number of successful spawners reaching the riverine spawning sites, and on the survival of spawned eggs and juveniles. Hence, the production can be hampered by migration barriers and poor habitat quality, affecting the stock size. When the stocks are decreasing due to poor reproduction, the relative effect of an unchanged fishing pressure increase. With as high catches as the recreational fishery currently has of sea trout, it can become increasingly important to consider and adapt the level of recreational fishery harvest to the development in stock sizes. This can be done by various regulations and restrictions, of which some are already in use in different countries (e.g., no natural sea trout allowed to be caught in the Finnish coastal waters).

There is still a considerable uncertainty in the data on recreational fishing effort and catches, which should be improved to enable better assessments of the impact from recreational fishing on sea trout in the Baltic sea. Moreover, the recreational fishing sector needs to be acknowledged in terms of its socio-economic role and included in management discussions and decision processes.

6.2 Sea trout river status in the Baltic sea region

Sea trout 0+ parr densities are used as the basis for the standard sea trout river status assessments in the Baltic sea region. In the assessment done for this report, sea trout parr densities varied up to over two orders of magnitude between different rivers and monitoring data. Over the assessment period 2010–2018 the sea trout parr densities also varied between years and countries, with an average level being highest in Denmark and lowest in Lithuania. No obvious trend over the assessment period was seen in the parr densities in any country, and the differences between countries partly reflect differences in monitoring sites and river type included.

The index used for evaluation the status of sea trout rivers/populations, *recruitment status RS*, relates the observed parr densities to a habitat-based estimation of the potential maximum parr density that the site could produce. Recruitment status varied considerably both between years and countries and assessment areas. In general, the *RS* was highest in GoF and Estonian river and lowest in the southern Baltic sea especially Germany. Finland and Estonia showed the strongest indications of a positive overall trend over the last decade, while Poland had the only negative trend indication.

The assessed current status of sea trout river populations, taken as an average of the last four years, showed the best status for Estonia and the poorest situation for Germany. The list of rivers with *black* status, that is rivers with dangerously low sea trout production ($RS \leq 0.2$) contains 67 rivers, of which the largest share was found in the southern Baltic sea region. The highest share of rivers belonging to the best status class *green* was found in the Gulf of Finland area. The Baltic sea black list of sea trout rivers is provided in Annex 2.

Although restricted in extent due to data availability, the outcome of this assessment highlights the current situation with a considerably high share of rivers still failing to reach a good status, and also pinpoints those rivers in the poorest condition needing urgent and prioritised recovery measures. At the same time, in certain areas positive development have been witnessed following increased emphasis and better management practices of sea trout populations and their rivers.

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Supplement A. Additional information on the sea trout data used

Table S1. Headings of the collected sea trout population and river data dataset.

Variable		Explanation
BASIC INFORMATION	Year	Year of sampling
	Country	Country name in English.
	ICESSubdiv	ICES Subdivision; e.g. Gulf of Finland = 32
	ICES Assessment unit	ICES WGBAST ST assessment unit (east, west, GoB, GoF)
	River	Your name of the river.
	Latitude	Latitude, given as WGS84, In degrees followed by a decimal point.
	Longitude	Longitude, given as WGS84, In degrees followed by a decimal point.
	Site_name	Your name of the site
	Site_distance_to_sea (km)	How many km from fishing site to outlet
SALMONID DATA	Density_0+ (ind/100m2)	Estimated abundance of trout 0+ per 100 m^2.
	Density >0+ (ind/100m2)	Estimated abundance of trout >0+ per 100 m^2.
	Density estimation method	Method used for estimating parr density
	Resident / brown trout (Y/N)	Are there on the site, or in the area around, a population of trout larger than the maximal smolt size
	Trout stocking (Y/N)	Are trout stocked on / near the site? (Y=yes, N=no)
	Stocking add. Info (if Y-->amount, year)	Additional information on trout stocking (amount and year, if possible)
	Salmon_density (ind/100m2)	Estimated abundance of salmon parr (all age groups) per 100 m^2.
	ST river/population category	Category of ST population according to HELCOM SALAR report
HABITAT DATA	Wetted width of stream (m)	Given in meters at sampling site
	Slope (%) of section	Given in precent (altitude change divided by stream length) for the site.
	Water velocity class	According to trout habitat score (see attached table 8)
	Average/dominating depth (m)	According to trout habitat score (see attached table 8)
	Dominating substratum	According to trout habitat score (see attached table 8)
	Shade (%)	According to trout habitat score (see attached table 8)
	River_habitat	Three classes; Good, Intermediate, Poor
	Waterquality (WFD)	Three classes; Good, Intermediate, Poor
	Ecol_status (WFD)	Ecological status given as required by the Water framework directive; High, Good, Moderate, Poor, Bad
	Catchment_area (m2)	Catchment of whole river given i km^2.
	Average_air_temp	Average annual air temperature, given in $^{\circ}$C.
THS	THS_0-12 (10)	What is the trout habitat score (THS) on the scale 0-12 (10) - see table (from SGBALANST 2011) below for scores at different variable values
	THS Habitat class 0-3	THS habitat class according to SGBALANST (2011) (0-1-2-3)
POTENTIAL PARR DENSITY	THS-based	calculated with the equation: pot_parr_dens=10^(0.963-0.906*LOG10(average_wetted_width)+0.045*average_air_temp-0.037*longitude+0.027*latitude+0.033*habitat_class)
	expert opinion	Potential parr density according to expert opinion (if THS-based estimate not available)
	other method	Potential parr density according to other method (if THS-based estimate not available)
STATUS	RS	Recruitment status (estimated parr density/potential parr density)
MIGRATION HINDRANCES	smolt downstream artificial Number of barriers	How many barriers of this type between the outlet and the fishing site
	Function	Is downstream migration past barrier in your opinion easy and with no or insignificant mortality - write 1, associated with some mortality - write 2, with heavy mortality - write 3
	Barrier type	Write in text (E.g. turbine, lake (including lake upstream to turbine)....)
	Remarks	Any remarks - please write in text
	smolt natural downstream Number of barriers	How many barriers of this type between the outlet and the fishing site
	Function	Is downstream migration past barrier in your opinion easy and with no or insignificant mortality - write 1, associated with some mortality - write 2, with heavy mortality - write 3
	Barrier type	E.g. waterfall, lake...Remarks -
	Remarks	please write in text
	adult upstream artificial Number of barriers	How many barriers of this type between the outlet and the fishing site
	Passage function	Is the upstream migration past the man made barrier in your opinion almost free and with no or insignificant delay - write 1, is passage variable probably some delay - write 2, always difficult but possible - write 3, impossible write 4) if several barriers with different passage explain in text
	Passage type	Has the barriers fish passage installed - write 1, different type of passage - write 2.
	Remarks	Any remarks - please write in text
	adult upstream natural Number of barriers	How many artificial barriers are found between the site and the outlet
	Passage function	Is the upstream migration past the man natural barrier in your opinion almost free and with no or insignificant delay - write 1, is passage variable probably some delay - write 2, always difficult but possible - write 3, impossible write 4) if several barriers with different passage explain in text
	Passage type	Has the barriers fish ladder installed - write 1, different type of passage - write 2.
	Remarks	Any remarks - please write in text
RESTORATION MEASURES	Measure 1	any restoration measure done in river (type of measure and year of implementation)
	Measure 2	any restoration measure done in river (type of measure and year of implementation)
	Measure 3	any restoration measure done in river (type of measure and year of implementation)
	Measure 4	any restoration measure done in river (type of measure and year of implementation)
	Measure 5	any restoration measure done in river (type of measure and year of implementation)
	Additional information	Any additional information regarding the restoration measure
	Note1	
	Note2	
	Note3	
	Note 4	

Annex 1. List of all 346 assessed sea trout rivers in the Baltic Sea over the period 2015–2018.

Denmark

River	*RS category*	*ES (WFD)*	*Trout stocking (Y/N)*	*Migration hindrances (Y/N)*
Brændemølle Å	4	-	N	N
Jeksen Bæk	3	4	N	Y
Lilleå	4	4	N	N
Lollikebæk	4	4	N	N
Odense Å	3	3	N	Y
Stokkebækken	4	4	N	N
Stubberup bæk	1	4	N	N
Svenskebæk	3	4	N	Y
Tjærbæk	4	4	N	N
Villestrup å	1	4	N	N

Estonia

River	*RS category*	*ES (WFD)*	*Trout stocking (Y/N)*	*Migration hindrances (Y/N)*
Altja	1	4	N	N
Höbringi oja (tributary of Riguldi)	1	4	N	N
Jämaja oja	1	4	N	N
Kaberla oja	1	4	N	N
Keila	1	2	N	N
Kolga oja	1	4	N	N
Loo oja	1	4	Y	N
Loobu	1	2	N	N
Männiku oja	1	4	N	N
Mustoja	1	4	N	N
Pada	1	4	N	N
Pidula oja	1	4	N	N
Pirita	2	2	Y	Y
Pudisoo	1	2	Y	N
Riguldi	1	4	N	N
Timmkanal	1	4	N	N
Toolse	1	4	N	N
Vääna	1	2	N	N
Vainupea	1	4	N	N
Valgejõgi	3	4	Y	N
Vasalemma	1	2	N	N
Vihterpalu	1	4	N	N
Võsu	1	4	N	Y

Finland

River	*RS category*	*ES (WFD)*	*Trout stocking (Y/N)*	*Migration hindrances (Y/N)*
Espoonjoki	1	4	N	N
Ingarskilanjoki	1	3	N	Y
Isojoki	1	4	Y	Y
Kuerjoki	1	5	N	N
Lestijoki	2	-	Y	N
Longinoja	1	3	N	N
Mankinjoki	1	4	N	N
Mustajoki	3	3	N	Y
Naalastojoki	2	-	N	N
Naamijoki	3	-	N	N
Olosjoki	4	-	N	N
Pakajoki	2	5	N	N
Valkeajoki	1	5	N	N

Germany

River	*RS category*	*ES (WFD)*	*Trout stocking (Y/N)*	*Migration hindrances (Y/N)*
Althöfer Bach	4	3	N	N
Au bei Klein Grödersby	4	3	N	N
Au bei Königstein	4	3	N	N
Augraben	4	3	N	Y
Bach aus Bernstorf	4	3	N	N
Bach aus Neu Karin	2	-	N	N
Bach aus Parchow	2	-	N	N
Bach aus Thorstorf	4	-	N	N
Bach aus Zierow	4	3	N	N
Bach bei Karschau	2	3	N	Y
Bachgraben	4	3	N	N
Bäk	4	-	N	N
Beke	2	4	N	N
Bienebek	4	3	Y	Y
Blowatzer Bach	4	3	N	N
Bollhäger Fließ	4	-	N	N
Carbäk	4	3	N	N
Damshäger Bach	4	3	N	N
Farpener Bach	4	3	N	N

Farver Au	2	3	Y	Y
Fauler Bach/Plastbach	4	3	N	N
Gätenbach	4	3	N	N
Goldbach	4	3	N	N
Göwe	4	4	N	N
Graben aus Ahrendsee	4	3	N	N
Graben aus Sandhagen	4	-	N	N
Habernisser Au	2	2	Y	Y
Hanshäger Bach	4	3	Y	N
Haubach	4	4	N	N
Hellbach	3	3	N	N
Hohen Sprenzer Mühlbach	4	3	N	N
Hohenfelder Mühlenau	2	3	N	Y
Holmbacher Graben	4	3	N	N
Hopfenbach	4	3	N	N
Iskiersand Au	2	3	N	N
Katzbach	4	4	N	N
Klosterbach	4	3	Y	N
Köhntop	4	-	N	N
Königsau	4	2	N	Y
Köppernitz	4	3	N	N
Körkwitzer Bach	4	3	N	N
Korleputer Bach	4	3	N	N
Korleputer Mühlbach	4	3	N	N
Koseler Au	2	3	Y	N
Kremper Au	2	3	N	N
Krieseby Au	4	3	Y	Y
Kronsbek-Aschau	2	2	Y	N
Lange Rie	4	4	Y	N
Linde	4	3	N	N
Lipping Au	2	2	Y	N
Maibach	4	3	Y	N
Marlower Bach	4	2	N	N
Maurine	4	3	N	N
Mechelsdorfer Bach	4	-	N	N
Mildenitz	4	3	N	N
Moltenower Bach	4	3	N	N
Mühlenbach Strelasund	4	-	N	N
Mühlenfließ	4	2	N	N
Nebel	4	4	N	N
Nessendorfer Mühlenau	2	2	N	Y
Neu Karin	4	-	N	N
Panzower Bach	2	3	N	N
Parchow	2	-	N	N
Peezer Bach	2	3	N	N
Poischower Mühlenbach	4	-	N	N
Polchow	2	3	Y	N
Rabeler Scheidebach	4	3	N	Y
Radebach	4	3	N	N
Randkanal	4	3	N	N
Ravensberg	2	-	N	N
Recknitz	4	3	N	N
Reppeliner Bach	4	3	Y	N
Ringsberger Au	4	3	N	Y
Rosengartener Bek	4	3	Y	N
Sagarder Bach	4	3	N	N
Schmieden Au	4	2	N	Y
Schwinge	4	3	Y	N
Sehrowbach	4	3	N	N
Siesbek	4	3	Y	N
Stepenitz	4	3	N	N
Strasburger Mühlbach	4	-	Y	N
Strehlower Bach	4	2	N	N
Swinow	4	3	Y	N
Tarnewitzer Bach	4	3	N	N
Tessenitz	4	3	N	N
Thorstorf	4	-	N	N
Waidbach	4	3	N	N
Wallbach	4	3	Y	N
Wallensteingraben	2	3	Y	N
Warnow	4	3	N	N
Wittbeck	4	-	N	N
Wolfsbach	4	3	Y	N
Zarnow	4	4	N	N
Zierower Bach	4	3	N	N

Latvia

River	*RS category*	*ES (WFD)*	*Trout stocking (Y/N)*	*Migration hindrances (Y/N)*
Abava	4	-	N	N
Aģe	1	3	N	N
Amata	1	3	N	Y
Bērzene	4	-	N	N
Brasla	1	-	Y	N
Ciecere	4	4	N	N
Durbe	4	3	N	N
Dursupe	2	-	N	N
Egļupe	1	3	N	N

Grīva	4	-	N	N
Īģe	2	-	N	N
Inčupe	4	-	N	N
Jaunupe	1	3	N	Y
Korģe	1	5	N	N
Korgene	1	-	N	Y
Kurliņupe	3	-	N	N
Lenčupe	1	4	N	N
Lētiža	2	-	N	N
Lielā Jugla	4	3	N	N
Liepupe	1	4	N	N
Līgatne	1	3	N	N
Loja	4	3	N	N
Lorupe	4	-	N	N
Mazā Jugla	4	3	N	N
Nurmižupīte	1	5	N	N
Pēterupe	3	3	Y	N
Pilsupe	4	-	N	N
Platenes kanāls	1	-	N	N
Rakšupe	4	4	N	N
Rauna	2	-	N	N
Raunis	1	-	N	N
Rauza	2	-	N	N
Rīva	3	3	N	N
Roja	1	3	N	N
Šepka	4	-	N	N
Skaļupe	3	4	N	N
Šķērvelis	2	-	N	N
Strīķupe	1	4	N	N
Svētupe	1	3	N	N
Tebra	2	3	N	N
Užava	4	3	Y	N
Vaive	1	-	N	N
Vanka	3	-	N	N
Vecpalsa	1	-	Y	N
Vējupīte	4	4	N	N
Virbupe	4	-	N	N
Vitrupe	1	5	N	N
Zaķupīte	1	-	N	N

Lithuania

River	*RS category*	*ES (WFD)*	*Trout stocking (Y/N)*	*Migration hindrances (Y/N)*
Agluona	2	4	N	Y
Aisė	3	4	N	N
Aitra	4	3	N	Y
Akmena	4	4	N	Y

		4			N	
		4			N	
		-			N	
		-			Y	
Alantas	2	-	4	N	N	N
Armona	3	-	4	N	N	N
Ašva	3	4	-	N	N	N
Bezdonė	4	-	-	Y	N	Y
Blendžiava	1	-	-	N	N	N
Bonal?	2	-	-	N	N	N
Bražuole	3	4	4	Y	N	N
Degalas	3	-	-	N	N	N
Dratvinys	2	-	-	Y	N	N
Dubysa	4	4	-	N	N	N
Dukšta	2		4	Y	N	N
Egluona	2	-	-	N	Y	N
Ežeruona	4	-	-	N	Y	N
Grabuosta	1	-	4	Y	Y	N
Grand Total	1	4		N	Y	N
Irtuona	4	-	-	Y	N	Y
Juodupis	2	5	-	Y	N	Y
Jūra	4	-	-	Y	Y	Y
Jusine	4	-	4	Y	N	Y
Karkluoja	2	-	-	N	N	N
Kena	1	4	5	Y	N	N
Kražantė	4	3	-	N	N	Y
Kulš?	1	3	-	Y	N	N
Lapišė	3	-	-	N	Y	N
Laukysta	2	-	4	Y	N	N
Lokys	4	5	3	N	N	N
Lomena	2	-	3	Y	Y	N
Luknė	2	-	-	Y	N	Y
Luoba	2	4	-	Y	N	N
Mera	3	4	5	Y	N	N
Minija	4	3	-	N	N	Y
Mišupis	2	5	-	Y	N	N
Muse	2	4	4	Y	N	N
Nemencia	2	-	4	N	N	N
Neris	4	3	3	Y	N	N
Peršokšna	4	-	5	Y	N	N
Plaštaka	4	-	4	Y	N	N
Pragulba	2	5	-	N	N	N
Rieše	2	-	3	N	N	N
Ringelis	4	-	-	N	Y	N
Šalpė	2	3	-	N	N	N
Saria	2	-	5	N	N	N
Šate	4	-	-	Y	N	N
Sausdravas	2	4	-	N	Y	Y
Šerkšne	4		3	Y		N
Šešuola	4		-	Y		N
Šiaušė	4		-	N		N
Siesartis	4		4	Y		Y

Širvinta	4	4	Y	Y
Skerdyksna	4	4	N	N
Skinija	2	-	N	N
Šlūžmė	2	-	N	N
Smiltele	2	-	N	N
Store	2	4	N	N
Šunija	2	-	Y	N
Šustis	1	-	Y	N
Šventoji	2	4	Y	N
Šventupis	2	-	N	N
Šyša	1	-	Y	Y
Upyna	3	-	N	N
Upynik?	2	-	N	N
Veiviržas	2	-	N	N
Venta	4	3	N	Y
Vilnia	1	4	Y	Y
Virinta	2	5	Y	N
Visete	4	3	Y	N
Voke	4	3	Y	Y
Žalesa	2	4	Y	N
Žeimena	4	5	N	N
Žiežmara	4	5	Y	N
Žvelsa	4	4	N	N

Poland

River	*RS category*	*ES (WFD)*	*Trout stocking (Y/N)*	*Migration hindrances (Y/N)*
Czarna Wda	1	3	N	N
Drweca	1	4	N	Y
Ina	3	3	N	Y
Kacza	4	2	N	Y
Leba	1	2	N	Y
Lupawa	1	4	N	N
Motlawa	4	4	Y	Y
Orzechowka	2	4	N	N
Parseta	3	4	Y	Y
Piasnica	4	4	N	Y
Reda	3	3	N	Y
Rega	2	4	N	Y
Slupia	3	3	N	Y
Wieprza	1	2	N	Y
Zagorska Struga	1	4	N	N
Zielona Struga	1	3	N	Y

Sweden

River	*RS category*	*ES (WFD)*	*Trout stocking (Y/N)*	*Migration hindrances (Y/N)*
Aapuajoki	3	-	N	Y
Älandsån	3	-	N	Y
Åvaån	1	3	N	Y
Bergshamraån	1	4	N	Y
Björkån	4	-	N	Y
Bönälven	1	-	N	Y
Borgforsälven	1	4	N	Y
Börrumsån	2	4	N	N
Byskebäcken	4	4	N	N
Degerbäcken	4	3	N	Y
Edstabäcken	3	-	N	Y
Fällforsån	4	3	N	N
Gådeån	2	-	N	Y
Hagbyån	2	4	N	N
Halmstadsbäcken	3	3	N	Y
Harrijoki	1	-	N	Y
Hugraifsån	3	4	N	N
Idbyån	1	-	N	Y
Inviksån	1	-	N	Y
Jyryjoki	1	-	N	Y
Kääntöjoki	1	-	N	Y
Kagghamraån	3	3	N	N
Keräntöjoki	3	-	N	Y
Kitkiöjoki	2	3	N	Y
Klappmarksbäcken	2	4	N	Y
Kolmårdsbäcken	2	3	N	N
Kopparviksbäcken	1	4	N	N
Kramforsån	1	-	N	Y
Kulleån	1	4	N	Y
Kutsasjoki	4	-	N	Y
Kvarnån	1	-	N	Y
Kvarsebobäcken	1	4	N	N
Lahnajoki	1	-	N	Y
Ljustorpsån	1	-	N	Y
Loån	1	4	N	Y
Lyckebyån	2	3	N	Y
Malbäcken	2	3	N	Y
Merasjoki	4	-	N	Y
Moraån	3	4	N	Y
Nätraån	1	-	N	Y
Pålböleån	4	3	N	Y
Prästbäcken	4	4	N	N
Råån	1	3	N	Y

Ramlösabäcken	3	3	N	N	Tolkkijoki	3	-	N	Y
Råtjärnbäcken	1	4	N	Y	Torsbäcken	4	4	N	N
Risängesbäcken	3	3	N	N	Tostarpsbäcken	3	3	N	Y
Risebergabäcke n	3	3	N	N	Trunnerupsbäck en	2	4	N	N
Saluån	1	4	N	N	Tryssjöbäcken	3	4	N	Y
Sege å	4	2	N	N	Valtiojoki	4	4	N	Y
Själsöån	3	4	N	N	Västanbäcken	1	4	N	Y
Skärjån	4	3	N	N	Vedån	1	4	N	N
Skeboån	4	2	N	Y	Verkaån	2	4	N	N
Smörbäcken	1	4	N	Y	Virån	4	3	N	Y
Stenbitbäcken	1	-	N	Y	Vitsån	1	4	N	Y
Stridbäcken	2	4	N	N					
Strinneån	3	-	N	Y					

Annex 2. Black list of sea trout rivers (river recruitment status ≤ 0.2) listed by country.

Denmark

Brændemølle Å

Lilleå

Lollikebæk

Stokkebækken

Tjærbæk

Finland

Olosjoki

Germany

Althöfer Bach

Au bei Klein Grödersby

Au bei Königstein

Augraben

Bach aus Bernstorf

Bach aus Thorstorf

Bach aus Zierow

Bachgraben

Bäk

Bienebek

Blowatzer Bach

Bollhäger Fließ

Carbäk

Damshäger Bach

Farpener Bach

Fauler Bach/Plastbach

Gätenbach

Goldbach

Göwe

Graben aus Ahrendsee

Graben aus Sandhagen

Hanshäger Bach

Haubach

Hohen Sprenzer Mühlbach

Holmbacher Graben

Hopfenbach

Katzbach

Klosterbach

Köhntop

Königsau

Köppernitz

Körkwitzer Bach

Korleputer Bach

Korleputer Mühlbach

Krieseby Au

Lange Rie

Linde

Maibach

Marlower Bach

Maurine

Mechelsdorfer Bach

Mildenitz

Moltenower Bach

Mühlenbach Strelasund

Mühlenfließ

Nebel

Neu Karin

Poischower Mühlenbach

Rabeler Scheidebach

Radebach

Randkanal

Recknitz

Reppeliner Bach

Ringsberger Au

Rosengartener Bek

Sagarder Bach

Schmieden Au

Schwinge

Sehrowbach

Siesbek

Stepenitz

Strasburger Mühlbach

Strehlower Bach

Swinow

Tarnewitzer Bach

Tessenitz

Thorstorf

Waidbach

Wallbach

Warnow

Wittbeck

Wolfsbach

Zarnow

Zierower Bach

Latvia

Abava

Bērzene

Ciecere

Durbe

Grīva

Inčupe

Lielā Jugla

Loja

Lorupe

Mazā Jugla

Pilsupe

Rakšupe

Šepka

Užava

Vējupīte

Virbupe

Lithuania

Aitra

Akmena

Bezdonė

Dubysa

Ežeruona

Irtuona

Jūra

Jusine

Kražantė

Lokys

Minija

Neris

Peršokšna

Plaštaka

Ringelis

Šate

Šerkšne

Šešuola

Šiaušė

Siesartis

Širvinta

Skerdyksna

Venta

Visete

Voke

Žeimena

Žiežmara

Žvelsa

Poland

Kacza

Motlawa

Piasnica

Sweden

Björkån

Byskebäcken

Degerbäcken

Fällforsån

Kutsasjoki

Merasjoki

Pålböleån

Prästbäcken

Sege å

Skärjån

Skeboån

Torsbäcken

Valtiojoki

Virån