Stressor Analysis carried out by each European Union Jurisdiction

Background and Methodology

This document is an overview of the individual stressor analysis carried out by each EU-Jurisdiction.

The information is presented in individual 'x/y axis' diagrams and is the result of having used the following methodology, using the best available scientific information and expert knowledge/advice:

- For the sake of consistency, the list of stressors used for this exrcise was the list considered by the '*ICES WGERAAS REPORT 2015',* which refers to the following stressors:

    - Stressor 1: Pollution
    - Stressor 2: Barriers
    - Stressor 3: Water Regulation
    - Stressor 4: Exploitation
    - Stressor 5: Aquaculture
    - Stressor 6: Habitat Degradation
    - Stressor 7: Diseases / Parasites
    - Stressor 8: Climate Change
    - Stressor 9: Invasives
    - Stressor 10: Stocking
    - Stressor 11: Predators
    - Stressor 12: Other

- **Effects axis** ranks the overall magnitude of the stressor as it currently impacts salmon stocks (taking into account the severity of the stressor, how widespread it is nationally & how much has been done to effectively mitigate its impacts):

    - Number of affected salmon populations (<10%, 10-20%, 20-50%, >50%)
    - Geographical distribution (depending on if this is a local, scattered, regional or national problem).
    - Negative impact (issues such as the reduction of production capacity and/or freshwater/marine survival were considered).

    [Scoring of effects: For each type of effect, the score ranged between 1 and 4, depending on the assessment of the expert in each EU Jurisdiction. This means that the maximum score could be 12. It may have been difficult to have specific base line data to come up with specific scoring, but the quantifying effort tried to facilitate to assess the relevance of each stressor among jurisdictions. If available,

[1] Revised 4 June 2025 to make a small change to text under the Ireland narrative on page 13.

the narrative tried to justify the reason why a specific score was given and the level of knowledge for each stressor was also mentioned when possible].

- **Development axis ranks** the overall trajectory of how the stressor category will continue to impact salmon stocks into the future, taking into account the likelihood of worsening or the likelihood of effective mitigation measures:

    - Potential for effective measures (planned): Here it was considered the potential to address the stressor by putting in place effective measures. If these measures were planned and/or in the pipeline, the score was lower than if nothing was foreseen or planned. A lower score here would imply that some action is planned/will be taken and the overall weight of the stressor consequently would be smaller than if nothing was planned.
    - Likelihood of further negative impacts (due to reduced production capacity or freshwater survival or marine survival): Here it was considered the future developments. Consequently, high score was given if experts thought that negative developments will continue in the future.
    - For this section on developments, it was considered a period of 1-5 years.

    [Scoring of developments: For each type of development, the score ranged between 1 and 4, depending on the assessment by the expert. This means that the maximum score could be 8. As in the previous section of effects, when possible, experts tried to justify why specific scores were given and experts described the level of uncertainty of projected development for each stressor].

- **Colours and symbols** represent knowledge related to the understanding of the impacts of each stressor category and uncertainty about the future trajectory of each stressor, in terms of whether it will worsen or improve:

    - Blue squares = Extensive knowledge and small uncertainty.
    - Yellow circles = moderate knowledge and moderate uncertainty.
    - Red triangles = poor knowledge and high uncertainty.

- You can see the template format in the next page and immediately after there are individual sections for each EU jurisdiction.

Results

- Globally speaking and looking at the most relevant stressors that impact each EU jurisdiction, it seems that the most common stressors are:

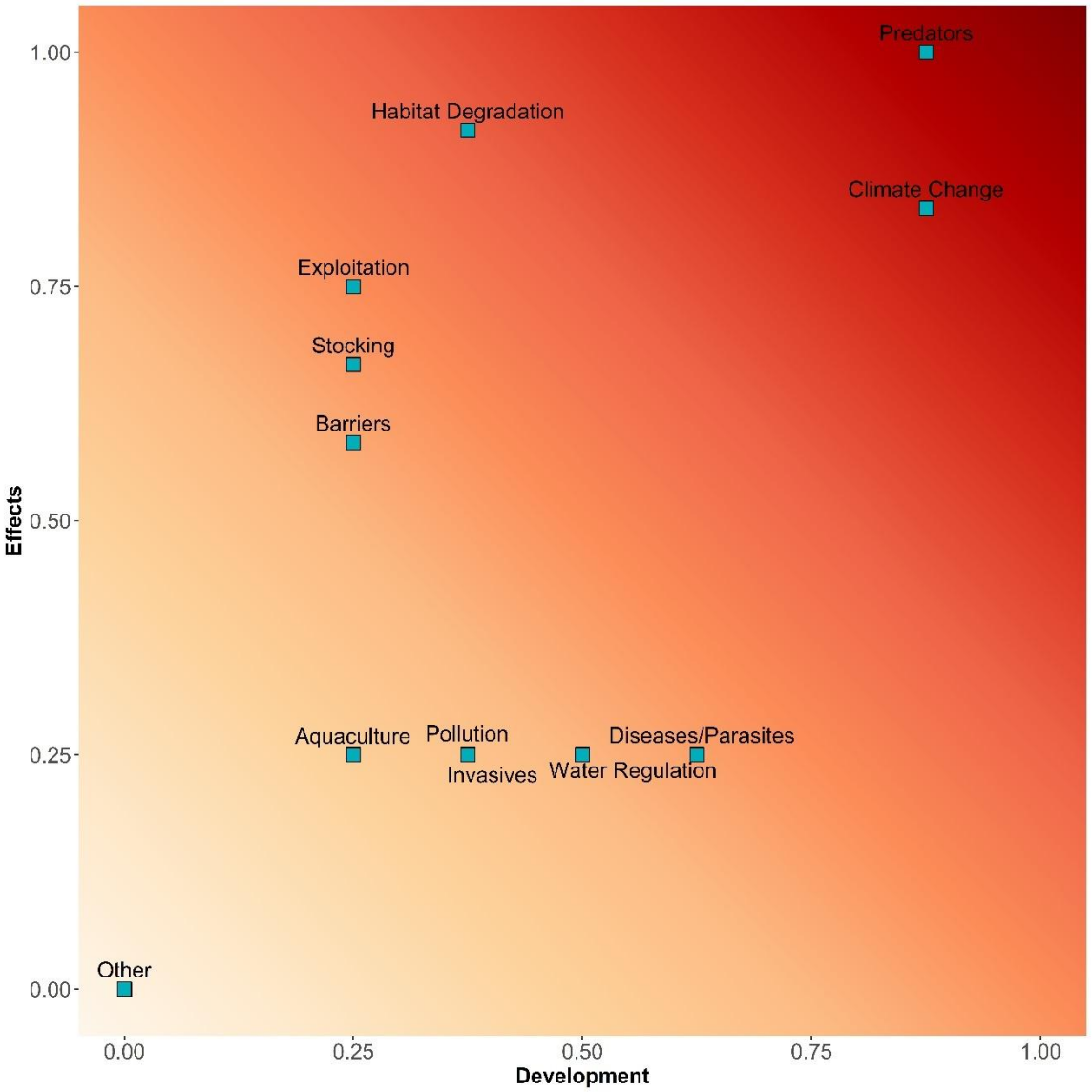
    - Climate change
    - Habitat degradation
    - Barriers
    - Predators
    - Water regulation

		Criteria & Scoring	1	2	3	4	5	6	7	8	9	10	11	12
a) Effects (axis Y)	1. Number of affected populations (including lost populations)	1 = <10%; 2 = >10%; <20%; 3= >20%; <50%; 4= >50%												
	2. Geographical distribution	1 = Local; 2 = Scattered; 3 = Regional; 4= National												
	3. Negative impact (due to reduced production capacity or freshwater survival or marine survival)	1= Small; 2 = Moderate; 3 = Large; 4 = Very large												
	Sum (maximum score = 12)													
	Score (0-1)													
	Knowledge	Extensive = 1, moderate = 2, poor = 3												

b) Developments (axis X)	1. Potential for effective measures (planned)	1 = High ; 2 = Moderate; 3 = Low; 4 = Negligible												
	2. Likelihood of further negative impacts (due to reduced production capacity or freshwater survival or marine survival)	1= Small; 2 = Moderate; 3 = Large; 4 = Very large												
	Sum (maximum 8)													
	Score (0-1)													
	Uncertainty of projected development	Small = 1, moderate = 2, large = 3												

Stressor Compiled Scores	Axis	1	2	3	4	5	6	7	8	9	10	11	12
Compiled relative effect (0–1)	y												
Compiled development (0–1)	X												
Knowledge & uncertainty of projected development Compiled Scores													

DENMARK


Predators
Habitat Degradation
Climate Change
Exploitation
Stocking
Barriers
Aquaculture
Pollution
Invasives
Water Regulation
Diseases/Parasites
Other
1.00
0.75
0.50
0.25
0.00
Effects
0.00
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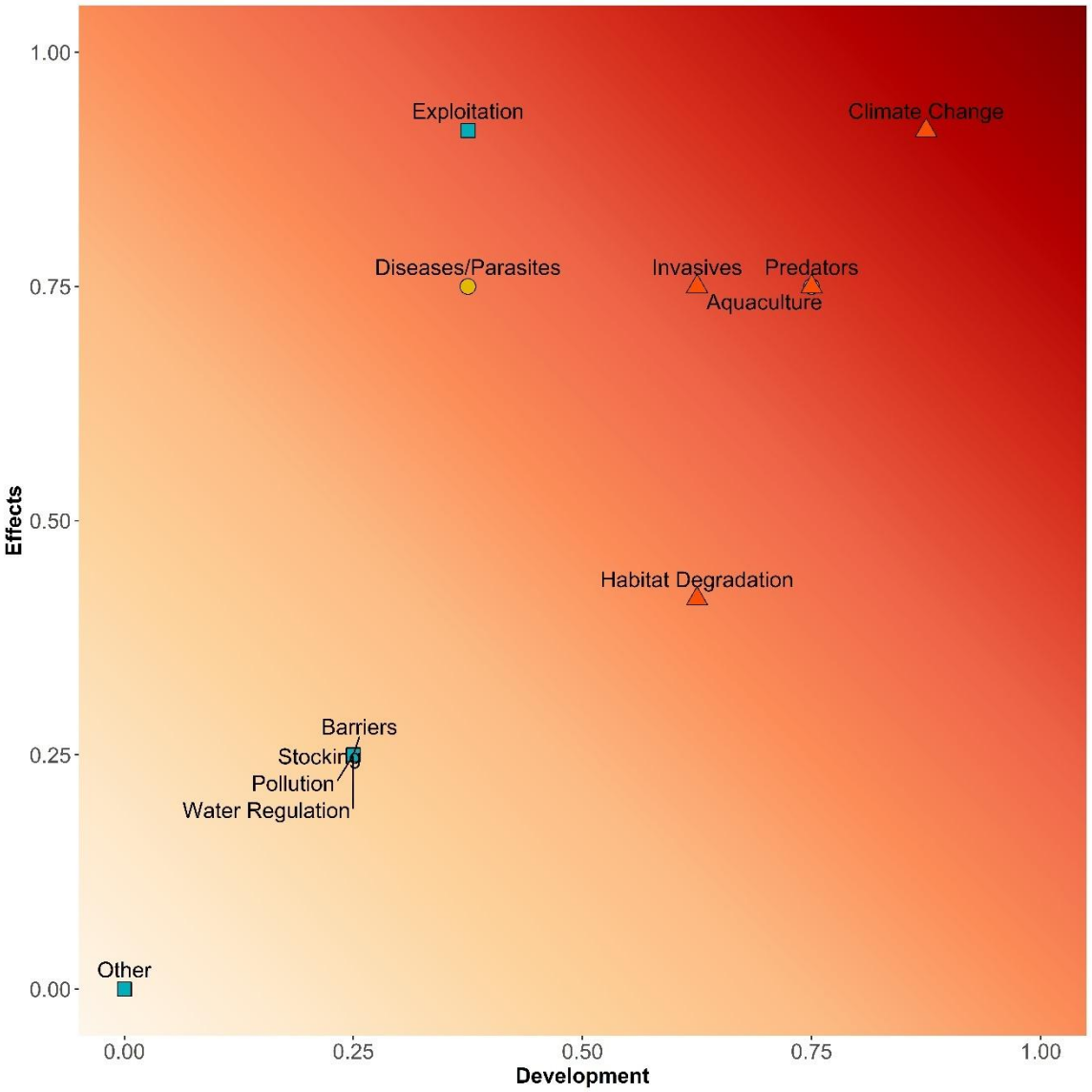
0.50
0.75
1.00
Development

FINLAND



Finland Narrative

Finland shares two Atlantic salmon rivers with Norway, Teno/Tana, Näätämöjoki/Neidenelva, both discharge to the Atlantic Ocean (Barents Sea). These rivers are located in the northernmost Fennoscandia, in a near-pristine sparsely populated areas where direct, local human impacts on the catchments are small. Therefore, most stressors for salmon populations in these systems are larger scale impacts, like global climate warming.

State of salmon populations and various environmental factors are relatively well monitored by bilateral programs in these catchments, and for most stressor variables the knowledge level is high (with some exceptions).

Stressor No 1: Pollution

There is very little pollution affecting the salmon populations in these sparsely populated catchments, and only some point sources can be identified potentially affecting some salmon populations.

Stressor No 2: Barriers

The only barriers in these river systems are road culverts, which have been mapped and surveyed, and most important ones have already been restored.

Stressor No 3: Water regulation

There is no water regulation in the Rivers Teno and Näätämöjoki and there are no plans for water regulation in the foreseeable future.

Stressor No 4: Exploitation

All salmon populations in the Rivers Teno and Näätämöjoki are subject of exploitation at the Norwegian coastal fishery. In the River Teno, a total salmon fishing ban has been effective since 2021 and most likely will continue in 2025. In the River Näätämöjoki, exploitation has been recently reduced by local fishing rules, and a bilateral (Finland-Norway) negotiations on renewal of the fishing agreement has recently started.
There is a potential for further negative impacts if exploitation is not effectively reduced.

Stressor No 5: Aquacluture

All salmon populations in the Rivers Teno and Näätämöjoki are potentially affected by the salmon aquaculture on the Norwegian coast (and potentially other facilities in the NE Atlantic area).

Some effects of aquaculture are known better (number of escapees in wild populations, introgression), but some aspects and potential impacts are less known (diseases, parasites, ecosystem effects, long-term introgression effects..).

Stressor No 6: Habitat degradation

Many salmon populations in the Rivers Teno and Näätämöjoki are subject of ongoing/potential habitat degradation from siltation and sedimentation, due to natural and man-made processes. However, habitat degradation due to natural/man-made siltation are not regularly monitored, and possible target areas are not well-known.

Stressor No 7: Diseases /Parasites

All salmon populations in the Rivers Teno and Näätämöjoki are potentially targeted by parasites/diseases, especially Gyrodactylus salaris (GS). Currently, no impact has been detected, but there's a serious overall potential for infection.

There are extensive information campaigns and strong legislation in effect, but potential for negative impacts remain.

Stressor No 8: Climate Change

All salmon populations in the Rivers Teno and Näätämöjoki are subject to Climate Change (CC). In the current situation, the effect of CC on these northern populations is considered large. Some effects on growth and life history characteristics have been detected and strongly deteriorated smolt survival at sea, and is probably due to climate change.

Stressor No 9: Invasives

All salmon populations in the Rivers Teno and Näätämöjoki are subjects to invasive species. Currently, small or negligible impacts of invasive species on native salmon are known, but there's lots of unknowns and uncertainties, especially in relation with the recently increased pink salmon surge into the Barents Sea rivers.

Some mitigation measures are possible, e.g. the Norwegian policy of intercepting pink salmon runs at river mouths.

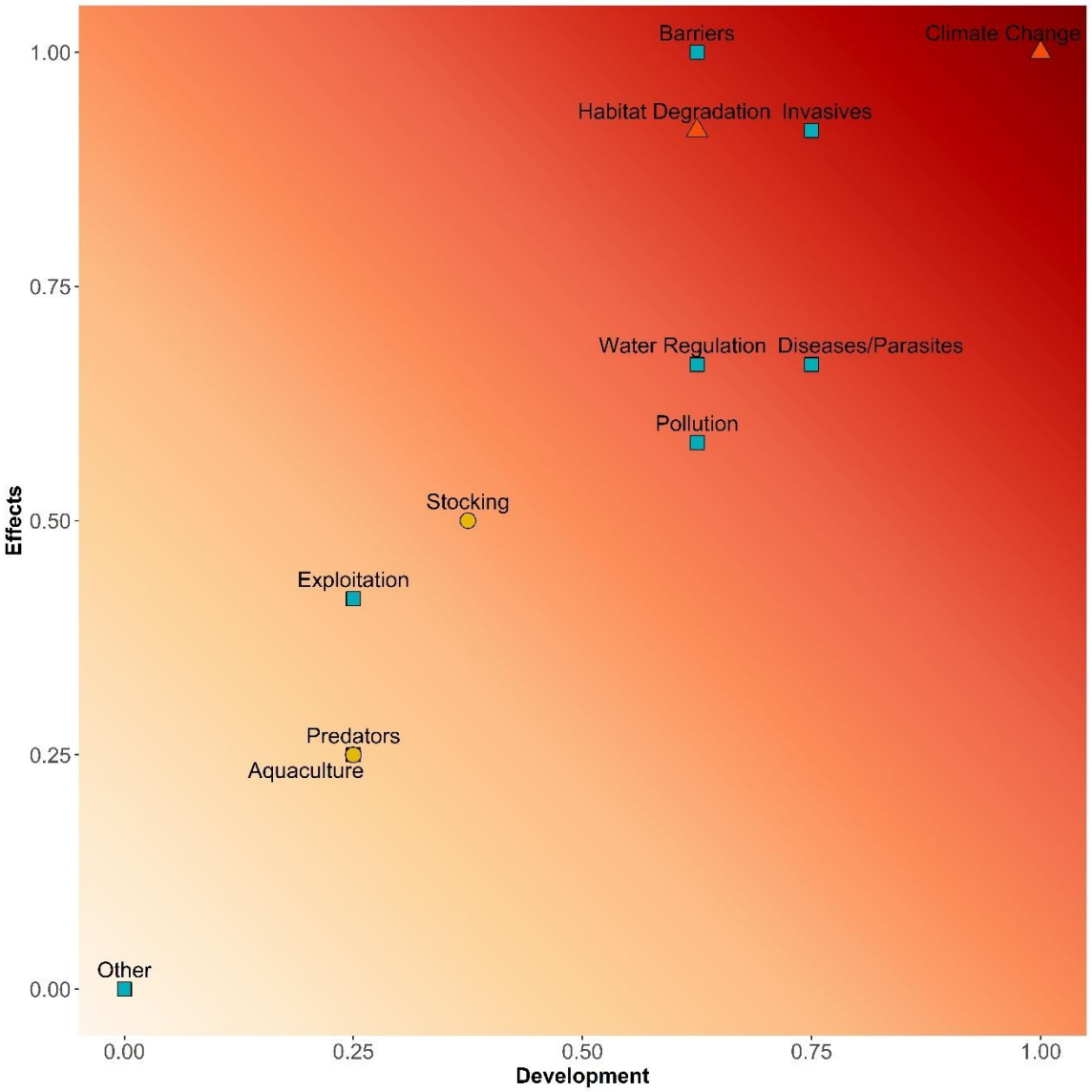
Stressor No 10: Stocking

The real number of affected populations is zero, as there is no stocking in the catchments of Rivers Teno and Näätämöjoki.

Stressor No 11: Predation

Natural predation affects all salmon populations, but the real impact on population status and dynamics are poorly understood. Some indications of increased predation pressure include climate change facilitating better recruitment of spring-spawning predators, like pike, and the overall low salmon population abundance which tend to increase the effects of predation.

FRANCE


Barriers
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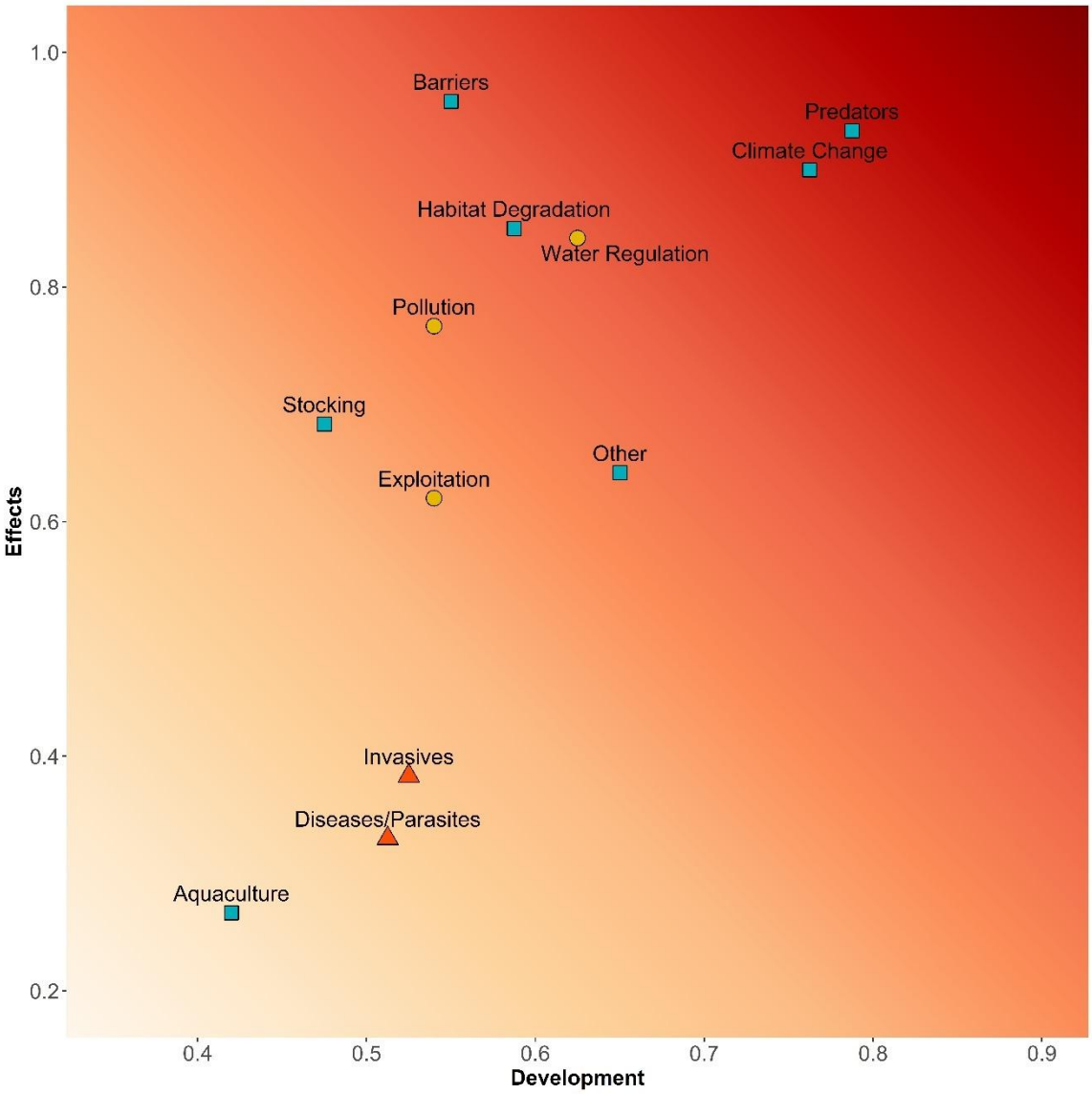
GERMANY



Germany Narrative

In the Federal Republic of Germany, the reintroduction of Atlantic salmon (*Salmo salar*) is taking place in nine of the German Laender (federal states)[2]. Responsibility and expertise for the reintroduction projects lies with the individual federal states.

In order to carry out the stressor analysis, the template was completed by each federal states on the basis of expert knowledge. And the obtained results were then averaged by the Federal Office for Agriculture and Food (BLE) to provide a representative result for Germany as a whole.

[2] Baden-Wuerttemberg (BW), Rhineland-Palatinate (RP), Hesse (HE), North Rhine-Westphalia (NRW), Saxony (SN), Saxony-Anhalt (ST), Brandenburg (BB), Lower Saxony (NI), Schleswig-Holstein (SH)

Stressor No 1: Pollution

All Atlantic salmon populations in Germany are in contact with a wide range of water pollutants at some stage in their life cycle.

Despite a considerable improvement in the situation since the mid-1970s, the level of pollution must still be considered serious. Existing pollution is impacting on the reproductive success of returning salmon.

Stressor No 2: Barriers

Migration barriers affect almost all salmon stocks in Germany.

Most of the transverse structures in the watercourses and their fish pass ability have been mapped, so there is a good level of knowledge about this problem.

The negative effect of barriers on salmon stocks in Germany was rated the highest of all twelve stressors. This assessment was almost identical in all federal states.

The probability that negative factors related to barriers could increase was assessed as moderate to high, due to the ongoing discussion concerning the construction of new hydropower plants.

Stressor No 3: Water Regulation

Changes in river flow or hydraulic engineering affect almost all salmon stocks in Germany. Substantial water regulation, frequently associated with hydropower, exerts a detrimental influence on the quantitative availability of habitat, structural diversity and habitat quality. A significant proportion of the historic salmon habitat has already been irreparably lost due to water regulations. Furthermore, hydraulic engineering frequently results in alterations to the flow regime, thereby impacting physical and chemical water parameters.

Unfortunately, many of the changes to water bodies caused by hydraulic engineering measures will be difficult to reverse in the medium to long term.

Stressor No 4: Exploitation

The negative impact of illegal catches of salmon or unintentional by-catches is considered to be low by almost all federal states. And there is currently little evidence to suggest that the situation for salmon will deteriorate in the medium term due to this stressor.

Stressor No 5: Aquaculture

Commercially farmed salmon was detected sporadically and in small numbers in a tributary in the lower reaches of the Elbe and a tributary in the lower reaches of the Weser.

The only threat to wild salmon stocks from aquaculture comes from salmonid farms releasing infected fish. However, farms are subject to mandatory veterinary surveillance. The direct impact of aquaculture on salmon is therefore considered as low.

Stressor No 6: Habitat Degradation

Loss of habitat quality is affecting all salmon stocks in Germany.

In particular, the accumulation of fine sediment in the riverbed and the clogging of salmon spawning gravels is a major problem in many salmon reintroduction rivers. In addition, in some tributaries, mechanical water maintenance measures (especially mobilisation of fine sediments during weeding and bed clearing; removal of dynamic structural elements; removal of gravel banks; removal of habitats = submerged vegetation cushions, dead wood) are a major problem.

The risk of an increase in habitat degradation is assessed as high, particularly in view of the future prioritisation of flood protection measures. In addition, an increase in habitat degradation is expected due to the increase in heavy rainfall events, which leads to an increased input of fine sediment into the waters. Major projects to improve Rhine navigation are currently planned in several sections of the Middle Rhine, which could severely affect the Rhine as a migratory habitat in these sections.

Stressor No 7: Diseases / Parasites

All Laenders state that they are marginally affected or have a lack of knowledge and consider that this stressor is only happening locally.

Although most federal states do not carry out standardised field studies on this topic, analysis carried out by one federal state show that adult salmon carry a number of pathogens that are bacterial, viral or fungal in nature.

Stressor No 8: Climate Change

All salmon stocks in Germany are affected by climate change.

The impact of climate change on salmon stocks is estimated to be highly negative on average. In addition, the consequences of climate change also amplify the negative effects of most other stressors in a variety of ways. When assessing this stressor, the federal states focussed in particular on the effects on salmon in freshwater. In the last 7-8 years, the consequences of climate change have been felt very drastically in German water courses and in many cases have had a very detrimental impact on the salmon reintroduction projects. And the potential of measures to mitigate the consequences of climate change is considered limited.

Stressor No 9: Invasives

The proportion of salmon populations affected by invasive species is not considered to be particularly high on average. However, the lack of knowledge about the impact of invasive species on salmon was also highlighted by some states.

Examples of invasive species that could potentially have a negative impact on salmon stocks are Wels catfish and pikeperch (allochthonous in the Rhine basin), rainbow trout, signal crayfish and cormorants. To note that the negative impact of these species on salmon is also considered under the stressor 'Predators'.

The potential for action with regard to the stressor of invasive species is assessed as low on average.

Stressor No 10: Stocking

As all salmon stocks in Germany are supported by stocking measures, all salmon stocks in Germany are influenced by this stressor. And the negative impact on wilds stocks is estimated to be low.

In Germany, salmon stocking is considered a necessary measure to rebuild stocks, and stocking must continue until self-sustaining salmon stocks have been re-established. As the salmon populations originally present in Germany are completely extinct, it is impossible for stocking to genetically distort autochthonous wild stocks. To date, there has been no evidence of any negative impact of stocking on naturally reproducing salmon and their offspring.

There are currently no indications that potential negative influences of the stressor 'stocking' will affect salmon stocks in the medium term.

Stressor No 11: Predators

Across Germany, all salmon stocks are subject to high predation rates and over-predation represents a considerable threat to salmon populations across Germany.

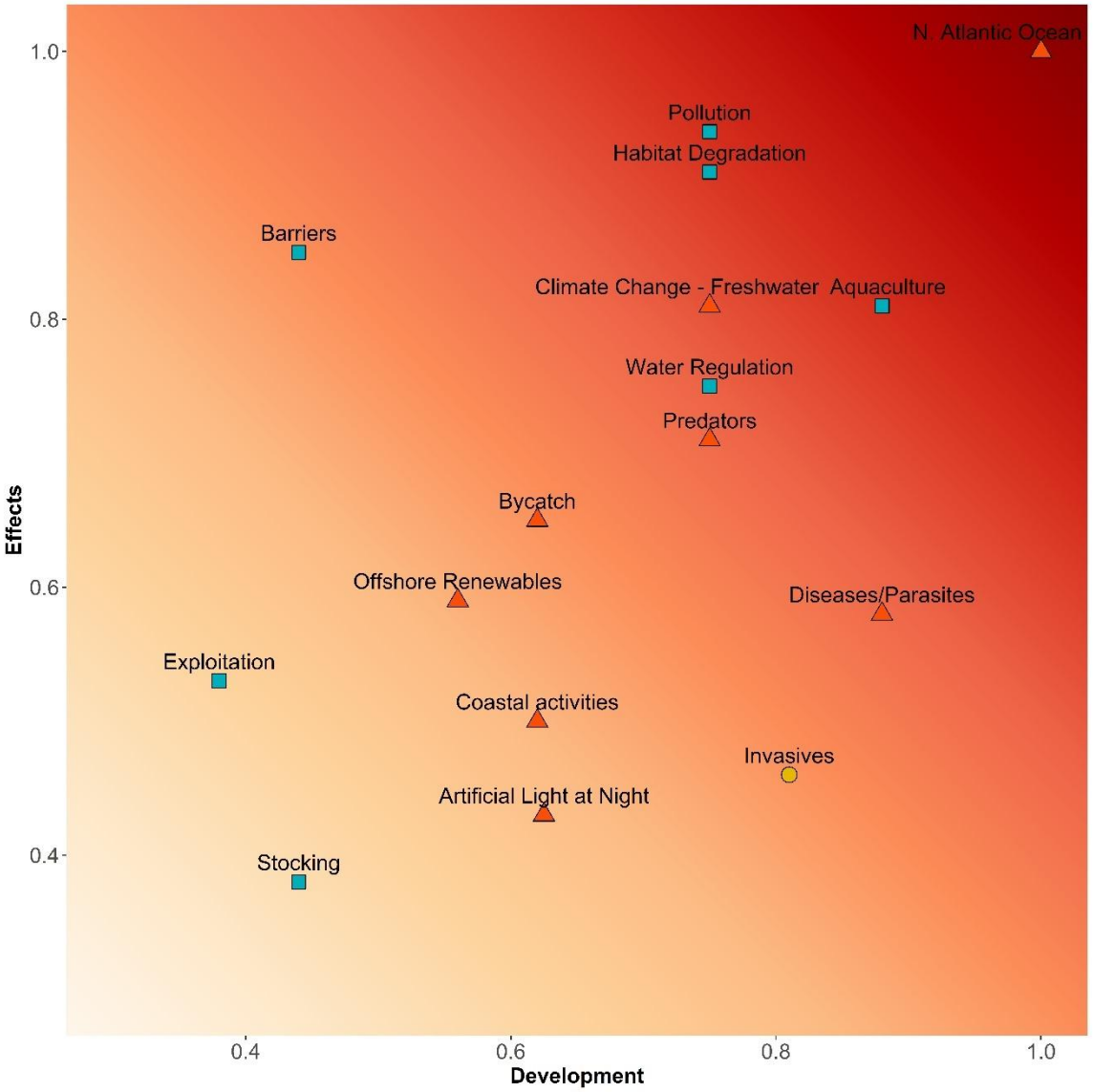
The impact of excessive predation on salmon stocks has been identified as a significant concern by all federal states. The most prominent predators affecting salmon in the Rhine basin include pike-perch, catfish, cormorants and goosanders, while in coastal areas, seals and porpoises are prevalent. Inland, catfish, whose population has exhibited exponential growth over the past two decades, are the only predators capable of consuming adult salmon. In addition to the predators previously identified in the Rhine basin, pike has been identified as a significant predator in the Elbe catchment area, and the otter has been observed to be increasingly present in salmonid waters. The overall impact of these predators is considered to be severely deleterious.

Predators are considered to have the greatest negative impact on salmon stocks in this assessor analysis carried out by Germany. Furthermore, there are concerns that the negative effects of this stressor could even become more severe.

Stressor No 12: Other

In some federal states, this stressor is related to injuries caused by ship propellers (especially at low water discharges), lack of national structures and funding instruments for the necessary supra-regional research for the reintroduction of salmon into German river basins, and lack of knowledge and inadequate implementation of the requirements of the EU legislation (Water Framework Directive).

IRELAND



Ireland Narrative

For the stressor analysis, Ireland assessed the scoring criteria pertaining to each stressor category for all rivers designated by the Technical Expert Group on Salmon as wild Atlantic salmon rivers which undergo annual stock status assessments (142 individual river systems). These rivers correspond with the Irish Atlantic salmon rivers systems provided to NASCO for the Wild Atlantic Salmon Atlas.

To ensure representative national scores were derived for each stressor category across all of the Ireland's individual salmon rivers, river systems were first divided by each of the seven Regional Basin Districts (RBD) in Ireland. A series of meetings were held with Inland Fisheries Ireland (IFI) staff (directors, inspectors, assistant inspectors, protection officers, environmental officers) working within each RBD to gain expert, local knowledge on stressor categories impacting individual Atlantic salmon stocks. This was coordinated by IFI scientific staff who were also present and had inputs into the final expert judgement scoring during each meeting.

The scorings from each individual RBD were then amalgamated and used to inform the final national assessment as presented here.

Stressor No 1: Pollution

This stressor category relates to water quality deterioration, which in Ireland primarily occurs due to nutrient loading, organic, sediment, silt & chemical pollution. The primary sources are agriculture, wastewater pollution (urban/domestic waste water and water treatment plants), industrial emissions, extractive industry (mines, quarries, peat), forestry and urban run-off. Impacts on salmon can be lethal (i.e. fish kills) or sublethal, chronically effecting growth and overall survival rates and ultimately limiting potential habitat in areas with water quality not suitable for salmon.

Pollution/water quality deterioration placed amongst Ireland's top four highest scoring stressors, and was generally deemed to be having widespread, intensive impacts on Irish salmon stocks through limiting quality and availability of suitable habitat. The challenge associated with effectively implementing measures to substantially improve the current poor water quality status in Irish water bodies was also reflected in the high score on the development axis.

Stressor No 2: Barriers

Primary sources of barriers that disrupt connectivity in Irish salmon rivers range from human-made structures (weirs, embankments, culverts) that can hinder upstream and downstream movement of salmon, to major impassable structures such as large weirs or dams associated with hydropower generation which completely impede upstream and downstream movement.

Whilst barriers scored highly on the effects axis owing to their widespread occurrence and documented impacts on salmon migration ecology, this stressor category showed an improved score on the development axis, owing in large part to the increased focus on attempting to implement barrier mitigation measures in Irish rivers in recent years. A pertinent example includes the investment in the newly established Barrier Mitigation Division in IFI, which is developing a programme of barrier mitigation projects around the country, planned for 2024 to 2027.

Stressor No 3: Water Regulation

In Ireland, this stressor category primarily relates to abstraction or regulation of water for the purpose of hydropower generation or human water usage (reservoirs, abstraction points). Impacts on salmon include unnatural river flow regimes and associated negative effects, particularly significant in the case of hydropower schemes, as well as reduction of wetted habitat and increased vulnerability to low flows during periods of high-water abstraction.

Despite hydropower schemes and large-scale reservoir abstraction not being as widespread nationally as some of the other stressor's categories, this stressor category stilled scored generally high, owing primarily to the intensive impacts that hydropower river regulation schemes have on several important wild Atlantic salmon populations (high score on the effects axis). The likelihood that water abstraction will continue to worsen and impact Atlantic salmon, especially under changing climate conditions and population spread or growth was also highlighted by a relatively high score on the development axis.

Stressor No 4: Exploitation

This stressor category primarily relates to over-exploitation (i.e. over-harvesting of salmon beyond levels which are deemed sustainable). The primary cause of this in Ireland is illegal fishing (i.e. poaching) or unreported catch.

Overall, exploitation scored reasonably low on both effects and development axes. This is mainly due to a reduction in exploitation in Irish salmon fisheries in recent decades (e.g. cessation of coastal drift-net fisheries in 2006), annual provision of catch advice based on recent stock assessment trends and the considerable extent of the protection work carried out by IFI against illegal fishing, both at sea and in rivers.

Stressor No 5: Aquaculture

This stressor category primarily related to the impacts associated with marine salmon aquaculture in open-net cages on wild Atlantic salmon populations, and in some instances, the effects of freshwater salmonid hatcheries on wild river populations. Main impacts on wild salmon include increased sea lice infestation pressure, escaped farmed salmon (both adults in the marine and juveniles in freshwater) and other potential infections related to fish farms that could spread to wild stocks.

Aquaculture placed within Ireland's top 4 highest scoring stressors. Despite typically occurring only regionally and not nationally, coastal regions impacted by aquaculture tend to coincide with high densities of Atlantic salmon rivers (i.e. along the western Irish seaboard). Lack of implementation of effective mitigation measures, and absence of planned future mitigation measures, largely contributed to the high overall score in this category.

Stressor No 6: Habitat Degradation

This stressor primarily relates to any changes in the physical river habitat and natural processes (hydromorphology) due to human activities and interventions. In Ireland, the primary sources of habitat degradation include channelisation and associated land drainage activities as well as human activities and structures encroaching to the edge of the riverbank, which alters riparian functioning and instream processes e.g. in areas with intensive agriculture, urban or industrial activities in the surrounding watershed.

Habitat degradation placed amongst Ireland's highest scoring stressors impacting Atlantic salmon populations (top four category). Scoring reflected that degradation of the quality and availability of suitable salmon habitat, especially spawning habitat and habitat that is resilient to adverse environmental conditions (floods, droughts etc), is currently ubiquitous and will require extensive planned measures to mitigate.

Stressor No 7: Diseases / Parasites

This stressor category includes naturally occurring diseases and parasites that can have significant impacts on salmon survival, condition and overall stock health. Specific Irish examples that have been documented in previous decades include furunculosis, *Saprolegnia* outbreaks, ulcerative dermal necrosis, red skin disease and red vent syndrome. In extreme cases, outbreaks of disease can lead to mass fish kills.

This category scored relatively low on the effects axis given that some degree of microbial disease or parasitic infection is expected and generally considered to be a natural element of wild salmon population ecology. However, owing to the likelihood that additional stressors (e.g. climate change, water quality) may continue to impact salmon unabated and increase susceptibility to currently known and emergent pathogens, diseases/parasites scored relatively high on the development axis, with a large degree of uncertainty surrounding the future projection of this stressor on Irish salmon stocks.

Stressor No 8: Climate Change - Freshwater

This stressor category principally relates to the effects of changing climatic conditions on freshwater temperatures and river flow regimes. Impacts on salmon include increased exposure to stressful river water temperatures and extreme flow regimes (floods and droughts), which can impact adult and juvenile condition and potentially impact on survival rates.

This stressor category scored highly on both effects and development axes, principally due to the widespread impacts – in general all Irish salmon populations are exposed to current and future changes in climate conditions that negatively impact salmon ecology. However owing to lack of knowledge on how current freshwater conditions effect salmon compared to historical reference points and a degree of uncertainty surrounding future projections of water temperatures and flow regimes in Ireland, the scoring of this category was classified as having poor knowledge and high uncertainty. Furthermore, considering that altering the global drivers of future climate is beyond the reach of national actions, implementing mitigation measures that remove concurrent stressors on a national scale that reduce the resilience of freshwater habitats to adverse climatic conditions (i.e. water quality deterioration, barriers, water regulation & abstraction, habitat degradation) will likely prove to be the most effective way to mitigate climate change in freshwater as a primary stressor for Irish Atlantic salmon stocks.

Stressor No 9: North Atlantic Ocean Change

This stressor category encompasses large-scale changes in oceanographic conditions in the North Atlantic Ocean, which impacts Atlantic salmon during their marine migration phase. Impacts on salmon include changes in physical oceanography (ocean currents and circulation systems, temperatures, salinities, chemistry) as well as biological oceanography, such as shifts in food web structures and the quantity and quality of prey which salmon rely on during their marine phase. Such changes have been strongly associated with decreased marine survival (i.e. lower rates of smolt-to-adult returns) observed in Atlantic salmon stocks around the North Atlantic watershed over recent decades.

This category was the highest scoring stressor for its impacts on Irish Atlantic salmon stocks, due in large part to all Irish salmon populations being exposed to the same changing marine environment during their marine migration. A reduction in contemporary adult marine return rates in a number of monitored Irish rivers supports this scoring placement. However, owing to a lack of knowledge on precisely how changing conditions in the North Atlantic are impacting salmon marine survival and a large degree of uncertainty surrounding how oceanographic conditions in the North Atlantic Ocean-atmosphere system will develop in the coming decades, the scoring of this category was classified as having poor knowledge and high uncertainty. Furthermore, considering the formidable scope of controlling or mitigating changes in the wider North Atlantic Ocean, focusing on removing additional stressors that can compromise salmon survival and production in Irish freshwater and coastal environments is

considered the most pragmatic way to help offset high marine mortality in the short-to-medium term.

Stressor No 10: Invasives

This stressor category relates to non-native and introduced fish species that can have negative impacts on Atlantic salmon. In Ireland, the primary sources include purposeful and accidental introductions or translocations of species to novel habitats containing wild salmon stocks through human activities (e.g. coarse fish), as well as range expansions of non-native species (e.g. pink salmon). Negative impacts on salmon include resource competition for space and food as well as increased predation pressure.

This category scored relatively low on the effects axis, denoting that current impacts by introduced or range-expanding non-native species (pink salmon) are not having substantial impacts on Irish Atlantic salmon stocks. However, this stressor category scored highly on the development axis (with a moderate amount of uncertainty surrounding future projections). This reflects the risk of potential future expansions of the ranges of non-native species such as pink salmon or further introductions of species through human activities. In addition, changing environmental conditions could provide a competitive advantage for introduced fish species that are more tolerant of warmer water temperatures or poorer water quality compared to salmon, and thus increase the magnitude of negative impacts associated with this stressor category.

Stressor No 11: Stocking

This stressor category relates to stocking of wild Atlantic salmon rivers with hatchery-reared fish, released either as fry, parr or smolts. In general, in Ireland, stocking typically occurs through ranching programmes, with hatchery fish reared to the smolt stage and released into the coastal environment before returning as adults. Impacts on wild salmon that can arise from hatchery ranching programmes include competition for resources (especially suitable spawning grounds) as well as interbreeding between hatchery-reared adults and wild adults in the river, which can change the genetic structure of the wild population.

This stressor category scored low on both axes. Ranching is only carried out on a small number of Irish rivers and in general attempts are made to remove hatchery fish before they can spawn in the river. In addition, in accordance with international guidelines on appropriate use of stocking for wild salmon conservation, it is not envisaged that widespread stocking of wild Atlantic salmon rivers will occur in future, and this was reflected in the low scoring (and reasonably high certainty) on the development axis.

Stressor No 12: Predators

This category relates to predation of Atlantic salmon (at juvenile and adult stages, in marine and freshwater environments) that is influenced by some degree by human activities. For example, where salmon stocks are depleted to the point that natural predation rates have a larger magnitude impact, where predator species are introduced, where a reduction in other prey species causes predators to switch to salmon as a predominant prey item or where habitat modification increases predation risk. Primary predators of Irish Atlantic salmon include avian, mammalian and piscivorous species, with negative impacts including a reduction in overall abundance due to predation losses.

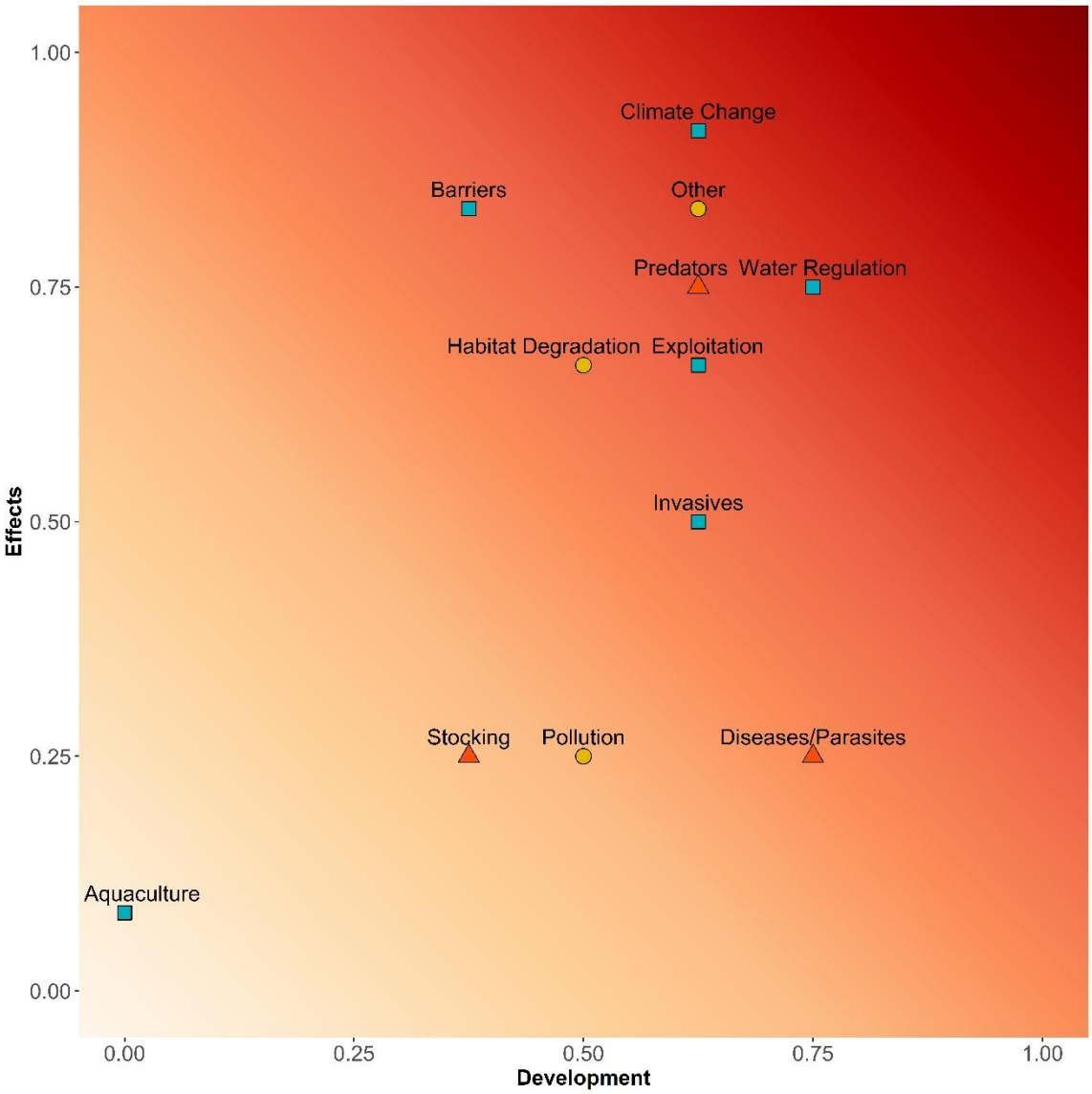
This stressor category scored reasonably high on both effects and development axes, reflecting that losses of Irish Atlantic salmon to predation are widespread and impact every population to some extent. However, the magnitude of predation losses may vary between river populations, with some river populations seemingly more vulnerable to predation based on non-empirical observations of predator density. Whilst predation of both adult and juvenile salmon is a natural part of Atlantic salmon ecology, the degree to which predation is impacting salmon abundance and productive capacity in Ireland is not fully known, which was reflected in the classification of this stressor score as lacking knowledge on current impact magnitude and having high uncertainty on future developments. Several studies have revealed predation losses of tagged Atlantic salmon smolts during marine migration both in freshwater and coastal habitats – extrapolating natural predation rates at a whole population level remains elusive, however. Additionally, further information is required on the extent of predation on adult salmon in coastal and freshwater habitats.

Stressor No 13: Others

This category relates to any other additional stressors potentially impacting Irish Atlantic salmon populations not encompassed under the previous categories. During the course of the scoring exercise, four additional specific categories were identified: bycatch of salmon in marine commercial fisheries, development of offshore infrastructure associated with renewable energy (principally wind energy in Ireland), coastal infrastructure and activities (e,g. dredging, shellfish aquaculture, harbour or port activities) and artificial light at night.

These “other” stressor categories varied in scoring along the effects axis but had similar scores for their anticipated development. All four stressor categories were classified as having poor knowledge on the current impact they have on Atlantic salmon populations and a high degree of uncertainty on future projections. This reflects that the current understanding of how these stressor categories impact Irish Atlantic salmon stocks lacks empirical evidence (e.g. bycatch, artificial light at night) and how they will develop in future in terms of expansion (offshore renewables and coastal activities) and anticipated impacts is difficult to gauge.

PORTUGAL



Portugal Narrative

Salmon populations are not nationally distributed in Portugal and are only restricted to a specific region in the north of the country, the Minho region, encompassing both Minho and Lima river basins.

Stressor No 1: Pollution

In these basins, the levels of pollution are very low and only restricted to specific sites with low or none effect on these salmon populations. Therefore, it is not expected that this stressor has a significant impact on Portuguese Atlantic salmon populations.

Stressor No 2: Barriers

The two river basins are highly affected by barriers, such as dams and weirs, resulting in a severe habitat fragmentation effect, especially in the respective tributaries. As such, more than 50% of national populations of this species are affected by this stressor.

This stressor has a large negative impact on salmon populations and is one of the main pressures affecting this species in this region in Portugal. This problem is particularly prominent in tributaries of both basins, compromising the adults of reaching suitable upstream spawning grounds and severely reducing the area available for this species.

There is high potential for improvement and for the application of measures related to habitat restoration for migratory fish. In this regard, there is currently ongoing the development and implementation of a National Program for the Removal of Obsolete Barriers, which aims to define, prioritise and implement specific interventions.

Stressor No 3: Water Regulation

The two river basins – Minho and Lima, are both highly affected by flow regulation in their main stems, particularly for hydroelectric production, resulting in severe hydromorphological changes and streamflow regulation. As such, more than 50% of national populations of this species are affected by this stressor.

This stressor is less present however in the tributaries of both basins where some of the most important life stages of the species happen, such as spawning and juvenile growth.

There is low potential for improvement and for the application of measures focused on mitigating the potential impacts of water regulation on the target species. Although there are some studies with objectives of optimizing implemented environmental flows for the protection and promotion of fish populations, the foreseen outcomes can be difficult to be accepted and integrated by companies managing and exploring such dams.

The possibility that this stressor will cause further negative impacts on national salmon populations is high. Demand for water regulation, particularly for hydroelectric production in Minho and Lima basins, is significantly increasing. This has a clear tendency to increase, especially in the current context of climate and global changes.

Stressor No 4: Exploitation

Authorised fishing for Atlantic salmon is already very limited, with only a few specimens allowed to be caught and only in the international stretch of the River Minho. However, since there has been a continued decline in the population of the species in this basin, a total ban on the exploitation of salmon is one of the measures that could be implemented in order to mitigate the impacts of this stressor.

Stressor No 5: Aquaculture

Since there are no aquaculture exploitation near the rivers where the Atlantic salmon occurs, no population is affected by this stressor.

Stressor No 6: Habitat Degradation

Some habitat degradation occurs, mainly related with some specific, and well-known, man-made interventions and changes to the riverine habitat (riverbank and riverbed artificial reinforcement, riparian alterations, etc.). As such, more than 50% of national populations of this species are affected by this stressor.

Stressor No 7: Diseases/Parasites

In the Portuguese basins where salmon populations occur, there is no evidence of consequences caused by diseases/parasites, so this stressor affects less than 10% of the populations of this species. And no specific studies have yet been carried out on this subject.

Stressor No 8: Climate Change

This stressor has a very large impact on salmon populations in this jurisdiction, and it can be considered, arguably, as one of the main stressors affecting the target species populations in this region. Several modelling exercises foresee the disappearance of salmon from most of this area in a matter of 50-100 years due to climate change. And knowledge of climate change problems in both Minho and Lima river Basins is extensive.

Stressor No 9: Invasives

Fish communities are mostly made up of native species, but non-indigenous/invasive species are an increasing problem in the Minho main stem, probably due to significant streamflow regulation, together with a related increase of no or low flow periods, with potential impacts on local salmon populations. Therefore, this stressor may be affecting between 20 and 50% of Portuguese salmon populations.

Stressor No 10: Stocking

Some salmon stocking actions have been developed in this jurisdiction, particularly in cooperation with Spanish entities, in a combined management effort of the transboundary Minho River salmon populations, but there is only a very small, almost negligible impact, positive or negative, impact on target populations, due to low survival of this fish when released in the wild. Despite being aware that survival of this fish in the wild is low, no specific and effective monitoring programs have been implemented to assess the true magnitude of the positive or negative impacts of these actions on wild salmon populations in this jurisdiction.

Stressor No 11: Predators

There is an impact caused by cormorant predation, particularly during smolt migration. This problem affects more than 50% of salmon populations. However, there is no sufficient knowledge about the impact of this stressor to propose and implement effective measures to

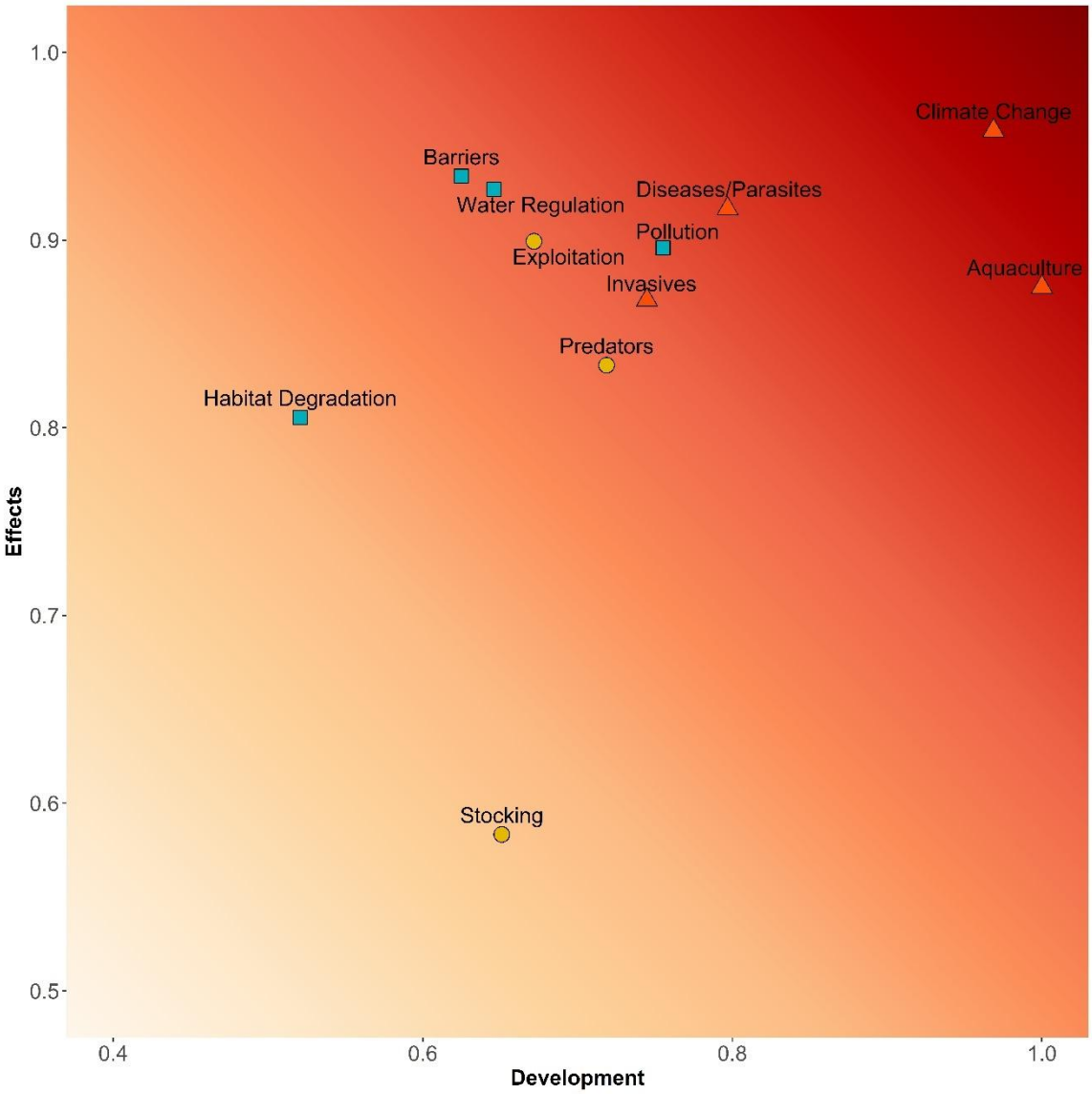
mitigate the impact of predators in salmon populations. And any control action directed to cormorants is forbidden by the entities responsible for managing these natural resources.

Stressor No 12: Others - Illegal fisheries/poaching

Commercial fishing is only permitted in the international section of the Minho River. However, Atlantic salmon is a highly endangered species in Portugal, illegal catches continue to be recorded in prohibited areas, namely in the tributaries of Minho basin, in the Lima basin and other basins where the species occurs sporadically (i.e. the Douro and Cávado rivers). Generally, these illegal catches are the result of accidental catches (bycatch) and mainly affect adult individuals during their reproductive migration, when they coincide with fishing seasons targeting other anadromous fish (i.e. sea lamprey and shad).

This stressor has a large impact on Portuguese salmon populations, because it affects not only the survival of mature individuals of Atlantic salmon during spawning migration, but also jeopardises the viability of future generations of the species.

SWEDEN



Sweden Narrative

The analysis conducted relates to the Atlantic salmon populations from the designated 24 rivers on the Swedish west coast.

As this analysis is only conducted for the Swedish west coast, 'National' refers to the west coast in its entirety.

Acidification is an important stressor on the Swedish west coast. This falls under Pollution.

A weighted average was taken based on scoring from the three counties that make up the Swedish west coast. And to determine the top stressors, the stressors were ranked as follows:

Stressors	Combined scores
Stressor 8 Climate Change	1.93
Stressor 5 Aquaculture	1.88
Stressor 7 Diseases/Parasites	1.71
Stressor 1 Pollution	1.65
Stressor 9 Invasives	1.61
Stressor 3 Water Regulation	1.57
Stressor 4 Exploitation	1.57
Stressor 2 Barriers	1.56
Stressor 11 Predators	1.55
Stressor 6 Habitat Degradation	1.33
Stressor 10 Stocking	1.23

Stressor No 1: Pollution

Acidification is deemed the main source of pollution. This was recognised in the 1970s when salmon stocks rapidly declined in the freshwater stage. Since 1976 an intense liming programme has been carried out to counteract salmon mortality due to low pH and high levels of aluminium (Appelberg et al. 1989; Degerman & Appelberg 1992; Alenäs et al. 1995; Holmgren et al. 2016). Most (18 of 24) of the rivers and their tributaries have been included in the liming program. However, funding of future liming programs is uncertain which can cause concern in maintaining a pH which is optimal for salmon growth and survival across the whole west coast. It has been estimated that ca 50-75 % of the wild salmon smolt production would be lost without liming (Appelberg et al. 1989, Degerman & Schibli 1998).

Other pollution effects could come from eutrophication in the means of run-off from agricultural practices and roads, as well as pollutants such as PFAS.

Stressor No 2: Barriers

A large number of barriers, many due to hydropower exist throughout the west coast rivers. In 2020 the Swedish government decided on a national plan to provide hydropower with modern environmental conditions according to best possible benefit for the aquatic environment while ensuring an efficient national access to hydropower electricity. The national plan is to be carried out over an operational period of 20 years with decisions taken in environmental courts of law, started in 2022 (https://www.domstol.se/amnen/mark-och-miljo/miljotillstand/moderna-miljovillkor---nationella-planen/). The process is expected to improve river restoration and biological re-establishment but is not known to its full extent and the future is uncertain regarding the exact outcomes (https://www.havochvatten.se/arbete-i-vatten-och-energiproduktion/vattenkraftverk-och-dammar/nationella-planen-nap/regeringens-beslut-och-provningsgrupper.html#h-Tidplanforprovningsgrupper). Some upstream passages and fish ways at barriers have been constructed in some rivers (e.g. Ätran) and have been deemed successful for Atlantic salmon passage to upstream areas, such as spawning sites (Nyqvist et al. 2017; 2018).

Other barriers that can have an impact on Atlantic salmon productivity are obsolete dams, irrigation dams and culverts.

Stressor No 3: Water Regulation

This stressor is mainly affected by the regulation of water due to hydropower dams and legal and illegal irrigation. Unnatural flow changes, discharge and regulations could have an impact on the salmon production (Aldvén et al. 2015). Outtake for drinking water may also affect water levels.

Stressor No 4: Exploitation

There is no commercial catch for Atlantic salmon on the Swedish west coast. Where recreational fisheries take place, there is no compulsory catch reporting, therefore there is uncertainty in actual catches. However, the use of passive gears for recreational fishing is heavily regulated on the Swedish west coast and potential catches of salmon is therefore expected to be low. There are voluntary catch reports collected by the Swedish Anglers Association regarding caught fish and catch and release information in rivers, although comprehensive, they are not exhaustive. However, data are lacking regarding the catch of salmon in the marine environment. There is some net fishing taking place, but no information on the effort and catch of these. There is lack of knowledge regarding any illegal fishing activities and bycatch in trawling fisheries at sea.

Stressor No 5: Aquaculture

There are no fish farms in the marine environment but there are some fish farms on land/freshwater for rainbow trout as well as compensation stocking facilities for Atlantic salmon for the rivers Lagan, Nissan and Göta älv. The largest threat in this context is from escapees from Norwegian salmon farms which can spread disease and affect the genetic stock by successfully spawning and producing offspring in Sweden (Palm et al. 2021). As this issue with strayers is mainly from farmed Norwegian salmon and is cross-boundary (see Hansen & Jakobsen 2003), there is little to nothing that can be implemented within the Swedish jurisdiction to halt this stressor.

Stressor No 6: Habitat Degradation

This stressor is caused by digging in smaller rivers due to agriculture and sustaining drainage from farmland, which results in extraction of organic matter, wood and sometimes gravel (Degerman & Näslund 2021). Settlement expansion, erosion protection constructions and siltation is also deemed an issue.

Stressor No 7: Diseases / Parasites

In recent years diseases have been more frequent, but vary between rivers and years, this makes it difficult to monitor and understand. The ectoparasite *Gyrodactylus salaris* is present in the southern half of the Swedish west coast (https://www.dataportal.se/datasets/59_5918) from records up to 2023, though no data are available yet from 2024. *G. salaris* has been reported not to have a detrimental effect upon Atlantic salmon parr in this region (Degerman et al. 2012) and are not considered a large threat to Atlantic salmon populations in this jurisdiction. Although, annual monitoring takes place to keep track of its distribution and spread.

Red skin disease, occurring as haemorrhagic, ulcerative and necrotic abdominal skin lesions, is also known to affect Swedish west coast Atlantic salmon populations, but no etiological

agent has yet to be linked to this disease (Lagadec et al. 2024). Proliferative kidney disease (PKD) is known to affect brown trout but the severity or spread is not understood fully in Atlantic salmon in this region. Many potential effects could also come from diseases and parasites associated with Stressor 5 Aquaculture.

Stressor No 8: Climate Change

There are large uncertainties regarding the impacts of climate change both in the freshwater and marine life stages. Climate change is likely having the most impacts in regards to marine survival, although difficult to pinpoint exact hypotheses (ICES 2023). Increase in water temperature, flooding and draughts likely having an impact on freshwater survival (Aldvén et al. 2015; Degerman & Näslund 2021). Changes in sea surface temperature may increase probability of invasive species (e.g. pink salmon) adapting to the local climate (e.g. Dunmall et al. 2025), which can lead to increased competition for resources. However, there is also much uncertainty for future prognoses. An increase in water temperature above the optimal range for Atlantic salmon makes them stressed and can affect their growth and reproduction as well as causing them to be more susceptible to diseases and parasites. For example, the effect of PKD on salmonids increases with higher water temperatures.
Much of what is occurring in regards to climate change is beyond the control of local and national actions, particularly effects on marine survival. Nonetheless, some local actions such as increasing riparian vegetation to help reduce water temperature and better management of water flows during times of drought and flooding events may help with the productivity and survival of Atlantic salmon in freshwater systems.

Stressor No 9: Invasives

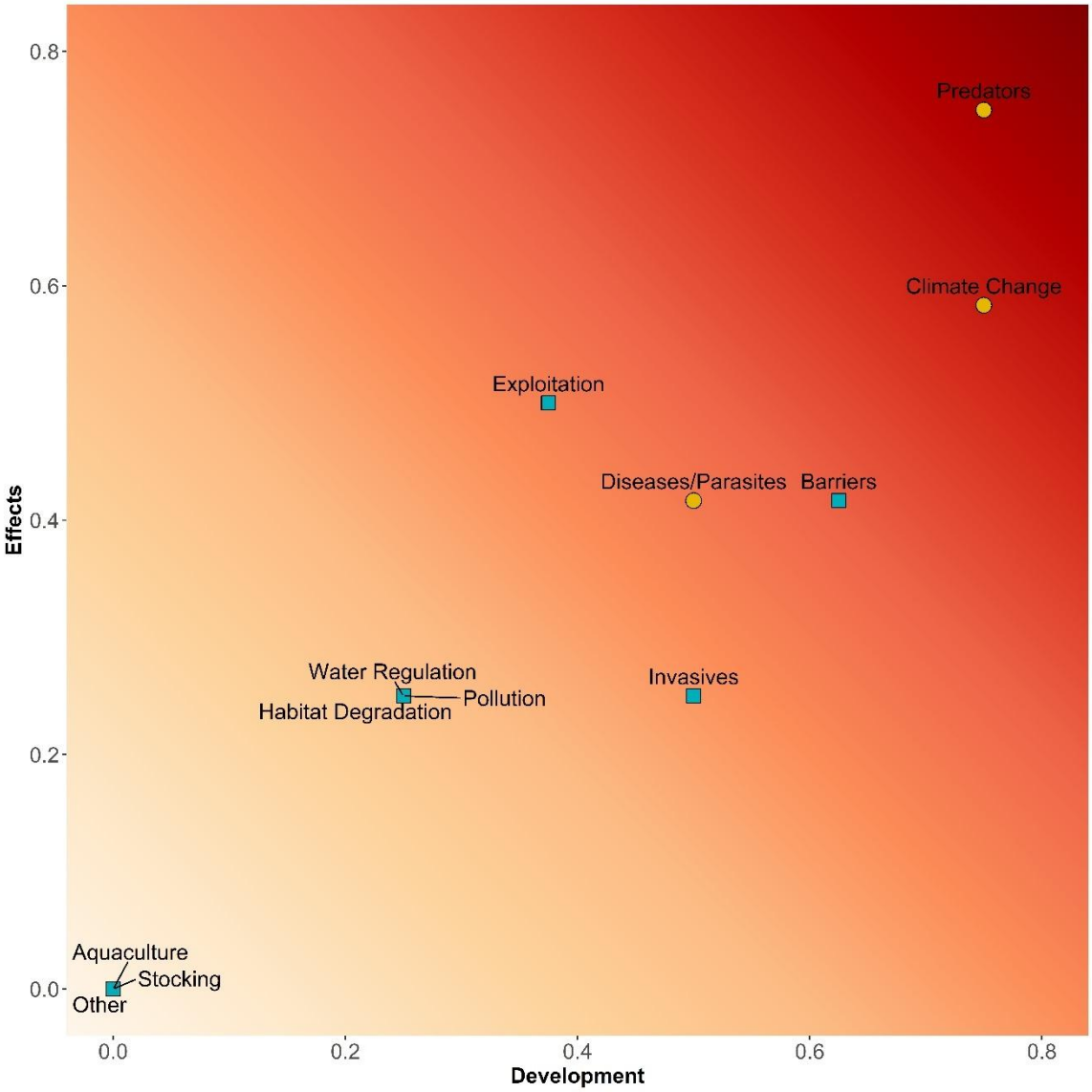
Pink salmon is probably the largest threat to Atlantic salmon when it comes to invasive species, and most likely during the freshwater phase (Thorstad et al. 2024). This species has now spread widely across rivers on the Swedish west coast (Staveley & Ahlbeck Bergendahl 2022; Staveley et al. 2025). Although knowledge regarding impacts of pink salmon on Atlantic salmon and aquatic ecosystems is still unknown. The risk of invasive species and diseases seems to have increased due to import of fish, escapes from fish farms and a warmer climate, that makes it possible for species, from example Asia, to survive the winters.

Stressor No 10: Stocking

Stocking is conducted in three rivers on the Swedish west coast due to regulations set from old hydropower regulations. It is difficult to predict if this practice will continue in the future with regards to the current re-examining of environmental regulations of hydropower stations (see Stressor 2 Barriers).
There are some more general negative impacts where stocking can impact wild Atlantic salmon populations. If the hatchery-raised salmons stray and enter the "wrong" rivers it may have negative genetic impacts on the wild stocks, such as diluting the gene pool and weakening local adaptation (i.e. negatively effecting fitness related traits important for survival and reproduction in the wild). Stocked salmon can increase competition with wild salmon in regards to, for example, prey, shelter and spawning sites. The introduction of hatchery-raised salmon into the environment has the potential to introduce new diseases that could affect wild salmon populations.
Stressor No 11: Predators

The number of predators have increased, such as otters, seals and cormorants, but we don´t know how it´s affecting the salmon populations and to what extent on the Swedish west coast. Diet studies on harbour seals and cormorants have been conducted by SLU and have given some results but it varies between the sea areas and diet preferences are unknown. Cormorants (and maybe porpoises) may prey on salmon smolts whereas seals are believed to affect the adults more, both on their way to the river and increasingly in the river and river mouth (anecdotal information from locals). In general, there is little evidence that predation alone causes severe population declines but it may keep weak populations from recovering (Falkegård et al. 2023).

SPAIN – ASTURIAS



Spain -Asturias Narrative

Stressor No 1: Pollution

There is very little pollution affecting populations, and it affects only in the Nalón river. The possibility that this stressor will cause further negative impacts is small.

Stressor No 2: Barriers

There are two rivers affected and there is no possibility of short-term changes due to the existence of large dams.

Stressor No 3: Water Regulation

Large dams affect the upper areas of the Nalón river. These dams are necessary for water supply and there is no possibility for changes in the short-term.

Stressor No 4: Exploitation

There is a well-regulated level of exploitation, which has been adjusted to the productive capacity.

Stressor No 5: Aquaculture

There is no aquaculture.

Stressor No 6: Habitat Degradation

Caused by large dams affecting the upper areas of the Nalón river. These dams are needed for water supply.

Stressor No 7: Diseases / Parasites

Tapeworm (*Diphyllobothrium*) and anisakis infection detected in some rivers. Maybe there are intermediate hosts (*Lutra*, otter?).

It is not possible to know its evolution in the medium term.

Stressor No 8: Climate Change

It affects basins located in places of lower altitude more.

Its evolution in the medium term is not known, but the possibility that this stressor will cause further negative impacts is high. Restocking are carried out as a compensatory measure.

Stressor No 9: Invasives

The impact in production is low, due to the presence of cyprinids that do not actively compete with salmon.

It is not possible to know its evolution in the medium term.

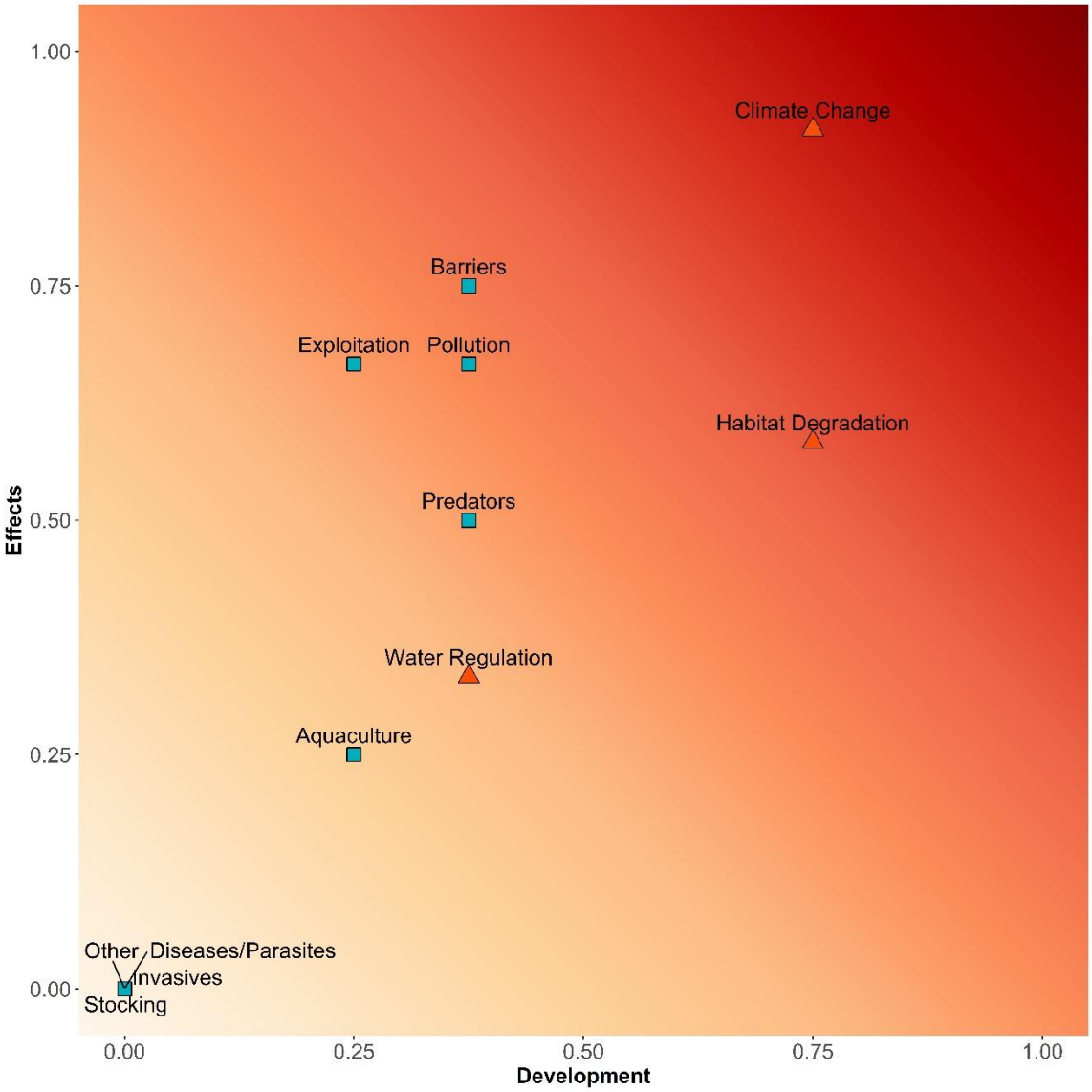
Stressor No 10: Stocking

N/A

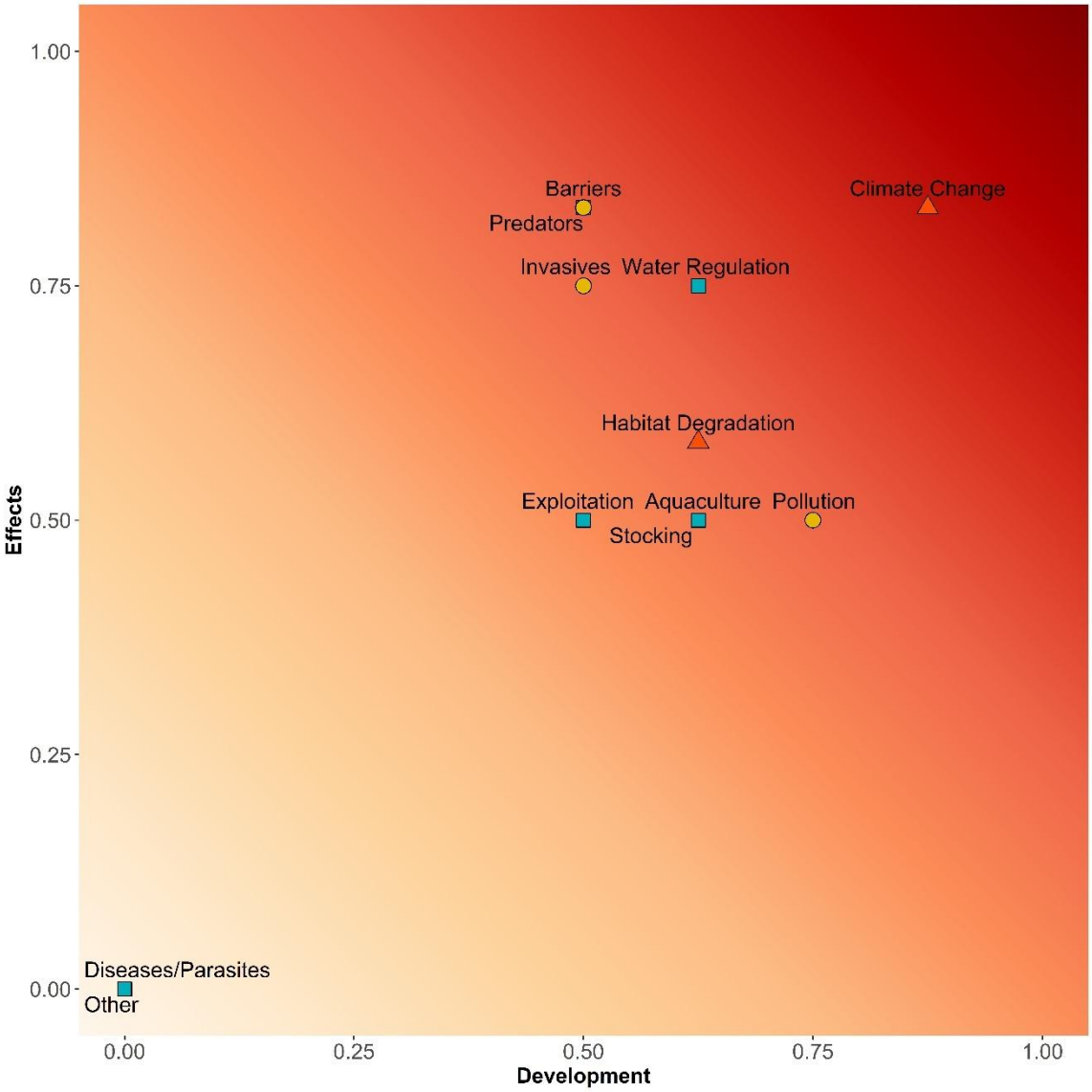
Stressor No 11: Predators

Presence of Utter (*Lutra*) and Cormorán grande (*Phalacrocórax carbo).* And predation during the descent to the sea, especially in the estuary, by fish such as sea bass (*Dicentrarchus labrax*), even by dolphins, is being very difficult to calculate.

SPAIN – CANTABRIA



SPAIN – GALICIA



Spain – Galicia Narrative

Stressor No 1: Pollution

Neither industrial nor urban pollution is a severe stressor in Galician salmon rivers, but organic pollution from agricultural practices may be in the larger catchments.

Stressor No 2: Barriers

Large hydropower dams are a major stressor in Galicia and are responsible for the poor state of most populations or even their loss.

Stressor No 3: Water Regulation

Water regulation (abstraction, altered flows, or both) resulting from hydropower operations is a common stressor in Galician rivers affected by hydropower dams.

Stressor No 4: Exploitation

Exploitation is not considered a major stressor in Galician salmon rivers, as it is highly restricted and controlled.

Stressor No 5: Aquaculture

Aquaculture is not considered a major stressor for Galician salmon populations, as there are no commercial salmon farming facilities, and existing controls seem to work quite well.

Stressor No 6: Habitat Degradation

In-stream and riparian habitat degradation is not considered a major stressor for Galician salmon populations, as most of them inhabit reaches protected by environmental regulations. However, catchment degradation may be a stressor in some basins, particularly the larger ones.

Stressor No 7: Diseases / Parasites

Diseases/parasites are not considered stressors for Galician salmon populations, as existing controls show no evidence of their presence in our rivers.

Stressor No 8: Climate Change

Climate change is a major stressor for Galician salmon populations, as many are restricted to the lower catchments with no access to thermal refuges. In larger rivers, riparian cover (shade) is insufficient to mitigate solar radiation, and there may be some synergy with other stressors, such as pollution.

Stressor No 9: Invasives

Aquatic invasive species are not currently considered a major stressor for salmon populations. There are no competitive species for salmon in our rivers, nor predatory fish, except in very localized areas. Some other species, such as mollusks, crayfish and small cyprinids, may be present locally.

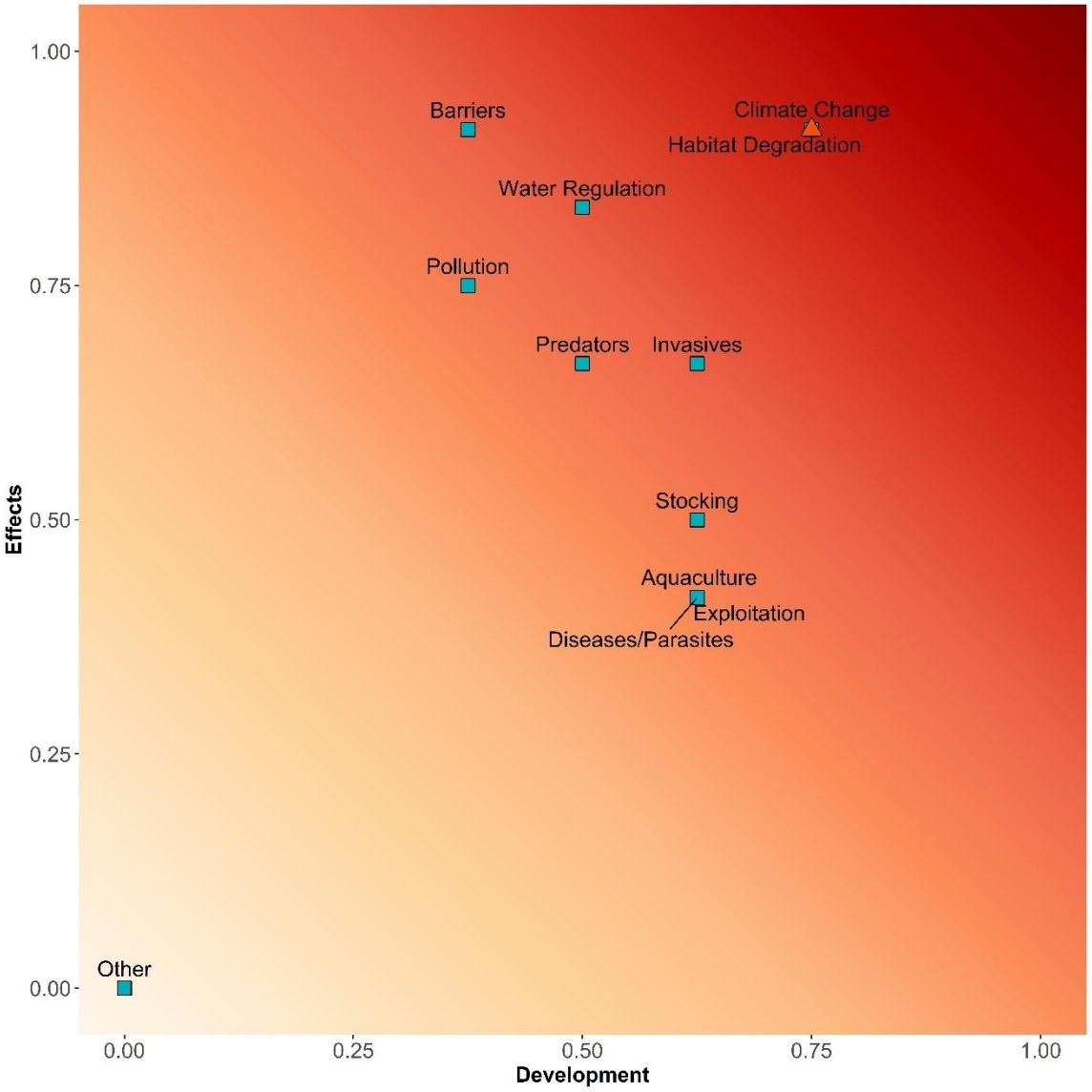
Stressor No 10: Stocking

Stocking in rivers is very limited and restricted to regional government operations, under strict controls, so it is not considered a stressor for our populations.

Stressor No 11: Predators

Cormorants (winter juvenile migrants from Northern Europe) are abundant in the lower reaches of our rivers and may be a major stressor for our populations.

SPAIN – GIPUZKOA



Spain - Guipuzkoa narrative

Stressor No 1: Pollution

All river basins lost their population during the 20th century mainly due to pollution. Before they were very affected by low habitat availability due to dams and overfishing. Nowadays, there are 2 small salmon populations in 2 river basins (Urumea and Oria), one river basin with sporadic spawners (Oiartzun) and 2 rivers with no salmon population (Urola and Deba).

Water treatment plans were implemented decades ago, pollution is not being a problem in some rivers and stretches, but there are some rivers still affected. There are funds for water quality improvement.

Stressor No 2: Barriers

Barriers have a large impact in fish migration in mainly all basin. Although some of the upstream migration problems are being solved, through the removal of obsolete obstacles (mainly dams) and construction of fish passes in the dams that are in use (mainly hydropower plants), there are many inaccessible river stretches and tributaries for salmon. In addition, the downstream migration remains as an unsolved problem. Mortalities of smolts in the turbines and of kelts in the canals of the HPPs have been proved to negatively affect the freshwater survival.

Knowledge is extensive and well documented. Studies on adult salmon upstream migration and distribution and smolt and kelt mortality on hydropower plants during the downstream migration have been carried out.

None of the HPPs in rivers with presence of salmon have effective solutions to avoid fish mortality in the turbines or canals, but implementation of measures to avoid fish entering the canals are being negotiated with the owners in some of them. There are many obstacles affecting upstream migration that should be permeabilized, trough demolition or by improving the ineffective fish passes.

Stressor No 3: Water regulation

Water regulation affects all river basins, with or without salmon, mainly by small hydroelectric station flow divertion, water provision, consumption or industrial exploitation.

There is little chance that new projects involving water abstraction that would negatively impact target species such as salmon will be permitted.

Stressor No 4: Exploitation

Recreational and professional salmon exploitation or angling is forbidden in Gipuzkoa river basins.

Stressor No 5: Aquaculture

There is only one salmon aquaculture facility in Gipuzkoa, owned and managed by the Council of Gipuzkoa, and it is used only to support the population recovery programme (stocking). No commercial aquaculture is present in Gipuzkoa river basins. And security measures are taken to prevent the emergence and possible transmission of diseases. In addition, all the broodstock used in captive breeding come from Urumea and Oria rivers in Gipuzkoa.

There is no chance that any new salmon commercial aquaculture facilities will be set up in the region.

Stressor No 6: Habitat degradation

All river basins (5 in total) are affected by habitat degradation.

Very large, hydromorphological alterations both longitudinal and transversal are high in all main streams, heavily affected by urbanizations and other infrastructures (roads, bridgers,

dams, etc.). These physical alterations enhance other pressures as water pollution, high water temperatures due to riverside vegetation elimination or physical-chemical quality deterioration.

Efforts to remove dams may improve but not much, since actions they have already been undertaken and it is unlikely that the remaining dams will be removed in the next few years as they have long-term use concessions. Riverbank restoration it will be difficult to develop in a broad scale due to high anthropic pressure in a small territory.

Stressor No 7: Diseases/Parasites

No problems caused by the diseases or parasites have been reported in salmon population in Gipuzkoa.

Stressor No 8: Climate Change

All river basins (5 in total) are affected by climate change.

The impacts of climate change are likely to be felt first in the populations located in the southernmost edge of the salmon distribution range. In fact, these effects are already being seen, with warmer, drier summers causing mortality in adult salmon due to high water temperatures. A delay in spawning has also been observed, due to the late arrival of winter, which causes a delay in the growth of fry that could also have consequences in the smoltification rate. It is also believed that torrential rains may be negatively affecting the survival of the first life stages (eggs and fry).

The likelihood of further negative impacts due to climate change is very large, since all reports suggest that as climate change evolves, it will lead to a more hostile environment for salmon, especially for populations located at the southern limit of the distribution.

Stressor No 9: Invasives

There are no known invasive species that have caused a reduction in salmon productivity in rivers of Gipuzkoa.

Although measures for an early detection of the presence of pink salmon have been implemented, it seems unlikely that the species could reach so far in the South.

Stressor No 10: Stocking

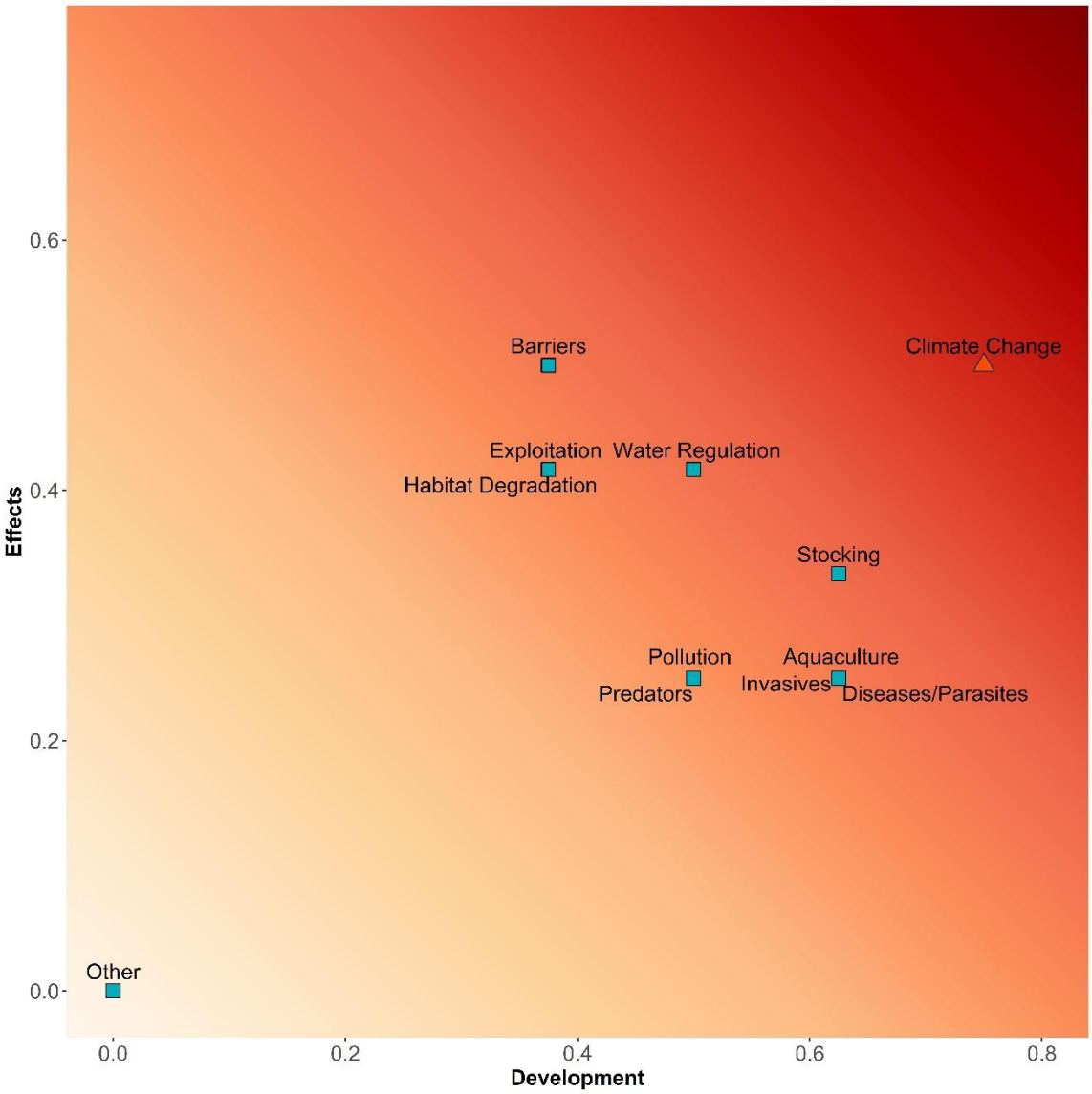
Salmon stocking is only managed by the Regional Council of Navarra, and it is done only to support the population recovery programme. The Government experts in the production and subsequent restocking of fry consider all guidelines and recommendations issued by NASCO. All the broodstock used in captive breeding come from Urumea and Oria rivers.

Stressor No 11: Predators

It has not been reported that predators have a significant impact in the production capacity and/or freshwater survival. Main predators would be great cormorant (Phalacrocorax carbo) and grey heron (Ardea cinerea), but populations remain stable and no significant effects have

been seen. It does not seem feasible that changes in the trophic behaviour or in the population size of predators will occur in the coming years.

SPAIN – NAVARRA



Spain – Navarra Narrative

Since only one salmon population (Bidasoa River) is present in Navarra, the effects of all stressors have been considered as "local".

Stressor No 1: Pollution

Pollution has had very little impact in the production capacity and/or freshwater survival. Water treatment plans were implemented decades ago, resulting in pollution not being a problem anymore in this river.

Knowledge is extensive and well documented. A yearly report on the water quality is published and can be downloaded from: https://www.navarra.es/home_es/Temas/Medio+Ambiente/Agua/Documentacion/Memorias/

Stressor No 2: Barriers

Barriers have a large impact in the fish migration in the basin. Although most of the upstream migration problems have been solved in the last decades, through the removal of obsolete obstacles (mainly dams) and construction of fish passes in the dams that are in use (mainly hydropower plants), the downstream migration remains as an unsolved problem. Mortalities of smolts in the turbines and of kelts in the canals of the HPPs have been proved to negatively affect the freshwater survival.

The possibility that this problem will cause further negative impacts on the salmon population is moderate, because although the solutions are being negotiated with the HPP producers, the economic cost may be high.

Stressor No 3: Water regulation

The impact of this stressor is high because the diversion of water for hydroelectric production has a negative impact on the availability of habitat for salmon.

The potential for improvement is low, as water concessions are long-term and are unlikely to be modified in the next 5 years.

Stressor No 4: Exploitation

The impact of this stressor is high because angling in the Bidasoa directly affects the most important fraction of the population: the multi-winter females.

A yearly report on the population monitoring, which includes the impact of the angling activity on the population, is published and can be downloaded from https://www.navarra.es/es/medio-ambiente/pesca/informacion-tecnica

The potential for improvement is high. Angling has been banned in the Bidasoa in 2023 and 2024 and is foreseen to be also banned in 2025.

Stressor No 5: Aquaculture

The impact of this stressor is low because the only salmon aquaculture facility in the basin is owned and managed by the Regional Government of Navarra, and it is used only to support the population recovery programme (stocking). No commercial aquaculture is present in the Bidasoa.

A yearly report on the population monitoring, which includes the information about captive breeding and stocking programme, is published and can be downloaded from https://www.navarra.es/es/medio-ambiente/pesca/informacion-tecnica

The potential for improvement is negligible, since all security measures are taken in the only salmon aquaculture facility present in the basin, owned by the Government of Navarra. In managing the fish farm, government experts consider all the possible impacts that the facility and its activity may have on the wild salmon population and take the necessary measures to

prevent the emergence and possible transmission of diseases. In addition, all the broodstock used in captive breeding come from the Bidasoa River itself and genetic studies are periodically carried out to ensure that crossbreeding and subsequent restocking of the fry do not affect the genetic diversity of the population. Stocking is carried out only in upstream areas where wild salmon does not access, thus preventing restocked fry from competing with wild ones.

Stressor No 6: Habitat degradation

The impact of this stressor is large because the diversion of water for hydroelectric production reduces the availability of habitat for salmon. Besides, the areas upstream of each dam represent a modification of the natural habitat of the river, creating areas that are not suitable for the species where, in addition, the physical-chemical quality of the water deteriorates (due to heating and reduction of oxygen). Furthermore, there are large areas of the basin where riverside vegetation has been eliminated, reducing the shading of the riverbed, which increases the water temperature, especially in summer. As a result, water reaches temperatures unsuitable for salmon life as has been proved by the radiotracking studies carried out (salmon mortality in dry season is estimated in the Bidasoa at around 50% of migrating adults).

The potential for improvement is moderate. Efforts to remove the disused dams have already been undertaken and it is unlikely that the remaining dams will be removed in the next few years as they have long-term use concessions. Regarding shading, efforts are being made to restore riparian vegetation, but the results will only be seen in the long term.

The likelihood of further negative impacts due to habitat degradation is low, since current legislation prevents further deterioration of this space included in the Natura 2000 Network, which prevents for further installation of new HPPs or elimination of riparian vegetation.

Stressor No 7: Diseases/Parasites

The impact of this stressor is small because there are no known parasites or diseases that have caused a reduction in salmon productivity in the Bidasoa.

The likelihood of further negative impacts due to diseases or parasites is low, because there has never been an event of negative impact due to diseases or parasites in the Bidasoa.

Stressor No 8: Climate Change

The impact of climate change is large, since the impacts are likely to be felt first in the populations located in the southernmost edge of the salmon distribution range. In fact, these effects are already being seen, with warmer, drier summers causing mortality in adult salmon due to high water temperatures. A delay in spawning has also been observed, due to the late arrival of winter, which causes a delay in the growth of fry that could also have consequences in the smoltification rate. It is also believed that torrential rains may be negatively affecting the survival of the first life stages (eggs and fry).

Although some effects of the climate change are already being seen, there is still a reasonable uncertainty about how the population could adapt to the changes derived to the foreseen climate change.

The potential for improvement is moderate, since measures could be implemented to prevent water retention upstream of dams (thus reducing water warming) or to restore riparian

vegetation (thus increasing shading). However, the implementation of these measures currently seems unlikely. Furthermore, global forecasts on climate change are not encouraging.

The likelihood of further negative impacts due to climate change is very large, since all reports suggest that as climate change evolves, it will lead to a more hostile environment for salmon, especially for populations located at the southern limit of the distribution.

Stressor No 9: Invasives

The impact of this stressor is small, since there are no known invasive species that have caused a reduction in salmon productivity in the Bidasoa. And the presence of invasive species is monitored at the regional government's monitoring station on a regular basis.

Although measures for an early detection of the presence of pink salmon have been implemented, it seems unlikely that the species could reach so far in the South.

Stressor No 10: Stocking

Salmon stocking is only managed by the Regional Government of Navarra, and it is done only to support the population recovery programme. All guidelines and recommendations issued by NASCO are considered by the Government experts in the production and subsequent restocking of fry. All the broodstock used in captive breeding come from the Bidasoa River itself and genetic studies are periodically carried out to ensure that breeding and subsequent restocking of the fry do not affect the genetic diversity of the wild born population. Stocking is carried out only in areas where wild salmon do not access, thus preventing stocked fry from competing with wild ones. Contact with the fish is kept to a minimum in the fish farm to prevent domestication, and they are stocked as soon as possible to allow rapid adaptation to the natural environment.

A yearly report on the population monitoring, which includes the information about captive breeding and stocking programme, is published and can be downloaded from https://www.navarra.es/es/medio-ambiente/pesca/informacion-tecnica

And the potential for improvement is negligible, since all security measures are already taken in the only salmon aquaculture facility present in the basin, owned by the Government of Navarra.

Stressor No 11: Predators

It has not been reported that predators have a significant impact in the production capacity and/or freshwater survival. Main predators would be great cormorant (Phalacrocorax carbo) and grey heron (Ardea cinerea), but populations remain stable and no significant effects have been seen.

The possibility that predators will cause further negative impacts on the salmon population is small, because it does not seem feasible that changes in the trophic behaviour or in the population size of predators will occur in the coming years.