	Council	CNL(25)31
NASCO	*Atlantic Salmon Stressor Analysis UK - Northern Ireland*	Agenda item: 6.g)(i)

Atlantic Salmon Stressor Analysis – UK - Northern Ireland

1. Background

Within Northern Ireland there are two discrete management areas with respect to Atlantic salmon. The Loughs Agency manages the cross-border catchments of Loughs Foyle & Carlingford, whilst the Department of Agriculture, Environment and Rural Affairs (DAERA) has responsibility for all other catchments and coastal salmon fisheries in Northern Ireland. Across Northern Ireland salmon management is based on annual assessments of the status of salmon stocks conducted on all the main or 'primary' salmon rivers. To allow assessment of stocks, Biological Reference Points, expressed as Conservation Limits (CLs), have been developed for all primary salmon rivers.

Salmon population declines have been observed across the North Atlantic region and recent research efforts have attempted to identify and quantify the range of potential stressors impacting stocks (Friedland *et al*., 1993; Jonsson & Jonsson, 2004; Forseth *et al*., 2017). In response to calls from NASCO for signatory countries and jurisdictions to classify and evaluate the major stressors impacting local salmon stocks, an analysis of stressors on NI salmon populations has been undertaken and is reported in this document.

2. Methods

a. Classification

A total of 13 potential stressors, capable of impacting salmon stocks in Northern Ireland, were identified after consultation with fisheries staff from DAERA, Loughs Agency and AFBI and with stakeholders such as the Irish branch of the Institute of Fisheries Management (IFM) and the Ulster Angling Federation (UAF). A range of literature and research on the potential stressors impacting salmon in Northern Ireland was subsequently assembled. Varied local level information was collated across a variety of issues such as climate change (Kennedy & Crozier, 2010; Otero et al., 2014); marine migration (Rodger *et al*., 2024; Lilly *et al*., 2023; Barry *et al*., 2020); marine survival (Tyldesley *et al*., 2024; Almodovar *et al*., 2020); predation (Barry *et al*., 2024; Kennedy *et al*., 2023; Kennedy *et al*., 2020; Favio *et al*., 2019; Kennedy *et al*., 2018; Kennedy & Greer, 1987); fish passage (Kennedy *et al*., 2013); stocking (Kennedy *et al*., 2012a); habitat & water quality (Kennedy *et al.,* 2014; 2012b; DAERA, 2024; DAERA Map Viewer).

The semi-quantitative 2D classification system developed by Forseth *et al*. (2017) was employed to assess and rank the various stressors at a national level. This system relies on determination of the relative impact of stressors across two dimensions. The effects axis (y-axis) describes the assessed current effect of each stressor on salmon whilst the second development axis (x axis) describes the likelihood of development of each stressor over the next decade. Combined together, these axes form a convenient 2-D classification system, that can be used to assess, plot and categorize the impact of each individual stressor (Forseth *et al*., 2017; Gilson *et al*., 2022).

b. Evaluation

The 13 stressors were discussed, considered in relation to local data and evaluated by a panel composed of members from DAERA, AFBI & Loughs Agency during an extended meeting at Bushmills Salmon Station on 8th November 2024. Following the procedure from *Forseth et al*.,

(2017) several characteristics were used to describe each impact factor. For the effects axis these included the number of rivers affected, geographical distribution, impact on returning adults, number of lost populations and implemented mitigation measures. For the development axis the characteristics considered included potential for effective measures, likelihood of losing populations and likelihood of further losses. Each characteristic was scored from one to four and the cumulative scores expressed as a proportion of the potential maximum score to produce a final axis score between 0-1. In addition, the confidence of each score was determined, reflective of the inherent uncertainty, and graded as low, moderate or extensive.

3. Results

The outputs of the stressor analysis are plotted in Figure 1, with the scores for individual stressors available in *Appendix I.* A range of stressors including predation, climate change, invasive species, barriers, habitat loss, disease and water quality were deemed to exhibit current population effects >0.5. A number of other stressors scored <0.5 and included factors such as marine aquaculture, exploitation and offshore energy (Figure 1). Exploitation, for example, was judged to exhibit a lower level of threat given current regulations and controls on fishing mortality.

Figure 1. The relative effect and development coefficients for 13 stressors plotted on 2D axis (combined current effects axis and future development axis) and mapped against an impact quadrant. The confidence grades for each stressor are shown as low ▲, moderate ■ or extensive ●.

4. Future Development

Confidence was considered low for several of the stressors assessed for Northern Ireland. For example, the future impact of cyanobacteria on salmon populations in large lake catchments or the likelihood and potential impact of offshore energy systems are relatively uncertain. Two of the most critical stressors for N. Ireland, classed as expanding population level threats, are climate change and invasive species (e.g. pink salmon). The confidence grades for both these threats were considered low and it is therefore important that future research efforts are invested towards expanding the regional understanding of these important factors. *The stressors currently exerting the highest effect, and assessed with the highest confidence, included Smolt Predation, Barriers/Abstraction and Habitat loss. These stressors have therefore been selected as the issues of concern for the next NASCO reporting cycle.*

5. References

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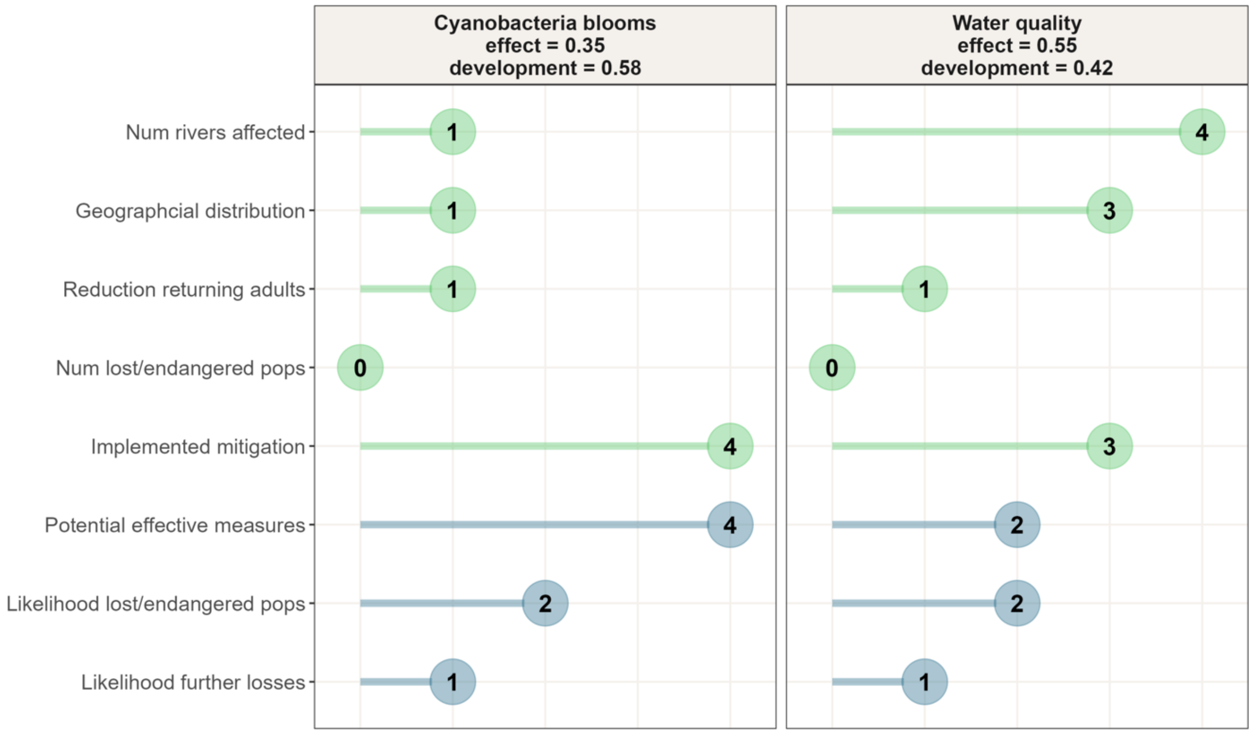
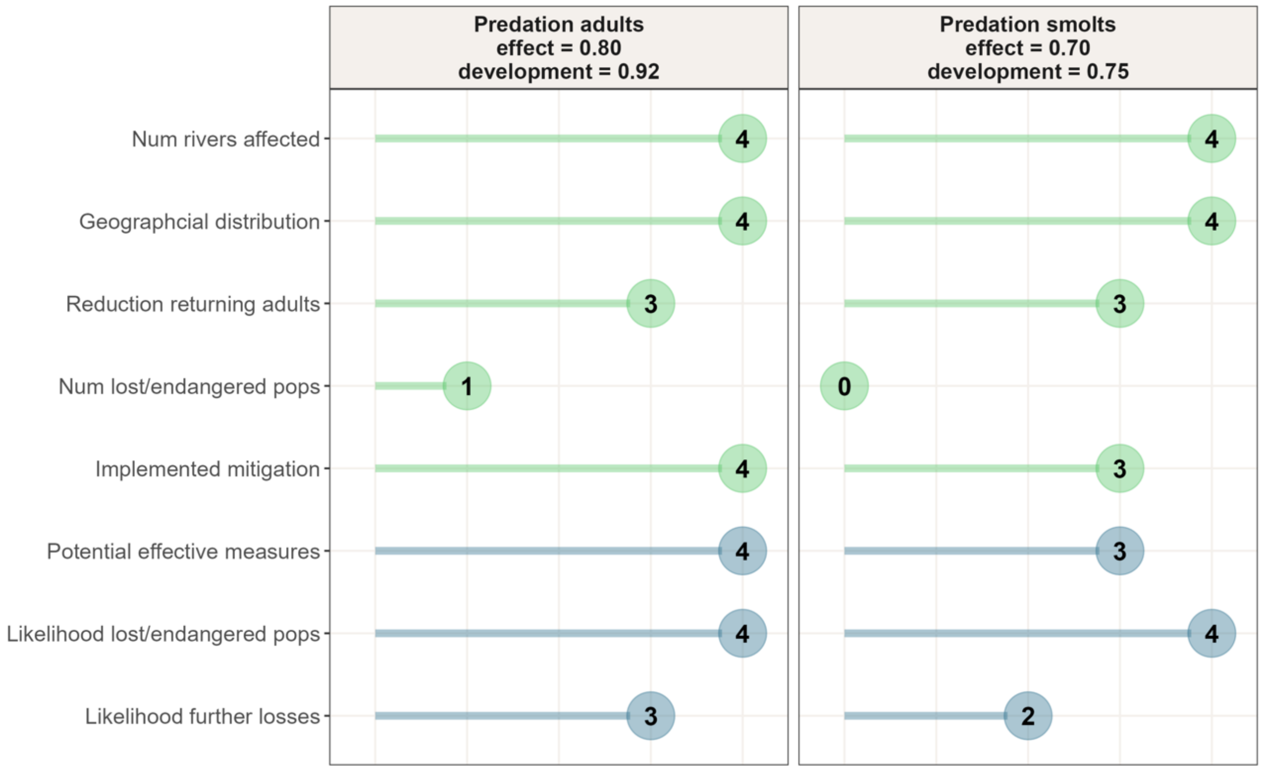
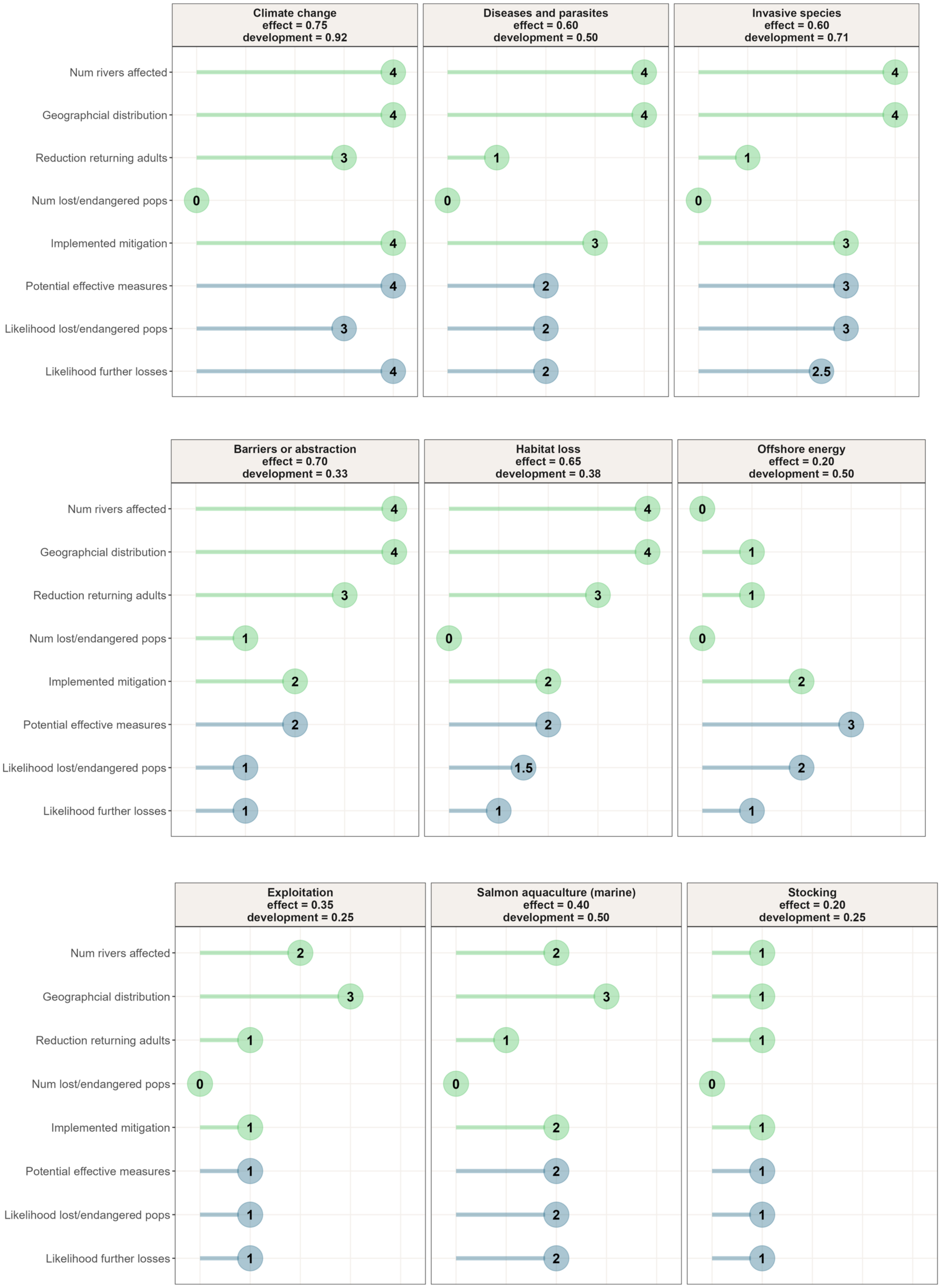
APPENDIX I

Salmon stressor effect and development scores: Northern Ireland 2024


Cyanobacteria blooms
effect = 0.35
development = 0.58
Water quality
effect = 0.55
development = 0.42
Num rivers affected
Geographcial distribution
Reduction returning adults
Num lost/endangered pops
Implemented mitigation
Potential effective measures
Likelihood lost/endangered pops
Likelihood further losses


Predation adults
effect = 0.80
development = 0.92
Predation smolts
effect = 0.70
development = 0.75
Num rivers affected
Geographcial distribution
Reduction returning adults
Num lost/endangered pops
Implemented mitigation
Potential effective measures
Likelihood lost/endangered pops
Likelihood further losses



Climate change
effect = 0.75
development = 0.92
Diseases and parasites
effect = 0.60
development = 0.50
Invasive species
effect = 0.60
development = 0.71
Barriers or abstraction
effect = 0.70
development = 0.33
Habitat loss
effect = 0.65
development = 0.38
Offshore energy
effect = 0.20
development = 0.50
Exploitation
effect = 0.35
development = 0.25
Salmon aquaculture (marine)
effect = 0.40
development = 0.50
Stocking
effect = 0.20
development = 0.25
Num rivers affected
Geographcial distribution
Reduction returning adults
Num lost/endangered pops
Implemented mitigation
Potential effective measures
Likelihood lost/endangered pops
Likelihood further losses
4
4
3
0
4
4
3
4
4
4
1
0
3
2
2
2
4
4
1
0
3
3
3
2.5
4
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3
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2
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1
1
4
4
3
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1.5
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