Agenda item 5.7
For decision

Council

CNL(16)11

Report of the Working Group on Stock Classification

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1. Background

1.1 The 2012 External Performance Review of NASCO's work, CNL(12)11, stated that '*A major advance in the protection and restoration of habitat has been the establishment by NASCO of the NASCO Atlantic Salmon Rivers Database, which provides information on river location and characteristics, stock status, and impact factors and allows information to be viewed interactively on maps and reports to be generated*'. However, the Review Panel had concluded that it is not easy to reconcile the information in the Rivers Database with the ICES advice. In 2013, the Council adopted an 'Action Plan for taking forward the recommendations of the External Performance Review and the review of the 'Next Steps' for NASCO', CNL(13)38. It is noted in this Action Plan that the stock categories used in the NASCO Rivers Database are out-dated and that consideration should be given to reviewing these in the future.

1.2 The Council has recognised the value in developing a consistent and uniform approach to presenting information on stock status and, as a first step, had requested that ICES provide a review of the stock status categories currently used by the jurisdictions of NASCO, including within their Implementation Plans, and advise on common approaches that may be applicable throughout the NASCO area. The response from ICES was presented at NASCO's 2014 Annual Meeting, CNL(14)8. ICES had concluded that it might be possible to develop a classification more closely reflecting the generally applied categories used for describing stock status and providing management advice, i.e. conservation limits (CLs), and had provided a tentative example. To take forward this work, the Council established a Working Group on Stock Classification in 2014, comprising experts in science and management (Raoul Bierach (Norway), Gérald Chaput (Canada), John McCartney (European Union), Sergey Prusov (Russian Federation) and Steve Gephard, Chairman (USA)). The Group worked mainly by correspondence but held a brief meeting during NASCO's Thirty-Second (2015) Annual Meeting in Happy Valley-Goose Bay and made a verbal report on progress at that meeting.

2. Terms of Reference

2.1 The Terms of Reference (TORs) for the Working Group are contained in document CNL(14)61 and are as follows:

1. Recommend a classification system to be used by jurisdictions to indicate stock status relative to conservation limits, or where these have not been established other reference points or indicators of abundance;
2. Develop recommendations to address the following:
    a. What time period the stock indicators cover (e.g. annual, averaged over five years);
    b. Frequency of updates;
    c. How the absence of any data will be reported; and

d. How other relevant information to describe stock status can be taken into account in relation to NASCO's goals for salmon management, e.g. biodiversity and harvestable surplus.

3. Recommend changes to the NASCO Rivers Database to implement the recommended classification system.

2.2 The Working Group discussed the interpretation of these TORs. With regard to the Rivers Database, the Council's Action Plan, CNL(13)38, states that '*The Council will convene a Working Group, to work by correspondence or at the Annual Meeting, to develop recommendations for revisions to the stock categories that are used in the database that better reflect status of stocks relative to attainment of conservation limits. The Parties would then be requested to update the stock category information held in the database and provide information on threats to those stocks. With the available information, the NASCO Secretariat should be requested to prepare an overview of the status of stocks around the North Atlantic and the threats to them using the information contained in the rivers database.*' This statement, together with the TORs above, suggested to the Group that its remit was to develop a more consistent and uniform stock classification system for use with the Rivers Database, not necessarily for use domestically by Parties/jurisdictions. The Group noted that it is clear that in some cases there are differences in the information on stock status currently included in the Rivers Database and that presented in the Implementation Plans. Since the Council seeks a more consistent and uniform approach to presenting information on stock status, the new classification might also be considered for use in reporting to NASCO under Implementation Plans/Annual Progress Reports. While that might result in more consistent reporting, this broader application would be a matter for the Council to decide.

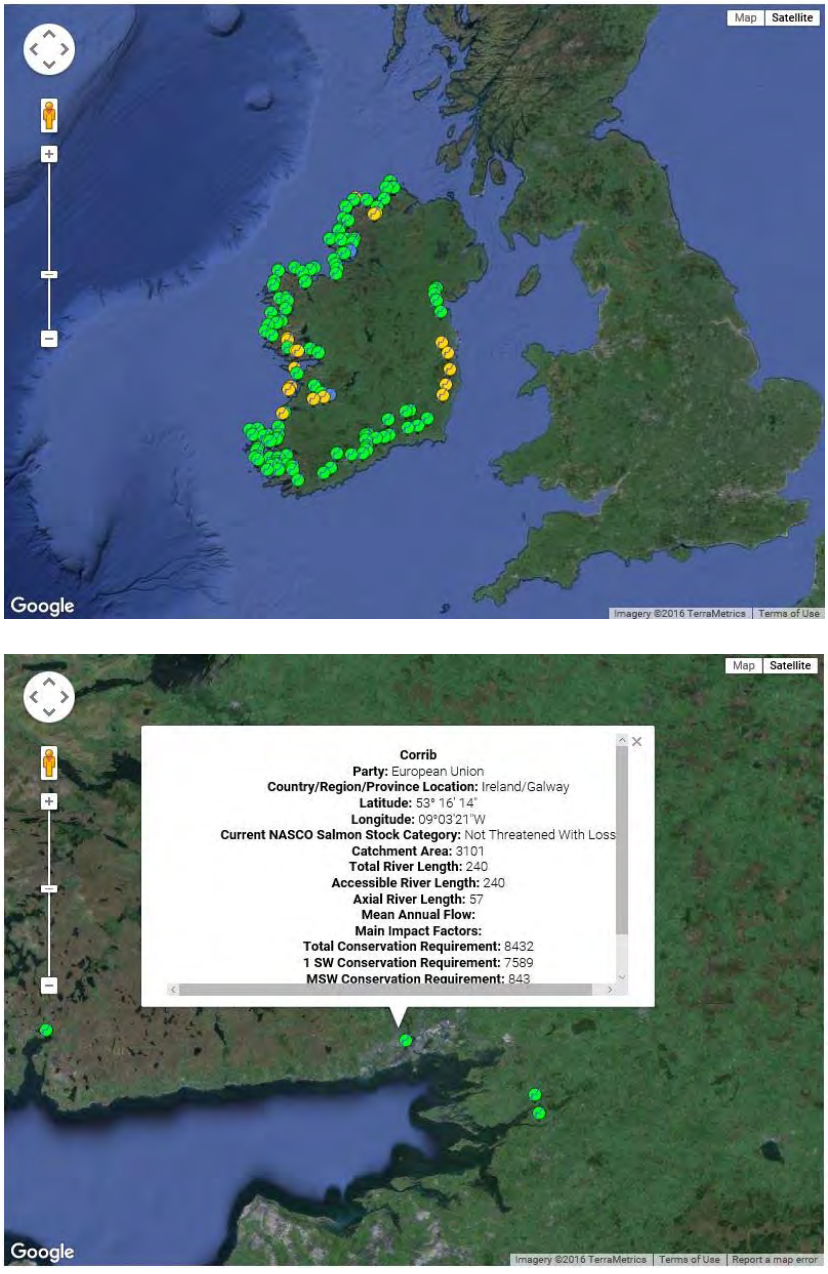
2.3 In the following sections, a brief overview of the Rivers Database (section 3) is provided by way of background and then sections 4 - 9 address each of the Working Group's TORs.

3. The NASCO Rivers Database

3.1 The Council first established a database of salmon rivers in 1989 and over the last 26 years it has undergone several changes. Initially, the Rivers Database comprised a listing of all salmon rivers flowing into the Convention area where stocks had been lost or were threatened with loss. In 1990, the Council agreed a system of categorising rivers (Lost, Maintained, Restored, Threatened with Loss, Not Threatened with Loss) together with definitions for each category. Parties were asked to contribute information but it was recognised that it would take some time to assemble the information and once that was done it should be updated every 5 to 10 years. By 1995, information had been provided by all Parties (approximately 1,800 rivers).

3.2 In 2001, following the adoption of NASCO's Plan of Action for Habitat Protection and Restoration, CNL(01)51, a major change was proposed to the Rivers Database. This plan required, *inter alia*, the establishment of inventories of salmon rivers and reporting on progress. In 2004, an expanded Rivers Database, developed by the US in consultation with the other Parties, and which reflected the information requirements detailed in the Plan of Action, was adopted and made available on the NASCO website. The new Rivers Database format allowed for inclusion of river data, salmon production

data, and habitat impact data. Additionally, two new stock categories were added – 'Unknown' and 'Not Present but Potential'. Some progress was made over a number of years in populating the Rivers Database, but this was a substantial undertaking given the extensive information sought. However, given that reporting was still incomplete after several years, Parties/jurisdictions were reporting on habitat issues through their new Implementation Plans and Focus Area Reports (now Annual Progress Reports) and the Rivers Database was incomplete but publically available via the NASCO website, the Council decided to revert to the simpler listing which has been used since. The current Rivers Database fields, including the seven stock categories and their definitions, are shown in Annex 1.



Screen captures showing information for EU - Ireland and the detailed information held for the River Corrib

3.3 All Parties/jurisdictions (with the exception of Portugal) have contributed information and the Rivers Database now contains information for ~2,550 rivers. Complete information has been included for all rivers for river name, location and stock category. However, only partial information has been provided for catchment area, river length, mean annual flow, main impact factors, special stock characteristics and conservation requirements (data has been provided for 13 - 59% of rivers, depending on the information concerned). The Working Group recognised that any new categories proposed would need to lend themselves to use for public relations purposes on the NASCO website and to the development of a status report, i.e. they should be clear and not too numerous.

4. A new classification system based on stock status relative to conservation limits or other indicators of abundance

4.1 The Working Group considered that there are a number of limitations in basing a stock classification system only on attainment of conservation limits (CL) and noted that its TORs specifically ask that the Group considers how other relevant information to describe stock status can be taken into account in relation to NASCO's goals for salmon management, e.g. biodiversity and harvestable surplus. The Working Group noted that NASCO's objective, as stated in the Convention, is to conserve, restore, enhance and rationally manage Atlantic salmon through international cooperation taking account of the best available scientific information. Furthermore, under the Strategic Approach for NASCO's 'Next Steps', CNL(05)49, NASCO Parties have agreed the following vision: '*NASCO will pursue the restoration of abundant Atlantic salmon stocks throughout the species' range with the aim of providing the greatest possible benefits to society and individuals*'. The Agreement on Adoption of a Precautionary Approach and the Strategic Approach also recognise that a goal for NASCO's is to *promote the diversity and abundance of salmon stocks and to maintain all stocks above their conservation limits*. The Working Group considered that any system that is based only on attainment of CLs and that fails to take into account other considerations would not be consistent with these goals and visions (although such a system may potentially be an improvement on the current categories used in the Rivers Database). By way of examples, the Working Group noted that:

- a stock may only be achieving its CL because there have been reductions in fishing effort such that there is little or no harvestable surplus remaining. A stock that is clearly declining in abundance over time cannot be considered to be 'healthy' even if it is still achieving its CL;
- the current CL may not take account of historically available habitat that has been lost to salmon production, e.g. through construction of impassable dams;
- there may be qualitative concerns about a stock that are not obvious from a classification based on attainment of CL, e.g. genetic changes as a result of impacts of fish farm escapees, selective fishing etc.

4.2 While taking broader considerations into account increases the complexity of the classification system, the Working Group believes that doing so should provide a more accurate classification of stock status consistent with NASCO's objectives and vision. The Working Group recognises that the classification system for use in the Rivers Database should be relatively simple and amenable to display through the existing web-

based maps, which are an important outreach tool for use by a broad target audience, and of value to NASCO delegates, researchers and others.

4.3 The Working Group discussed the existing categories used in the NASCO Rivers Database and recommends that while the '**Lost**' and '**Unknown**' categories should be retained, the '**Not present but potential**' category should be removed because the Rivers Database should not relate to the potential introduction of salmon in rivers that have not previously supported wild Atlantic salmon populations. There are only two rivers listed under this category in the current Rivers Database. The Working Group also recommends that the '**Maintained**' category be renamed '**Artificially sustained**' to cover rivers that once supported a salmon stock but in which the current stock survives only due to regular stocking and it is likely that it would be lost if this stocking was discontinued. This category would include cases where the salmon stock was lost a long time ago and salmon from another river were introduced to recreate a run that is maintained by stocking and situations where fish from the salmon stock were taken for live gene banking, the remaining salmon stock in the river was then removed and the salmon were re-introduced and sustained through stocking. The Working Group notes that if the salmon stock is re-established such that stocking is no longer required, then the river would be re-assigned to another category based on risks to the stock.

4.4 For all other salmon rivers with an existing self-sustaining stock of salmon and where there is information on stock status, the Working Group proposes the use of four categories based upon the risks to the abundance and diversity of those stocks (High, Moderate, Low, Not at Risk). These four categories of risk to the existing stocks would be assigned by the use of two scores: a '**CL Attainment Score**' (CAS) and an '**Impacts Assessment Score**' (IAS). The use of an IAS is intended to address the issues associated with a classification based only on attainment of the CLs identified in paragraph 4.1 above.

CL Attainment Score (CAS)

4.5 The CAS would be assigned based on available information concerning the extent to which the conservation limit is being attained (see table below). The Working Group recognises that CLs are not available for many rivers and for such rivers the Party/jurisdiction would be asked to use the best available information to assign such rivers to an appropriate CAS category based on an assessment of the abundance of the stock (but see section 7 below), recognising that smaller stocks might be more vulnerable than larger stocks. If CLs are subsequently established for the rivers then these assignments, based on best professional judgement, would be changed as necessary when updating the Rivers Database. There is already a field in the existing Rivers Database that provides details of conservation requirements that could serve to identify the basis of the assignment of the CAS. The proposed categories for the CAS are as follows:

Range of CL attainment	Risk Description	Category Score
<50%	High	3
50 – 75%	Moderate	2
>75 – 100%	Low	1
>100%	None	0

Impacts Assessment Score (IAS)

4.6 The second step in assigning the stock classification requires that an assessment be made of the known impacts affecting the stock by referring to the table below.

Level of Impacts	Category Score
Heavily impacted	3
Moderately impacted	2
Lightly impacted	1
Not impacted	0

4.7 The IAS for a river could be assigned based on a range of factors including: habitat degradation e.g. deterioration in water quality or obstacles to migration; over-harvest or selective harvest; diseases and parasites, e.g. sea lice; *G. salaris*; impacts on genetic integrity e.g. due to aquaculture escapees; or a steadily declining stock trend where the causes are unknown. The IAS would be assigned by the Party/jurisdiction concerned based on the best available information. A river may be assigned a high IAS by having low to moderate impacts from more than one factor or having severe impacts from one factor. The procedure for assigning the IAS would be a matter for the Party/jurisdiction concerned. The Working Group does not suggest that there be any effort to standardise the scoring among Parties/jurisdictions and the rationale for each score would not be specified in the Rivers Database, although it is possible that a Party/jurisdiction may receive enquiries about this. The Working Group notes that naturally small stocks, by their nature, are more prone to impacts than larger stocks and this would need to be considered in assigning the IAS.

Stock Classification Score (SCS)

4.8 Once both a CAS and an IAS have been assigned to a river, they would be added together to assign a Stock Classification Score (SCS). In most cases it is assumed that each river would be assigned only one CAS and one IAS (but see paragraph 4.9 below). The SCS would assign the river to one of four categories as indicated by the different colours in the table below. The lowest three categories of SCS are defined by a single numerical score (0 (Green) = Not at Risk; 1 (Yellow) = Low Risk; 2 (Orange) = Moderate Risk) but the highest risk category (3 or higher (Red) = High Risk) would apply to all rivers with an SCS of 3 or greater.

CAS Score	**IAS Score**			
	0	**1**	**2**	**3**
3	**3**	**4**	**5**	**6**
2	**2**	**3**	**4**	**5**
1	**1**	**2**	**3**	**4**
0	**0**	**1**	**2**	**3**

4.9 These four categories would be used in the Rivers Database, together with categories for 'Lost', 'Artificially Maintained' and 'Unknown', resulting in a total of 7 categories as shown in the table below. This is the same number of stock categories as currently used in the Rivers Database and should not create any issues with the mapping facility. The Working Group recommends that if the stock status differs markedly in different parts of a single river, these rivers could be divided into segments and each segment would be classified according to status. For example, if a river has a healthy salmon stock below a dam but the dam has resulted in the loss of salmon upstream, the lower river could be classified in the 'No risk' category and the river above the dam could be classified as 'Lost'. However, the more categories that are assigned to each river the more complex the mapping becomes.

Stock Classification Score	***Salmon Classification Category***	***Description***	***Map Colour***
0	Not at Risk	Rivers in which there are stocks of Atlantic salmon for which Stock Classification Scores of 0 have been assigned because there are no risks to the abundance and/or diversity of the stocks	Green
1	Low Risk	Rivers in which there are stocks of Atlantic salmon for which Stock Classification Scores of 1 have been assigned because risks to the abundance and/or diversity of the stocks are considered to be low	Yellow
2	Moderate Risk	Rivers in which there are stocks of Atlantic salmon for which Stock Classification Scores of 2 have been assigned because risks to the abundance and/or diversity of the stocks are considered to be moderate	Orange
3	High Risk	Rivers in which there are stocks of Atlantic salmon for which Stock Classification Scores of 3 have been assigned because risks to the abundance and/or diversity of the stocks are considered to be high	Red
N/A	Artificially Sustained	Rivers which are known to have had stocks of Atlantic salmon which have been lost and in which the current stocks are only sustained through hatchery stocking	Gray
N/A	Lost	Rivers which are known to have previously had stocks of Atlantic salmon that currently have none	Black
N/A	Unknown	Rivers in which there are known to be stocks of Atlantic salmon but for which there is no information on which to assess their abundance.	Blue

5. Time period for stock indicators

5.1 NASCO's *Guidelines on the Use of Stock Rebuilding Programmes in the Context of the Precautionary Management of Salmon Stocks*, CNL(04)55, recognise that assessing the status of the stock requires more than simply determining whether the escapement has fallen below the CL, and a range of other factors will influence management decisions on the nature and extent of the Stock Rebuilding Programme required. Both the duration and degree of the CL failure (e.g. failure by more than X% for more than Y

years) are relevant to the assessment and the further that a stock falls below its CL and the more years for which it does this, the greater the probable risk.

5.2 A short-term failure to meet the CL may not be a basis for assigning the stock as at risk, for example, if the stock has been well above the CL in previous years. The Working Group recognised that it would be important to agree on a time period that provides a reliable guide to stock status rather than a system that could be influenced by either one anomalously high or low year of returns. The Working Group suggests basing the stock indicators on the average CL attainment over the previous five-year period, which is the proposed frequency of updating of the information for the Rivers Database (see 6 below).

6. Frequency of updating

6.1 The Council's 2013 'Action Plan' states that '*With the available information, the NASCO Secretariat should be requested to prepare an overview of the status of stocks around the North Atlantic and the threats to them using the information contained in the rivers database*'. However, it does not indicate at what frequency such a report should be prepared. The Public Relations Group had suggested that an annual State of the Salmon report be prepared but the Working Group considers that this would place a considerable additional reporting burden on the Parties/jurisdictions, would be a considerable undertaking for the Secretariat and there may be relatively small changes on an annual basis. When the Rivers Database was established, the Council's intention was that it would be updated every 5 - 10 years. The Working Group notes that the Implementation Plans have a duration of five years, with the current plans covering the period 2013 - 2018 and recommends that five years would be an appropriate frequency for updating the Rivers Database. It should be noted that the Annual Progress Reports request information on any significant changes in the status of stocks relative to the reference points described in the Implementation Plan and of any new factors which may significantly affect the abundance of salmon stocks. There is, therefore, a process by which Parties/jurisdictions could highlight any major changes in stock status on an annual basis and the factors responsible.

6.2 If the Council agrees that five-yearly updating would be appropriate, a 'State of the Salmon' report might be prepared in the first year of each Implementation Plan period, drawing on the updated stock status information and summarising new threats and challenges and the management actions planned to address them over the coming five-year period. The launch of the status report and the new Implementation Plans might be of considerable media interest. The next cycle of Implementation Plans is scheduled to commence in 2018/19 but the idea of a report summarising the status of stocks around the North Atlantic and the threats to them was first raised several years ago. The Working Group, therefore, recommends that if a new classification system is agreed by the Council at the Thirty-Third Annual Meeting, Parties/jurisdictions be asked to update the current information held in the Rivers Database by 31 December 2016. This is important because at present the information contained in the Rivers Database presents a very different picture of stock status to that contained in the Implementation Plans for some Parties/jurisdictions. There should be no need to update much of the information in the Rivers Database, but the stock categories would need to be revised and as noted in section 3 above, this would be a good opportunity to augment those fields where only partial information has been provided (catchment area, river length, mean annual flow,

main impact factors, special stock characteristics and conservation requirements). There could then be a further updating of the Rivers Database in 2019 and the first status report could then be prepared. Thereafter, the Working Group recommends five yearly updates. Depending on the timing of the proposed International Year of the Salmon, the first State of the Salmon report could be timed to occur during that year.

7. Reporting where data is lacking

7.1 At present there are approximately 400 rivers in the Rivers Database for which the stock category is reported as 'Unknown'. As became clear at the 2014 Theme-based Special Session, not all Parties/jurisdictions have established CLs or other reference points and in some cases closure of fisheries means that information on stock status is lacking. As noted above (see section 4), where no CL has been established a CAS might be assigned based on best available information, but it has to be recognised that there are rivers around the North Atlantic, particularly in remote areas, where little or no information on stock status is available and for this reason the Working Group recommends that the 'Unknown' category is retained when the Rivers Database categories are revised.

8. How other relevant information to describe stock status can be taken into account in relation to NASCO's goals for salmon management, e.g. biodiversity and harvestable surplus

8.1 The classification system proposed by the Working Group is based on both a CAS and IAS in order to address the need to take into account NASCO's goals for salmon management and the limitations identified in section 4.1 above relating to a system based only on attainment of conservation limits.

9. Changes to the NASCO Rivers Database

9.1 The Working Group recommends that if the Council agrees to the proposed new classification system, as outlined above, the information currently held in the Rivers Database should be updated as a matter of urgency given that this information is many years old and, as indicated above, may be very different from the information on stock status provided in the Implementation Plans. However, this should not be a major undertaking as most of the fields in the Rivers Database will remain unchanged. Given the nature of the report envisaged in the Council's Action Plan (describing the status of stocks and the threats to them), the Council may consider that both the 'Salmon Stock Category' and 'Main Impact Factors' fields be updated as a priority but it would also contribute to the completeness of the Rivers Database, and its utility, if all the fields where only partial information has been provided to date could also be completed/updated.

9.2 The Working Group recommends that once the classification system is agreed the Council asks that the current information in the Rivers Database be returned to the Parties/jurisdictions by the Secretary in Excel spreadsheet format (incorporating a choice field reflecting the new stock categories), together with updated guidance notes to reflect the changes. The Parties/jurisdictions should be asked to update the information and return it to the Secretariat no later than 31 December 2016.

10. Conclusions

10.1 The Council believes that NASCO should be the source of information on salmon stock status around the North Atlantic and has recognised the value in developing a consistent and uniform approach to presenting information on stock status. Once this is agreed, it has decided to develop a State of the Salmon report using the updated stock categories in the Rivers Database. The Rivers Database is an important public relations tool for the Organization. The Working Group has reviewed the existing categories used in the Rivers Database and has proposed a new system based on both attainment of conservation limits (or other indicators where CLs have not been established) and an assessment of known impacts. The Working Group recommends that once the Council has agreed a new classification of salmon rivers for use in the Rivers Database, the Parties/jurisdictions be asked to update the data by 31 December 2016 and that a further update be undertaken in 2019 with a view to preparing a State of the Salmon report, based on this information, thereafter.

Annex 1

Current Guidance notes to assist in providing or updating information for the Rivers Database

Rivers' Database - file structure

The spreadsheet contains the following fields:-

Field Name	Data Type	Notes
RegionProvince	text	
RiverName	text	For the purposes of the simplified database the definition previously adopted by the Council is proposed, i.e., a river is named as the mainstem of the system of rivers and tributaries where it reaches the sea.
LocationLatitude	number	2 digits of degrees plus 2 digits of minutes, zero-padded where required e.g 0464, not 464
LocationLongitude	number	2 digits of degrees plus 2 digits of minutes, zero-padded where required
LocationEastOrWest	text	E or W
SalmonStockCategory	text	Select only from options listed below to categorise the status of the salmon stocks. See definitions appended. ***Not threatened with loss*** ***Threatened with loss*** ***Lost*** ***Restored*** ***Maintained*** ***Unknown*** ***Not present but potential***
CatchmentArea	number	square kilometres (km^2)
TotalRiverLength	number	kilometres (km), maximum 1 decimal place
AxialRiverLength	number	kilometres (km), maximum 1 decimal place
AccessibleRiverLength	number	kilometres (km), maximum 1 decimal place
MeanAnnualFlow	number	Cumecs (m^3s^{-1}), maximum 1 decimal place
MainImpactFactors	text	255 characters maximum. A description of the main factors adversely affecting the salmon stock
TotalConservationRequirement	number	total number of salmon
1SWConservationRequirement	number	number of 1 sea-winter salmon (if available)
MSWConservationRequirement	number	number of multi-sea-winter salmon (if available)
SpecialStockCharacteristics	text	255 characters maximum. e.g. run timing
OtherInformation	text	255 characters maximum. e.g. details of any designations; protected areas

Current River Categories as Agreed by the Council of NASCO for use with the Original Non-Web Based Rivers Database

CATEGORY 1: LOST [Red]

Rivers in which there is no natural or maintained stock of salmon but which are known to have contained salmon in the past.

CATEGORY 2: MAINTAINED [Blue]

Rivers in which there is no natural stock of salmon, which are known to have contained salmon in the past, but in which a salmon stock is now only maintained through human intervention.

CATEGORY 3: RESTORED [Purple]

Rivers in which the natural stock of salmon is known to have been lost in the past but in which there is now a self-sustaining stock of salmon as a result of restoration efforts or natural recolonization.

CATEGORY 4: THREATENED WITH LOSS [Amber]

Rivers in which there is a threat to the natural stock of salmon which would lead to loss of the stock unless the factor(s) causing the threat is(are) removed.

CATEGORY 5: NOT THREATENED WITH LOSS [Green]

Rivers in which the natural salmon stocks are not considered to be threatened with loss (as defined in Category 4).

Note: Following adoption in 2002 of the NASCO Plan of Action for Habitat Protection and Restoration an expanded web-based database was developed by the US. In accordance with the Plan of Action two additional categories were proposed (but not defined) as follows and we have proposed definitions for these below:

CATEGORY 6: UNKNOWN [White/Grey]

Rivers in which there is no information available as to whether or not it contains a salmon stock.

CATEGORY 7: NOT PRESENT BUT POTENTIAL [Black]

Rivers in which it is believed there has never been a salmon stock but which it is believed could support salmon if, for example, natural barriers to migration were removed.