Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2018/004

Central and Arctic Region

Proceedings of the regional recovery potential assessment (RPA) of Rainbow Trout, *Oncorhynchus mykiss* (Athabasca River populations)

December 8-9, 2016
Spruce Grove, Alberta

Chairperson: Kathleen Martin
Editors: Lia Kruger and Kathleen Martin

Fisheries and Oceans Canada
501 University Crescent
Winnipeg, Manitoba R3T 2N6

March 2018

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

ISSN 1701-1280

Correct citation for this publication:

DFO. 2018. Proceedings of the regional recovery potential assessment of Rainbow Trout, *Oncorhynchus mykiss* (Athabasca River populations). DFO Can. Sci. Advis. Sec. Proceed. Ser. 2018/004.

TABLE OF CONTENTS

SUMMARY

A regional science peer-review of the recovery potential assessment (RPA) of Athabasca River populations of Rainbow Trout (*Oncorhynchus mykiss*) was held on December 8 and 9, 2016 in Spruce Grove, Alberta and via teleconference/WebEx. The purpose of the RPA was to assess the recovery potential of Athabasca River Rainbow Trout populations based on the Fisheries and Oceans Canada (DFO) National RPA frameworks.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) met in May 2014 and recommended that Rainbow Trout (Athabasca River Populations) be designated Endangered. This was their first assessment of Athabasca River populations of Rainbow Trout.

The Science Advisory Report resulting from this RPA will provide the information and scientific advice to inform the *Species at Risk Act* (SARA) listing decision. If listed, this scientific advice will also be needed to fulfill SARA requirements, including the development of a recovery strategy, and to support decision-making with regards to SARA agreements and permits.

Meeting participants included experts from DFO Science, Species at Risk and Policy programs, Government of Alberta and the University of Alberta.

This proceedings report summarizes the relevant discussions from the peer-review meeting and presents revisions to be made to the associated research documents. The Proceedings, Science Advisory Report and the supporting Research Documents resulting from this advisory meeting are published on the DFO Canadian Science Advisory Secretariat (CSAS) website.

Compte rendu de l'évaluation du potentiel de rétablissement (ÉPR) à l'échelle régionale de la truite arc-en-ciel, *Oncorhynchus mykiss* (Populations de la rivière Athabasca)

SOMMAIRE

Une évaluation du potentiel de rétablissement (EPR) de la truite arc-en-ciel, *Oncorhynchus mykiss* a eu lieu au cours de deux réunions, du 8 au 9 décembre 2016 à Spruce Grove, Alberta, et par téléconférence et WebEx. L'objectif de l'EPR était d'évaluer le potentiel de rétablissement des populations de la truite arc-en-ciel de la rivière Athabasca d'après les cadres nationaux d'EPR de Pêches et Océans Canada (MPO).

Le Comité sur la situation des espèces en péril au Canada (COSEPAC) s'est réuni en mai 2014 et a recommandé que la truite arc-en-ciel (populations de la rivière Athabasca) soit désignée « en voie de disparition ». Il s'agissait de la première évaluation des populations de la truite arc-en-ciel de la rivière Athabasca par le comité.

L'avis scientifique découlant de cette évaluation du potentiel de rétablissement fournira les renseignements et les conseils scientifiques nécessaires pour éclairer la prise de décisions concernant l'inscription de cette espèce en vertu de la *Loi sur les espèces en péril* (LEP). Si l'espèce est inscrite, cet avis scientifique sera également nécessaire afin de satisfaire aux exigences de la LEP, telles que l'élaboration d'un programme de rétablissement, et d'éclairer la prise de décisions concernant les ententes et les permis en lien avec la LEP.

Parmi les participants à cette évaluation figuraient des experts de MPO, programmes des sciences, gestion des écosystèmes et des pêches et la politique et économique, Gouvernement d'Alberta et l'université d'Alberta.

Le présent compte rendu résume les discussions tenues et expose les révisions à apporter aux documents de recherche connexes. Le compte rendu, l'Avis scientifique et les documents de recherche qui découlent de la présente réunion de consultation scientifique sont publiés sur le site web du Secrétariat canadien de consultation scientifique (SCCS) du MPO.

INTRODUCTION

In May 2014, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended that Rainbow Trout (Athabasca River populations) be designated Endangered (COSEWIC 2014). This was their first assessment of Athabasca River Rainbow Trout (Athabasca Rainbow Trout) populations which are now being considered for listing under the *Species at Risk Act* (SARA).

A Recovery Potential Assessment (RPA) was conducted on December 8-9, 2016 to inform development of a recovery strategy and to support decision-making with regards to SARA agreements and permits. The intent of the meeting, as described in the Terms of Reference (Appendix 1), was to assess the recovery potential of Athabasca River populations of Rainbow Trout using the Fisheries and Oceans Canada (DFO) National RPA frameworks (DFO 2005, 2007a, b, 2011, 2014). The RPA is a science-based peer review that assesses the current status of a species and possible recovery targets, what is known about its biology, habitat and threats to it or its habitat and potential mitigation measures or alternatives to the threats, and scope for human-induced mortality from threats.

Meeting participants (Appendix 2) included Fisheries and Oceans Canada (DFO; Science, Species at Risk, and Policy), the Alberta Government and University of Alberta.

Two working papers were drafted and distributed to participants in advance of the meeting. One report included information on biology, habitat and threats to the species and its habitat. A second report included information on growth patterns, stage-specific annual mortality, fecundity-at-stage, population sensitivity, recovery targets (abundance and habitat) and allowable harm. The meeting generally followed the agenda in Appendix 3.

This proceedings report summarizes the relevant discussions from the meeting and presents recommended revisions to be made to the associated research document. The working papers presented at the workshop have been published as Canadian Science Advisory Secretariat (CSAS) Research Documents (Caskenette and Koops 2017, Sawatzky 2017). The Proceedings, Science Advisory Report and Research Documents resulting from this science advisory meeting are published on the DFO CSAS website.

ASSESSMENT

The meeting began with a round of introductions followed by a brief overview of DFO's CSAS Science Advisory Process and the guiding principles for the meeting. The Chair reviewed the purpose of the meeting and the elements in the Terms of References (ToR).

The Chair also went over the SARA listing and RPA processes.

DFO RECOVERY PLANNING

Presenter P. Rodger

The presentation provided an overview of the *Species at Risk Act*, who is responsible for administering the Act and how it provides protection to species and their habitat. The presentation also included the recovery potential assessment and its role within SARA Recovery Planning.

Discussion

A participant asked if there was a target for when critical habitat orders were posted. Critical habitat orders are to be posted within 180 days of the recovery strategy being posted on the Species at Risk Public Registry.

A participant noted that Alberta is working on a provincial recovery plan for Athabasca Rainbow Trout. DFO has a responsibility to develop a federal recovery strategy for the species and will work with Alberta to do it. DFO will use the provincial plan where possible to fill out the sections required in the federal plan, identify any gaps and then address them, as needed. This would then address both SARA and provincial requirements. Participants suggested that DFO identify what is needed so that Alberta could reduce the gaps.

The Chair clarified that the RPA process provides the information that can be used by the Recovery Team and Species at Risk managers to make decisions about allowable harm and setting recovery targets. The RPA does not determine the allowable harm or set the recovery targets.

A participant expressed concern with the use of socio-economics in decisions about listing and asked whether there are critically endangered species that have not been listed as a result of socio-economics. The federal listing process does consider socio-economics and there have been decisions made not to list species where socio-economics played a role in the decision (e.g., Pacific Salmon, Porbeagle Shark).

ALBERTA RECOVERY PLANNING

Status and Recovery through Adaptive Management

Presenter M. Sullivan

The same presentation had been given to the Athabasca Rainbow Trout Recovery Team. It described Athabasca Rainbow Trout and illustrated the type of streams occupied in the watershed. The presentation described the threats Athabasca Rainbow Trout are facing and proposed a logical, step-wise process of adaptive management for the species.

Sixty years ago the problem identified in the eastslope streams was too many Rainbow Trout; they were overpopulated and stunted. Now they are endangered. Alberta has come up with a logical, step-wise process of adaptive management to try to address the decline.

Alberta has been divided into HUC (Hydrologic Unit Code) level 8 watersheds. HUC8s were chosen as a balance between genetics and manageability in terms of regulations and recovery. Athabasca Rainbow Trout occur in 19 HUC8s. Alberta is focusing on managing the HUCs. Modelling focuses on modelling populations (i.e., HUCs). Alberta is working with Parks Canada so the 19 HUCs include those in Jasper National Park. Status is based on density threshold analysis using relative densities sampled within the HUCs. Dose response curves are developed for stressors associated with direct mortality (e.g., temperature, angling mortality, Brook Trout, phosphorus runoff). The cumulative effect of parameters is the product of the responses. Running the cumulative effects model quantifies the threat of each stressor, specific to that sub-population and allows directed actions to address the key stressors. The model can identify key threats (and uncertainties) so that management can be focused on these and experiments can be used to evaluate them. Places in the watersheds with the highest potential for recovery are targeted.

One threat stands out; overharvesting could be the major issue, catch and release mortality could be the cause of the lack of recovery. The presenter pointed out an error in the threats section of the non-modelling research document related to this issue. The post-release mortality

rate of 3–5 % is actually an angling accident rate and is dependent on the number of anglers. It is possible for the mortality that results to be higher than the population can sustain if there are enough anglers. It relates to the total catch not the total population size. The text needs to be changed to reflect this.

The modelling identifies four key uncertainties; angling, sediment, fragmentation and invasives (Brook Trout and non-native Rainbow Trout). These would be hypotheses that could be tested. Alberta plans to run experiments to test these over the next five years. They will focus on watershed-scale studies in five HUCs.

Discussion

The Chair asked if the HUC8s represented populations. The presenter indicated they were genetically distinct populations. There is a scale of relatedness, however, it is possible to distinguish between HUCs but not within HUCs. There is some movement between HUCs but it is low enough to give genetic separation. The Chair indicated that this would come into play when discussing the recovery target as it is meant to be the target for population units rather than for the whole species.

A participant identified that in the lower McCloud HUC, Athabasca Rainbow Trout are in the upper small reaches and the lower McCloud mainstem contains Northern Pike and Walleye. This results in ecological isolation for these fish.

A participant asked if temperature was a top threat. The presenter said they haven't had large temperature changes yet. Flow (February, August) may be a bigger problem. The participant asked if they thought that post release mortality would change depending on the HUC (as a result of different temperatures) and whether this was considered in the model. The presenter indicated it was in the separate angling mortality model.

A participant asked if interactions between the levers used to make adjustments in the model could be another uncertainty. The presenter indicated that interactive effects are considered within the model as well as cumulative effects.

BIOLOGY, ABUNDANCE AND DISTRIBUTION

Author and presenter: Chantelle Sawatzky

Summary

COSEWIC's reason for designating Athabasca Rainbow Trout as Endangered was the population decline and severe threats to the species and its habitat (COSEWIC 2014). Sampling indicated > 90 % decline over three generations (15 years) in the majority of sites sampled. Threats were assessed as severe due to habitat degradation associated with resource extraction and agricultural practices. Ongoing climatic change and associated altered thermal regimes and hydrology, habitat fragmentation, introgression from non-native Rainbow Trout, and fishing threaten the species. There is also a potential impact of invasive Brook Trout.

This Research Document (Sawatzky 2017) describes the current state of knowledge of the biology, ecology, distribution, population trends, habitat requirements and threats to Athabasca Rainbow Trout and its habitat. Mitigation measures and alternative activities related to identified threats, which can be used to protect the species, are also presented. This assessment considers the most up-to-date science pertaining to the recovery of Athabasca Rainbow Trout in Alberta.

Discussion

A participant suggested that some of the photographs of Athabasca Rainbow Trout in the presentation were questionable. The author indicated they were found online but wouldn't be used in the report. A participant noted that all Athabasca Rainbow Trout have white tips on their pelvic, dorsal and anal fins. Another participant noted that the pattern of spots can be used to identify individual fish for mark-recapture projects.

A participant noted that the introgression information is just a snapshot and is changing all the time. A sentence should be added about introgression that indicates changes are expected to occur as new types of hybridization (stocked Rainbow Trout or other *Oncorhynchus* species e.g., Cutthroat Trout, Golden Trout) are looked at and new samples are analysed.

The COSEWIC report had not included any populations in Jasper National Park. The report author included the one pure population (Buffalo Prairie). Participants noted a second (Minaga Creek). Participants agreed all populations in Jasper should be included.

A participant noted there are low water temperature issues and asked that a sentence be added with respect to winter temperatures and land-use practices which combine to reduce groundwater inputs and lower winter water temperatures. This can delay larval development particularly for winter spawners.

A participant noted that in the cold low diversity systems, Rainbow Trout eat everything. They are strong generalists. This makes them vulnerable to fishing.

A participant indicated that information was lost when just stating that 'late summer-dense swarms of a small mayfly were an important food item'. This refers to the first or second instar of *Baetis* spp. which are an important part of the drift and therefore the diet when fry are coming out of the gravel. Land-use activities that could threaten these invertebrates could impact Rainbow Trout.

The group discussed the special significance section. They discussed whether Rainbow Trout was an important resource for Indigenous peoples. There is some evidence for their importance in the Jasper area. People indicate their heart is with the fish. A participant suggested changing the wording in the document to say Rainbow Trout are an important cultural resource.

The Chair noted that the word 'native' should to be added to 'the only Rainbow Trout population found east of the Continental Divide'. Participants agreed.

The author indicated that the estimated habitat occupancy listed in the COSEWIC report was an error (16,890 stream km was based on an incorrect entry for tertiary watershed 07AC). This was noted in the research document. A participant suggested adding how the habitat occupancy was measured. The group agreed that the statement 'Occupied habitat has been estimated as making up less than 58 % of potentially available habitat' should be removed. COSEWIC also did not include Jasper National Park in their calculations and inaccessible areas were also excluded. Based on the COSEWIC assessment Rainbow Trout have been lost from over half of the streams. Surveys conducted where Rainbow Trout are expected but are not found could be because they were never there or because they have been lost. The information on historical distribution could be used if the goal is to recover the population to areas where they are no longer found. The near-term goal is to recover Athabasca Rainbow Trout in the best habitat and then return them to historical areas.

The author included all trend data in the report and will add updated 2016 Fish Sustainability Index (FSI) information. The total HUC number will also be updated and changes will be made based on the discussions.

HABITAT AND RESIDENCE REQUIREMENT DISCUSSION

Presenter: Chantelle Sawatzky

A participant suggested removing the sentence ‘In small streams, overhead cover (large woody debris and riparian vegetation) is a critical habitat component.’

A participant stated that Rainbow Trout are summer, not spring, spawners. The group decided to remove spring and replace with mid- to late May to early June. This will be changed throughout the document. One participant noted the earliest they have seen spawning was 19 May in the Tri-Creeks watershed. Spawning may be better described as occurring at a mean of 6 °C or maximum 8 °C in Tri-Creeks. Participants suggested adding a sentence saying that the Tri-Creeks information used is in the central range and spawning will occur later at higher elevations and earlier at lower elevations.

In the section on spawning habitat, participants noted that Athabasca Rainbow Trout are small fish, and need gravel to spawn. So in high flow, gravel is on the stream margins, in low flow, access to gravel is in the center of the channel. These are small fish that are vulnerable to slight changes in flow and particle size. Participants also noted that gravel is temporary, it moves from year to year.

In the functions, features and attributes table, a participant noted that the first bullet under feature(s) should be rifle crests not riffle creek.

Young-of-the-Year to Age 1

A participant commented that emergence happens as late as September.

A participant suggested adding ‘or’ between aquatic vegetation and woody debris in the examples of abundant cover for nursery habitat.

A participant mentioned summer silt. When it occurs, Athabasca Rainbow Trout move out and Brook Trout come in. Participants thought it impacted the eggs and fry that were still in the gravel.

Juvenile and Adult

A participant thought the preferred depth should be removed. The fish seem to use all depths. The group agreed.

The statement on cover should include ‘or’ in place of ‘and’.

Overwintering

A participant noted there are clear oxygen and temperature thresholds for overwintering. Oxygen should be 3 mg/L or higher. Water temperatures can be near zero, but at around 0.2 °C frazil ice forms.

A participant noted that the measurements came from Tri-Creeks. The size of the primary pools was before freeze-up. The latter half of the sentence ‘average loss of volume of 80 % by mid-winter (February)’ should be removed. Also, ‘minimum’ should replace ‘maximum’ for mean depth in the first bullet.

A participant suggested clarifying that a landscape function is needed to maintain groundwater inflow. The cover and riparian vegetation is not as important to these fish as some other salmonids but groundwater must be maintained. They suggested changing ‘riparian’ to ‘watershed’ or ‘functional watershed’. Woody debris can be important for the really small streams because it forms the channel.

The author used the maps that were in the recovery plan. The maps have current information and may change as new information is collected. In the Jasper watershed map the areas identified as Ecologically Significant Habitat also had to have Athabasca Rainbow Trout. In the other maps the habitat was identified whether or not Athabasca Rainbow Trout were present. Essentially it is ever second and fourth order tributary below barrier falls.

During the discussion of residence, one of the participants noted again that gravel in the streams changes position over time. Redds may therefore not occur in the same locations year after year. Gravel is a dynamic feature.

RPA MODELLING

Author and Presenter: Amanda Caskenette

Summary

The presenter gave an overview of the life cycle, parameter estimates, sensitivity, and recovery targets for abundance and habitat. She summarized results and outlined some key uncertainties.

Discussion

Karl Dietz's M.Sc. thesis from University of Alberta includes fecundity data from several river fish. There were eight fecundity counts of about 600–1,000 eggs and the associated fish lengths. These data will be provided to the author to add to the fecundity data (parameter estimates).

Modelling indicates sensitivity to survival of young-of-the-year (YOY) and age 1. A participant noted that this would indicate that small tweaks to YOY and age 1 survival would have large impacts on the population, while small tweaks to adult survival would have little impact on the population. However, on the land, fishing pressure can tweak adult survival enough to have a huge impact on the population. This gives a false sense of optimism that they can be fished hard. Care should be taken when drawing conclusions.

The author indicated that there was variability and the results change as the population trend changes. In other models, as you move from a declining population to an increasing population, larger older individuals may be of greater importance. That was not the case here.

Recovery Targets and Allowable Harm Discussion

A participant noted that the allowable transient harm could also be used differently from what is intended. It could be used to identify benefits. It would help to understand how many fish could be removed from one place to add to another and used to identify the level of additions needed to show a population level increase as a one-time improvement.

There was some discussion about the number of hectares of creek used in the modelling. The author used all the creeks with the information from the FSI but it may have included the mainstem Athabasca. The difference seems to be occupied habitat versus all water. The mean wetted width used to calculate habitat size in one of the working papers differed from what Alberta used which was the mean 'measured' wetted width. The author will rerun using stream orders 2, 3, and 4 and using the measured average wetted widths in Table 2 of the provincial recovery plan for determining better abundance estimates and for calculating the probability of extinction. They will update to the most recent FSI information.

A participant noted that today, the stream segment density averages < 6 adults. Twenty three adults is the benchmark. The author indicated the probability of extinction was based on the

potential achievable adult abundance. A participant noted that people shouldn't be shocked to see 10 % of the streams going extinct in any one run. This is expected and is the potential winterkill scenario. For example, if you were to get three droughts in a row they would be out of the creek but could recolonize later under more favourable conditions. At some point over 100 years the streams would be ephemeral. This is not always perfect habitat, this is low density and unproductive. The participants expect to see higher than comfortable extinction points. This doesn't happen to all areas at the same time so over the long-term they are dependent on being able to recolonize from other areas. Another participant pointed out that they were able to recover after flooding in 1980 very quickly. The author noted that the extinction rate considered the extinction in the whole HUC rather than at the stream level.

Participants further discussed the stream orders (2, 3, 4) that were appropriate to use for current hectares occupied. In some instances stream orders other than 2, 3 and 4 should be used. Occupied habitat corresponded to the pink lines mapped for each HUC representing the ecologically significant habitat identified by the Alberta Athabasca Rainbow Trout Recovery Team. These are included in the non-modelling Research Document (Sawatzky 2017).

The author indicated that modelling on the river migrant population might change if they had different survival and growth rates. She would be adding the fecundity data from Karl Dietz's thesis. Researchers were not aware of the river migrants until they began the Tri-Creeks study where fish were tagged. Large individuals spawned and then left the creeks into the river whereas river residents stayed in the smaller creeks. There are some native Athabasca Rainbow Trout in the mainstem but also many hatchery raised fish. There may have been about 10 or so river migrants in each of the creeks. One of the participants indicated that the streams were ≥ 90 % stream residents. The author discussed changing alpha to better reflect this. It was agreed that alpha should be constrained to a much smaller range like 0.9 to 1 as the highest proportion of stream migrants was likely < 10 %.

A participant noted that in the Tri-Creeks area stream study there were improvements in spawning success after the 1980 flood when the indices of substrate quality were better than before logging. Spawning success had declined from the mid-1970s after the road went in. The flooding reworked the entire surface layers of the substrate and there was no sediment; spawning went through the roof.

THREATS TO SURVIVAL AND RECOVERY DISCUSSION

Presenter: Chantelle Sawatzky

Natural Limiting Factors

A participant commented that Athabasca Rainbow Trout spilled over from the Fraser system but only into the Athabasca River and as a result there is not an outside source of individuals to repopulate. Athabasca Rainbow Trout is also a glacial relict.

Threats

Invasive Species

A participant pointed out that invasive species result in replacement or displacement of Athabasca Rainbow Trout. There is also hybridization with Rainbow Trout, Cutthroat Trout, etc. It was noted that the 'invasives' were all stocked fish.

A participant indicated that 'outside of Jasper National Park' should be removed from the first bullet under hybridization and competition with non-native Athabasca Rainbow Trout.

Participants noted that Athabasca Rainbow Trout are not lake fish. They are typically found just outside of the lakes although they may move through them on occasion.

A participant commented that they do get some illegal stocking annually and that should be added to the document.

A participant noted that they think the Powder Creek Brook Trout were misidentified and could be removed. They couldn't be verified and were likely Bull Trout. There is no naturalized population of Brook Trout in Powder Creek or the Wildhay River; there is in Moberly Creek.

Replacement or displacement of Athabasca Rainbow Trout by Brook Trout poses a significant threat.

The author will add that research is continuing on untangling genetics of hybridization with other species (e.g., Golden Trout, coastal Cutthroat Trout, Atlantic Salmon).

A participant noted that stocking of invertebrates has occurred (e.g., *Mysis* spp.) but is no longer occurring.

Pathogens

A participant commented that sources of infections are mainly from commercial hatcheries. All other sources are minor in comparison. Participants also suggested removing the bird example.

Participants noted that Alberta is currently most concerned about whirling disease. They also noted that population declines rarely occur from the disease. A participant indicated that in Montana, the fish that have been wild for many generations seem to have a higher resistance. So keeping natural and varied genetic stocks on the landscape would result in reduced susceptibility which should be considered a mitigation strategy. Participants indicated that the Athabasca River watershed should be the least susceptible of the Alberta watersheds to this disease because of temperature and sediment loading.

Habitat Loss and Degradation

A participant suggested that nutrient loading should be added to the habitat loss or degradation section. The author agreed.

A participant noted that alteration of peak flows is responsible for moving silt into the system and eventually moves silt out of the system.

During the discussion on dams under altering natural flow regimes, a participant pointed out the information currently included in the report refers to large hydropower dams. This should be clear (e.g., Dams, Hydro). There would be negative impacts expected to spawning sites for several species.

Related threats should also be identified in the report. Run of the river facilities and low-head dams are being proposed; two were proposed in Jasper National Park in 2016.

Another participant indicated that in the Athabasca drainage they are now getting pumped hydro facilities. Water is taken from the Athabasca and put into a reservoir. From there it is pumped uphill to another reservoir. When the water runs back downhill electricity is created. These are generally closed systems and there are four proposed right now (2016). One is proposed near Obed (Canyon Creek area). These are not dams but are additional water usages that could have impacts. Water transfers would be needed to replace losses due to evaporation. Impacts should include potential reservoir breaches which result in sediment loading.

Large scale water transfers (e.g., to Montana) have been noted.

A participant suggested adding that culverts result in increased water temperatures.

Another participant suggested adding that erosion risk is generally high for most of the area as it is a glacial deposition area.

Participants asked about updating the information on water withdrawals to 2016 data which they thought was available from Alberta Environment online. Water withdrawals are included in the Alberta cumulative effects modelling. Participants were not sure that reporting is being done. There are now guidelines specific to the upper Athabasca watershed which may be more restrictive. Participants thought that some wording should be added that water withdrawal may not be a problem at the current levels but this could change in the future. If levels increase it may become more of a concern and there may be a need to restrict withdrawals.

A participant suggested adding that similar disturbances (e.g., forest harvesting, road development, grazing) can also alter groundwater flow causing cooler winter temperatures.

A participant indicated that negative impacts to groundwater should include both flow and temperature. The statement about further research is not needed.

There was some discussion about whether the retention of a buffer zone is still being stipulated; participants thought that it is. Some companies are arguing that it is not needed as they are emulating the effects of natural disturbance such as forest fires. However, the scale of disturbance may be quite different. Participants pointed out that you can't leave a 10 m strip, destroy the remainder of the watershed and expect to protect the stream. There are different ways to apply the buffer zone; some good and some not. Current proposals have described keeping a 3 m retention zone for woody debris to provide stems to fall into the stream at some point. This wouldn't provide shade or retain sediments.

With respect to changes in water temperature, a participant noted that in the upper parts of the watershed the problem is cold, in the lower parts it is heat. There was a response in Deerlick Creek when the channel was exposed.

A participant suggested adding 'promotes invasive species' as an impact of suspended and deposited sediments.

A participant reiterated the negative impacts of off-highway Vehicle (OHV) use. They erode banks, disturb stream beds and destroy riparian areas. OHV use in streams directly destroys redds. For example, in Ruby Creek, at every crossing the creek has gone from a single channel to a large wide braided channel. It destroys habitat quality. Another example, is destruction from OHV use in the upper Pembina. Strong language is needed as this is one that is easy to solve – designated trails only, hardened crossings.

A participant suggested adding nutrient loading to the impacts of unmanaged livestock grazing/watering in addition to sediment loading.

Fragmentation

Culverts increase sedimentation and temperature. This will be added to the document.

Participants discussed MacPherson et al. (2012) which had indicated that culverts were not major barriers to upstream passage. However, it was noted that upstream self-sustaining populations could account for their findings for low elevation fringe habitats with low densities of Athabasca Rainbow Trout. Participants pointed out that culverts were barriers although there were not consistent population extinctions above them over the 20–40 years that they were in place. There are a lot of examples where culverts are barriers. There are even examples where a hanging culvert has been used to prevent fish passage into a lake. A participant suggested adding Park et al. (2008) who found that half of the culverts surveyed were barriers.

There was a discussion about dams and weirs. A participant noted that more are proposed annually. The tertiary watersheds and labels don't match with the HUCs; however, they were included on the map as COSEWIC had used them in their report.

Participants indicated that the table with dam and weir characteristics needed to be reviewed and updated. There are some missing from the table. For example, Emerson Lake had a dam built by Alberta Environment which is not included. Some of the weirs (e.g., Goose Lake), didn't affect Athabasca Rainbow Trout. The author planned to keep all in the table but the dams that didn't impact Rainbow Trout could be noted in the text. One participant agreed to review the table for the author after the meeting.

Participants indicated concern with weirs especially associated with settling ponds in the coal mining operations, where there is always a risk that they could fail. Participants noted that following a bit of rain, sediment can be mobilized from the ponds. A participant suggested the addition of a separate bullet noting that settling ponds and berms are an extended feature of industrial activity in this area and are a serious concern.

A participant indicated that active open pit coal mining operations have caused the direct loss of habitat. The habitat is not degraded, it is gone. Participants also indicated that the irrigation canal information could be removed as there are no irrigation canals.

Mortality

Post-release mortality rates are unknown but could range from 0–25 %. The high end of this range can occur when water temperatures are high or bait is used. Mortality can be variable but is often in the 3–5 % range. A participant also noted that illegal harvest does occur. Scientific research does cause mortality (3–5 %) but sampling seldom occurs so there is very low impact to the population. Genetic sampling is non-lethal sampling. Participants suggested removing lethal sampling as it doesn't occur.

Contaminants and Toxic Substances

A participant noted that glyphosate is a phosphate mimic to algae and it is being used more frequently with the prevalence of Roundup® Ready crops.

Participants indicated that there are high levels of a waterproofing chemical (PCT) from China showing up in the Alberta glaciers transported by the jet stream. Fire retardant chemicals should be included in the list of potential contaminants. Wastewater contamination, from phosphate reducing oxygen levels, has caused major fish kills.

The author will add a map of contaminated sites from the federal database to the report.

Information on the oilsands can be removed as there are no oilsands and there are no petrochemical refineries in the Athabasca Rainbow Trout area. Oil spills from pipeline leaks occur annually. Train derailments occur regularly. Participants also indicated that sediment in surface water runoff will increase as a result of infrastructure development around well sites.

Participants noted that nutrient loading can also be associated with outbreaks of parasites. Effluents have caused reductions in dissolved oxygen below acceptable thresholds in the Athabasca mainstem.

Climate Change

A participant indicated that climate change results in highly variable precipitation events that boost the sediment and phosphate coming into the system. The participant indicated that they have run the IPCC-5 climate change models downscaled to Alberta. The extended frost-free period will impact access to the rivers. Road activity was high for much longer last year and the rivers were running mud because of fall sediment inputs. So far, spring hasn't changed much

but fall has. Participants indicated that the Athabasca glaciers will likely last longer than those further south.

Frequency of large floods is expected to increase and it is the increased frequency that is of concern. Similarly the change in wildfire extent and frequency can be of concern.

Interactive and Cumulative Affects

A participant noted that resilience is important for long-term survival of Athabasca Rainbow Trout as are strategies to increase resilience.

THREATS ASSESSMENT

Presenter: Chantelle Sawatzky

The author gave an overview of the threat assessment process and provided the definitions of the likelihood, impact, and certainty categories used.

Participants discussed how the dose response curves that Alberta was developing compared to DFO's threats assessment. Dose links to the likelihood of occurrence. Some of the dose percentages could be used as examples within the likelihood tables. The author will describe the link between the two approaches.

Threats are evaluated at the HUC level and then are rolled up to the tertiary watershed level and then to the overall species distribution level. However, it was noted that when the information was rolled up, the worst case scenario is taken. The proposed table was populated based on information from the recovery plan. Participants reviewed the proposed level of impact, causal certainty, threat occurrence, threat frequency and threat extent table.

The participants agreed with the proposed table after the following changes:

- Causal certainty for invasive species (algae and aquatic invertebrate species) is Low with Low certainty
- Pathogen occurrence is Current and Anticipatory
- Alteration of Natural Flow Regime occurrence is Current and Anticipatory
- Alteration of Stream Temperature is Recurrent
- Suspended and deposited sediments and habitat fragmentation impacts are Extreme.
- Mortality impact is Extreme and the frequency is Continuous.
- Contaminants and toxic substance impact is Medium, the frequency is Recurrent and the Extent is Narrow
- Nutrient loading (moved under habitat loss and degradation) impact is Extreme and the frequency is Continuous
- Causal certainty was High for climate change. Climate change is detectable now but it is expected to have a High impact in the future. The latter detail should be captured in the text.

DEVELOPMENT ACTIVITES

Presenter: Peter Rodger

The presenter gave an overview of the current regulatory framework, and information about projects that were captured in DFO's Projects Activities Tracking for Habitat (PATH) database.

Alberta Environment and Parks (AEP) identifies and classifies watercourses. There are restricted windows for activities depending on the species that occur in the watercourse. DFO's Fisheries Protection Program (FPP) is the federal reviewer and regulator of development proposals and activities that have the potential to impact fish and fish habitat for fish that contribute to Commercial, Recreational and Aboriginal (CRA) fisheries. Pathways of effects diagrams are used in the impact assessment and mitigations have been described to mitigate the impacts (Coker et al. 2010). Authorizations are required for acceptable projects that have residual impacts after mitigation.

The table in the report identifies the applicable pathways of effects along with the types of works, projects and activities captured within DFO's PATH database. Three years of data were reviewed from PATH (2013–2015). The activities identified included culverts (1), dredging/excavating (6), fish passage (6), infilling/footprint (24), log handling/dumps (1), pipelines (1), watercourse alteration (1) and seven projects with no potential impacts. The presenter indicated that there were no authorizations under the *Fisheries Act* for this period. The dataset seemed to be missing watercourse crossings.

Discussion

A participant noted that the culvert projects they had been involved in failed within six months of installation. They were undersized and there didn't seem to be an understanding of the size needed during the spring.

A participant asked about the type of activities that are missed with this analysis. Cutting plans are approved by the Forestry Department but are not reviewed by DFO. A participant indicated the authorization for all of the mines wouldn't have been captured in this timeframe. Channel realignments were approved prior to this. There are well sites and cut lines that are not being captured by PATH. A participant noted that the activities they have included in their cumulative effects modelling are much more numerous than the PATH information would suggest.

Under the current process, PATH doesn't capture activities where the proponent has self-assessed their project as meeting certain criteria and therefore does not require an application to DFO. There is no record of the activity in PATH. There are clear limitations to using the PATH dataset to capture projects and activities. The database was not meant to capture all activities that would impact a species. The level of detail in the database depends on the individual assessors and their understanding of the systems where the activities are occurring. The author suggested they add in the report that this information is what came through DFO and that there are activities and projects that are not captured which could potentially impact Athabasca Rainbow Trout. Very large projects would be captured but small projects would be missed. Participants also noted that the way DFO handled activities over the last few years changed quite drastically from the way they were handled previously. This was associated with recent changes to the *Fisheries Act*.

The Chair said clearly more data are needed. The presenter suggested two more years would help to flesh out the information but still wouldn't capture everything. The maps of activities that came out of the ALCES (Alberta Landscape Cumulative Effects Simulator) report are better at displaying the human footprint within the HUC, but there are hundreds of maps. There may be key maps that illustrate what is going on in the area that could be included in the research document (e.g., roads, cut blocks, well sites). Participants would discuss what could or should be included.

MITIGATION MEASURES

Presenter: Chantelle Sawatzky

Standard mitigations to break pathways of effects are included in Coker et al. (2010). For each pathway of effect there are a series of mitigations. These are recorded in the summary of works, projects and activities. Participants discussed those threats not covered in Coker et al. (2010).

Participants agreed that Coker et al. (2010) was a good “cookbook”.

Invasive Species

Mitigation

A participant commented that they would like to add a bullet indicating to use existing ASERT (Alberta Support Emergency Response Team) reporting and action systems. Focus AIS action teams to where threats occur on this species.

Alternatives

A participant suggested that stocking should only be done with species already introduced, only 3N (i.e., triploid; Rainbow Trout, Brook Trout) and only into existing stocked systems with no outflows. There should be no connectivity to lotic habitats. There should be no new creations of stocked ponds and not into any waters with outlets. Another participant suggested adding that only certified disease free fishes be used for stocking.

It was pointed out that 3N fish are only 97 % 3N which is important when over one million fish are being stocked.

Stocking into end-pit lakes was attempted in the past to develop a wild broodstock of Athabasca Rainbow Trout to use for stocking in an attempt to move all stocked waterbodies to Athabasca Rainbow Trout for recreational purposes. Exposure to the hatchery was limited.

Mortality

Mitigation

A participant suggested using the term ‘recovery rest period’ instead of ‘fishery closures’.

Catch and release for Athabasca Rainbow Trout is practiced throughout the province except in Jasper National Park (currently allowed to keep two per day in the Park). Harvesting can occur in stocked waters but there are no stocked Athabasca Rainbow Trout. Harvest is not allowed for any Rainbow Trout in running water.

Alberta has moved away from barbless hooks. In 2016 Alberta implemented a total bait ban to reduce hooking mortality. Artificial lures and flies are allowed.

Collection/sampling licenses are not authorized during the spawning and incubation periods nor during low water and high temperature conditions.

Indigenous fishers must have a licence that includes conditions.

There is a draft Trouts and Droughts Policy (provincial) which identifies water level and temperature closures.

Alternatives

Restrict lethal scientific sampling.

Sampling for whirling disease was lethal sampling although it focused on Brook Trout or areas with high probability of hybridization.

Climate Change

The author will add information from the draft Trouts and Droughts Policy to the Climate Change section.

Interactive and Cumulative Effects

A participant suggested adding AEP cumulative effects modeling and adaptive management experiments to focus recovery efforts.

Existing Protection

Under the Alberta *Wildlife Act* the species is Threatened. Participants indicated this designation was signed off two years ago but it is not yet showing up in the regulations or on the website.

McKenzie Creek in the upper McLeod is closed to angling.

Portions of the range are within Jasper National Park and Wilmore Wilderness Area and smaller pieces are protected through some provincial parks (Sundance, Switzer), although intentional harvest is still allowed in Jasper National Park (two per day).

SOURCES OF UNCERTAINTY

The group discussed the key uncertainties of Athabasca Rainbow Trout. A participant thought that angling pressure was extremely important but difficult to measure. Modeling suggests that nearly undetectable levels of angling pressure can have severe consequences.

Another participant thought that sediment was a source of uncertainty. The dose response curve in isolation of other stressors (roads, access) is uncertain. Sediment may be less important than the models indicate. Sediment could be an important driver, but it has to be over the threshold (e.g., 20 % fines in gravel). Mobilized sediment is a problem. Suspended sediment at Tri-Creeks was extremely high, yet this area contained the best trout populations.

Another uncertainty that a participant noted was non-native species (including introgression). Are they replacing or displacing Athabasca Rainbow Trout. Are they a symptom or a cause of population decline? A participant added that habitat productivity was an uncertainty as the historical densities for each HUC are unknown.

A participant wondered if the genetic options for rescue effect were an uncertainty. The author will add rescue effect to the report following the information on existing protection.

Additional sources of uncertainty from the modelling research document were also reviewed. The Tri-Creeks watershed has over 40 years of data which shows variation without trend over the whole period.

There is uncertainty in the productivity of various streams and habitats. Productivity is variable so some streams with the lowest productivity will never support the highest densities of Athabasca Rainbow Trout and these areas will also be particularly sensitive to perturbations. Knowing the range in productivity would be relevant to estimating habitat per individual and would be informative in determining recovery goals. Historical density information would also be informative.

There is evidence that adults may stay in a relatively small area from spring to fall. There are length at age data collected during the 1970s.

TERMS OF REFERENCE

The Chair reviewed the Terms of Reference (Appendix 2) elements.

Element 1: The biology of Athabasca Rainbow Trout was summarized.

Element 2: The recent species trajectory for abundance, distribution and number of populations was evaluated to the extent possible.

Element 3: The modelling research document includes estimates of the current or recent life-history parameters for Athabasca Rainbow Trout that were used in the modelling.

Element 4: The habitat properties that Athabasca Rainbow Trout need for successful completion of all life-history stages were described as were the function(s), feature(s), and attribute(s) of the habitat. Quantifying how the biological function(s) that specific habitat feature(s) provides vary with the state or amount of habitat, including carrying capacity limits, if any, was not addressed and has been identified as an uncertainty.

Athabasca Rainbow Trout are not limited by spawning habitat but are likely limited by summertime productivity and the size of the streams. The HUC maps with Ecologically Significant Habitat identified from the provincial recovery strategy also identify areas where specific biological functions occur. This element might be addressed with dose response curves for each of the functions.

Element 5: Information on the spatial extent of the areas in Athabasca Rainbow Trout distribution that are likely to have these habitat properties (e.g., temperature, substrate) was provided to the extent possible.

Element 6: The presence and extent of spatial configuration constraints, if any, such as connectivity, barriers to access, etc. were addressed to the extent possible.

Element 7: The concept of residence applies to this species, and the species' residence was described.

Element 8: The threats to the survival and recovery of Athabasca Rainbow Trout were assessed and prioritized to the extent possible.

Element 9: Activities most likely to threaten the habitat were evaluated to the extent possible.

Angling, sedimentation, fragmentation and non-native introductions are the main activities threatening Athabasca Rainbow Trout.

Element 10: An assessment of any natural factors that will limit the survival and recovery of Athabasca Rainbow Trout is captured in the Research Document (Sawatzky 2017).

Element 11: There was limited information on the potential ecological impacts of the threats identified for Athabasca Rainbow Trout and other co-occurring species. There was no information on the possible benefits and disadvantages to Athabasca Rainbow Trout and other co-occurring species that may occur if the threats are abated. Alberta is carrying out monitoring efforts of densities. Uncertainties related to this element were discussed and are captured in the reports.

Alberta is working on an integrated Recovery Plan called Peace to the Pass (in draft) that includes Bull Trout, Westslope Cutthroat Trout, Athabasca Rainbow Trout, and Arctic Grayling.

A participant asked that Alberta provide more detail on the types of monitoring (e.g., density, genetics, blackspot) that is being undertaken for Athabasca Rainbow Trout including their standardized watershed monitoring.

Element 12: The RPA proposed potential abundance and distribution target(s) for recovery.

Element 13: The modelling provides input on potential population trajectories for Athabasca Rainbow Trout.

Element 14: Modelling provides some advice on the degree to which supply of suitable habitat meets the demands of the species both at present and when the species reaches the potential recovery targets.

Element 15: The modelling research document assesses the probability that the potential recovery targets can be achieved to the extent possible. Alberta has been evaluating management practices that are expected to improve the potential for recovery.

Element 16: An inventory of feasible mitigation measures and reasonable alternatives to the activities that are threats to the species and its habitat were identified, to the extent possible.

Element 17: The mitigation measures discussed are consistent with the goal of increasing survivorship by reducing threats to the species directly or indirectly by improving habitat quality.

Element 18: The feasibility of restoring the habitat to higher values was discussed to the extent possible.

A participant indicated it was more about improving habitat quality than supply. Improving sediment and decreasing fragmentation will increase the value of the habitat. In addition, removing Brook Trout would free up habitat for Athabasca Rainbow Trout.

Element 19: The only information on this element comes from the model manipulations Alberta is evaluating for the five watersheds they are focusing on. Moving the model sliders results in new FSIs. Otherwise, there are insufficient data with which to address this element.

Element 20: The modelling research document estimates the time to reach the potential recovery targets. Expected population trajectories (and uncertainties) are not provided. The Alberta ALCES modelling will address aspects of this element.

Element 21: The range of parameter values used were based on the best information available.

Participants indicated that stopping recreational fishing would be the most effective management strategy to support recovery. The adaptive management approach seems to be effective in evaluating management measures and is likely to have public support.

Element 22: The modelling research document provides information on the maximum human-induced mortality and habitat destruction that the species can sustain without jeopardizing its survival or recovery.

NEXT STEPS

All participants reviewed the draft summary bullets for the Science Advisory Report. ‘Fluvial migrants are very small portion of the population’ should be added to the fourth bullet.

A participant suggested adding a bullet about the greatest threats being fishing, sedimentation, habitat fragmentation, introduced salmonids, and climate change.

Participants indicated they liked the picture of the adult Athabasca Rainbow Trout on the hand as it provides scale.

The working papers will be updated based on the meeting discussions, and will be revised, as research documents, distributed for participants for a final review, approved and submitted for posting on the CSAS website. The science advisory report and proceedings (based on the

meeting discussions) will be drafted and sent to participants for their review before regional approvals and submission to CSAS for posting. Once all documents are published online the Chair will provide participants with links to the documents.

The Chair thanked meeting participants for their contributions and the meeting was adjourned.

REFERENCES CITED

Caskenette, A.L., and Koops, M.A. 2018. Recovery potential modelling of Rainbow Trout, *Oncorhynchus mykiss* (Athabasca River populations). DFO Can. Sci. Advis. Sec. Res. Doc. 2018/021. iv + 30 p.

Coker, G.A., Ming, D.L., and Mandrak, N.E. 2010. Mitigation guide for the protection of fishes and fish habitat to accompany the Species at Risk recovery potential assessments conducted by Fisheries and Oceans Canada (DFO) in Central and Arctic Region. Version 1.0. Can. Manuscr. Rep. Fish. Aquat. Sci. 2904: vi + 40 p.

COSEWIC. 2014. COSEWIC assessment and status report on the Rainbow Trout *Oncorhynchus mykiss* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. xi + 60 p.

DFO. 2005. A framework for developing science advice on recovery targets for aquatic species in the context of the *Species at Risk Act*. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/054.

DFO. 2007a. Revised protocol for conducting recovery potential assessments. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/039.

DFO. 2007b. Documenting habitat use of species at risk and quantifying habitat quality. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2007/038.

DFO. 2011. A complement to the 2005 framework for developing science advice on recovery targets in the context of the *Species At Risk Act*. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/061.

DFO. 2014. Guidance on assessing threats, ecological risk and ecological impacts for species at risk. DFO. Can. Sci. Advis. Sec. Sci. Advis. Rep. 2014/013.

MacPherson, L.M., Sullivan, M.G., Foote, A.L., and Stevens, C.E. 2012. Effects of culverts on stream fish assemblages in the Alberta Foothills. N. Am. J. Fish. Manag. 32: 480–490.

Park, D., Sullivan, M. Bayne, E., and Scrimgeour, G. 2008. Landscape-level stream fragmentation caused by hanging culverts along roads in Alberta's boreal forest. Can. J. For. Res. 38: 566–575.

Sawatzky, C.D. 2018. Information in support of a recovery potential assessment of Rainbow Trout, *Oncorhynchus mykiss* (Athabasca River populations). DFO Can. Sci. Advis. Sec. Res. Doc. 2018/022. vi + 162 p.

APPENDIX 1. TERMS OF REFERENCE

Terms of Reference

Recovery Potential Assessment – Rainbow Trout, *Oncorhynchus mykiss*
(Athabasca River Populations)

Regional Peer Review Meeting – Central and Arctic Region

December 8-9, 2016
Spruce Grove, Alberta (Teleconference and WebEx)

Chairperson: Kathleen Martin

Context

After the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses an aquatic species as Threatened, Endangered or Extirpated, Fisheries and Oceans Canada (DFO) undertakes a number of actions required to support implementation of the *Species at Risk Act* (SARA). Many of these actions require scientific information on the current status of the wildlife species, threats to its survival and recovery, and the feasibility of recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for consideration of peer-reviewed scientific analyses into SARA processes including recovery planning.

COSEWIC met in May 2014 and recommended that Rainbow Trout (Athabasca River Populations) be designated Endangered (COSEWIC 2014). This was their first assessment of Rainbow Trout (Athabasca River populations).

In support of listing recommendations for Rainbow Trout (Athabasca River populations) by the Minister, DFO Science has been asked to undertake an RPA, based on the national RPA Guidance. The advice in the RPA may be used to inform both scientific and socio-economic aspects of the listing decision, development of a recovery strategy and action plan, and to support decision making with regards to the issuance of permits or agreements, and the formulation of exemptions and related conditions, as per sections 73, 74, 75, 77, 78 and 83(4) of SARA. The advice in the RPA may also be used to prepare for the reporting requirements of SARA s.55. The advice generated via this process will update and/or consolidate any existing advice regarding Rainbow Trout (Athabasca River populations).

Objectives

To provide up-to-date information, and associated uncertainties, to address the following elements:

Biology, Abundance, Distribution and Life History Parameters

Element 1: Summarize the biology of Rainbow Trout.

Element 2: Evaluate the recent species trajectory for abundance, distribution and number of populations.

Element 3: Estimate the current or recent life-history parameters for Rainbow Trout (Athabasca River populations).

Habitat and Residence Requirements

Element 4: Describe the habitat properties that Rainbow Trout needs for successful completion of all life-history stages. Describe the function(s), feature(s), and attribute(s) of the habitat, and

quantify by how much the biological function(s) that specific habitat feature(s) provides varies with the state or amount of habitat, including carrying capacity limits, if any.

Element 5: Provide information on the spatial extent of the areas in Rainbow Trout's distribution that are likely to have these habitat properties.

Element 6: Quantify the presence and extent of spatial configuration constraints, if any, such as connectivity, barriers to access, etc.

Element 7: Evaluate to what extent the concept of residence applies to the species, and if so, describe the species' residence.

Threats and Limiting Factors to the Survival and Recovery of Rainbow Trout (Athabasca River populations)

Element 8: Assess and prioritize the threats to the survival and recovery of the Rainbow Trout (Athabasca River populations).

Element 9: Identify the activities most likely to threaten (i.e., damage or destroy) the habitat properties identified in elements 4–5 and provide information on the extent and consequences of these activities.

Element 10: Assess any natural factors that will limit the survival and recovery of the Rainbow Trout (Athabasca River populations).

Element 11: Discuss the potential ecological impacts of the threats identified in element 8 to the target species and other co-occurring species. List the possible benefits and disadvantages to the target species and other co-occurring species that may occur if the threats are abated. Identify existing monitoring efforts for the target species and other co-occurring species associated with each of the threats, and identify any knowledge gaps.

Recovery Targets

Element 12: Propose candidate abundance and distribution target(s) for recovery.

Element 13: Project expected population trajectories over a scientifically reasonable time frame (minimum of 10 years), and trajectories over time to the potential recovery target(s), given current Rainbow Trout population dynamics parameters.

Element 14: Provide advice on the degree to which supply of suitable habitat meets the demands of the species both at present and when the species reaches the potential recovery target(s) identified in element 12.

Element 15: Assess the probability that the potential recovery target(s) can be achieved under current rates of population dynamics parameters, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.

Scenarios for Mitigation of Threats and Alternatives to Activities

Element 16: Develop an inventory of feasible mitigation measures and reasonable alternatives to the activities that are threats to the species and its habitat (as identified in elements 8 and 10).

Element 17: Develop an inventory of activities that could increase the productivity or survivorship parameters (as identified in elements 3 and 15).

Element 18: If current habitat supply may be insufficient to achieve recovery targets (see element 14), provide advice on the feasibility of restoring the habitat to higher values. Advice must be provided in the context of all available options for achieving abundance and distribution targets.

Element 19: Estimate the reduction in mortality rate expected by each of the mitigation measures or alternatives in element 16 and the increase in productivity or survivorship associated with each measure in element 17.

Element 20: Project expected population trajectory (and uncertainties) over a scientifically reasonable time frame and to the time of reaching recovery targets, given mortality rates and productivities associated with the specific measures identified for exploration in element 19. Include those that provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.

Element 21: Recommend parameter values for population productivity and starting mortality rates and, where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts in support of the listing process.

Allowable Harm Assessment

Element 22: Evaluate maximum human-induced mortality and habitat destruction that the species can sustain without jeopardizing its survival or recovery.

Expected Publications

- CSAS Science Advisory Report
- CSAS Proceedings
- CSAS Research Document(s)

Participants

- Fisheries and Oceans Canada (Science, Policy and Economics and Species at Risk sectors)
- Government of Alberta
- Parks Canada Agency
- Other invited experts

References

COSEWIC. 2014. COSEWIC assessment and status report on the Rainbow Trout *Oncorhynchus mykiss* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 60 p.

APPENDIX 2. PARTICIPANTS

Kathleen Martin (Chair)	DFO, Science
Amanda Caskenette	DFO, Science
Chantelle Sawatzky	DFO, Science
Peter Rodger	DFO, Species at Risk
Colin Gyles	DFO, Policy (WebEx)
George Sterling	Government of Alberta, Retired
Michael Sullivan	Government of Alberta and University of Alberta
Mike Blackburn	Government of Alberta
Myles Brown	Government of Alberta
Kenton Neufeld	Government of Alberta

APPENDIX 3. AGENDA

Recovery Potential Assessment- Rainbow Trout (Athabasca River populations)

Regional Peer Review Meeting – Central and Arctic Region

Location: Spruce Grove, AB (WebEx & Teleconference)

December 8-9, 2016

Chairperson: Kathleen Martin

Day 1

9:00	Welcome and Introductions	Kathleen Martin
9:10	Purpose of Meeting	Kathleen Martin
9:20	SAR Recovery Planning Process	Peter Rodger
9:30	Provincial Recovery Planning	Michael Sullivan
10:15	Break	
10:30	Biology, Abundance and Distribution	Chantelle Sawatzky

- Species Description
- Distribution
- Taxonomic and Genetic Description
- Life History Diversity
- Physiology
- Feeding and Diet
- Reproduction
- Interspecific Interaction
- Special Significance
- Abundance and Trends
- Population Assessment

12:00	Lunch	
1:00	Habitat and Residence Requirements	Chantelle Sawatzky
2:30	Break	
2:45	Modeling Presentation and Discussion	Amanda Caskenette
3:45	Recovery Targets and Allowable Harm	Amanda Caskenette
4:30	End of Day 1	

Day 2

9:00	Recap of Day One	Kathleen Martin
9:15	Threats to Survival and Recovery	Chantelle Sawatzky
9:45	Overview of Threats Assessment Process	Chantelle Sawatzky
10:00	Threat Assessment	Chantelle Sawatzky

- Proposed Level of Impact
- Causal Certainty
- Threat Occurrence
- Threat Frequency
- Threat Extent
- Discussion

10:30	Break	
10:45	Current and Candidate Mitigation Measures	Peter Rodger

- Including Works/Projects/Activities Table

11:30	Additional Mitigation Measures	Chantelle Sawatzky
12:00	Lunch	
1:00	Sources of Uncertainty	Group
1:30	Summary Bullets for Science Advisory Report	Group
2:00	Review of Terms of Reference and Wrap-up	Kathleen Martin

End of Day 2