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Proceedings of the Pacific Scientific Advice Review Committee (PSARC) meeting for the assessment of scientific information in support of a Recovery Potential Assessment for the Misty Lake stickleback pair and the Salish Sucker

Compte rendu de la réunion du Comité d'examen des évaluations scientifiques du Pacifique (CEESP) sur l'analyse de l'information scientifique à l'appui de l'évaluation du potentiel de rétablissement de la paire d'espèces d'épinoches du lac Misty et du meunier de Salish

April 8, 2008 | **Le 8 avril 2008**

Pacific Biological Station
Nanaimo, BC

Station de biologie du Pacifique
Nanaimo, CB

Al Cass

Al Cass

Fisheries and Oceans Canada
Pacific Biological Station
3190 Hammond Bay Rd.
Nanaimo, BC V9T 6N7

October 2009 | **Octobre 2009**

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings 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.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d’analyses ou d’interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d’indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l’information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

Participants from Fisheries and Oceans Canada (DFO) Science, Habitat Management and Fisheries and Aquatic Management Sectors and external participants from the the ENGO community, the Province of British Columbia and the general public including invited biological consultants attended a PSARC review on April 8 2008 to assess and develop advice for the following working papers:

- Scientific information in support of a Recovery Potential Assessment (RPA) for the Misty Lake Stickleback pair (*Gasterosteus sp.*).
- Scientific information in support of a Recovery Potential Assessment for Salish Sucker (*Catostomus sp*.).

Comments received on the two working papers are presented in these Proceedings. Both papers were accepted subject to revisions. Products of the meeting will be a CSAS Research Document and a CSAS Science Advisory Report for each species.

SOMMAIRE

Le 8 avril 2008, des représentants des secteurs des Sciences, de Gestion de l'habitat du poisson et de Gestion des pêches et de l'aquaculture de Pêches et Océans Canada (MPO) ainsi que des participants externes des organisations non gouvernementales de l'environnement (ONGE), du gouvernement de la Colombie-Britannique et du public, y compris des experts biologistes invités, ont assisté à un examen tenu par le CEESP afin d'évaluer les documents de travail suivants et de formuler un avis connexe.

- Information scientifique à l'appui de l'évaluation du potentiel de rétablissement (EPR) de la paire d'espèces d'épinoches du lac Misty (*Gasterosteus* spp.).
- Information scientifique à l'appui de l'évaluation du potentiel de rétablissement (EPR) du meunier de Salish (*Catostomus* sp.).

Les commentaires formulés à propos de ces deux documents de travail sont exposés dans le présent compte rendu. Les deux documents ont été acceptés sous réserve que des révisions soient apportées. Les produits de cette réunion comprennent un document de recherche ainsi qu'un avis scientifique du SCCS pour chaque espèce.

INTRODUCTION

A peer review of scientific information in support of a Recovery Potential Analysis (RPA) for the Misty Lake stickleback pair and the salish sucker occurred April 8 2008 at the Pacific Biological Station, Nanaimo B.C. The Misty Lake Stickleback pair was designated Endangered by the *Committee on the Status of Endangered Wildlife in Canada* (COSEWIC) in November 2006 and a decision on whether to list the species pair under the Species at Risk Act (SARA) is pending. The reason for the COSEWIC Endangered designation is because each form *is part of an endemic, highly divergent species pair restricted to a single stream-lake complex on Vancouver Island with an extremely small area of occurrence. This species pair could quickly become extinct due to the introduction of non-native aquatic species or perturbations to the habitat. Proximity of this complex to a major highway and public access make an introduction likely. Logging activity in the watershed, as well as highway use and related maintenance, could impact habitat quality to some degree.*

The Salish sucker was designated Endangered by COSEWIC in November 2002. The species is listed under SARA. The reason for the COSEWIC designation is because the species *has a very restricted Canadian range within which populations are in decline as a result of habitat loss and degradation resulting from urban, agriculture and industrial development*. The Salish sucker (*Catostomus sp.*) has yet to be scientifically named as a species. Genetic and morphological data indicate it is distinct from the longnose sucker (*Catostomus catostomus*).

Working papers were prepared prior to the meeting and distributed to meeting participants. Formal reviews were presented at the meeting. Based on the reviews and discussion by meeting participants, conclusions and advice were formulated to inform the consultation and listing decision processes including recovery strategies in terms of species status (population and habitat considerations), threats (allowable harm), mitigation and recovery. It should be noted that the working papers were developed during the transition between the so-called Moncton protocol (2004) and subsequent revised DFO frameworks for developing RPAs and documenting scientific information in support of critical habitat identification:

http://www.dfo-mpo.gc.ca/csas/Csas/status/2007/SAR-AS2007_039_e.pdf
http://www.dfo-mpo.gc.ca/csas/Csas/status/2007/SAR-AS2007_038_E.pdf.

Participants from Fisheries and Oceans Canada (DFO) Science, Habitat Management and Fisheries and Aquatic Management Sectors and external participants from the the ENGO community, The Agenda is provided in Appendix 1. A list of participants is in Appendix 2.

DETAILED COMMENTS FROM THE REVIEWS

Scientific information in support of a recovery potential assessment for the Misty Lake stickleback pair
Brian Harvey

Working paper accepted with revisions

A summary of the working paper is in Appendix 3.

The author presented a summary of the working paper. He noted the poor data quality and high uncertainty in abundance estimates of the lake and stream forms and the complete lack of trend data. The main threats to persistence of the different forms are the potential for introductions of alien species, runoff from the Highway 19 rest stop, and changes in water quality that affect light transmission, dissolved oxygen and productivity. The author stressed that threats must be viewed not only in terms of their effect on population abundance, but also for their likelihood of causing hybridization between the lake and stream forms. Because the significance of the Misty Lake stickleback pair is its existence as a distinct pair, the risk of their becoming a genetically homogeneous single population is as important as the risk of simply losing individuals. The importance of habitat requirements thus becomes not only that which is needed to maintain abundance of the two forms, but also that which is needed to keep them from interbreeding and becoming a single hybridized species. The author reported that options for minimizing human activities and threats to habitat include expanding the ecological reserve to include the full length of the inlet streams; moving the rest stop to another stretch of Highway 19; aggressive signage and other means of raising public awareness concerning invasive species; ensuring that timber harvesting does not alter dissolved organic carbon in the wetland where the inlet enters the lake; instituting a precautionary captive breeding program to preserve the gene pool; and sharing information and research.

General discussion

Two formal reviews of the working paper were provided. Both reviewers acknowledged that the working paper provided a well-written account of the background material relevant for developing an RPA. In one reviewer's opinion, the persistence of the species pair really hinges on maintaining suitable conditions in the inlet stream, both to support that population and prevent hybridization with the lake form, as has happened in the outlet stream. The reviewer cited published evidence indicating the existence of substantial gene flow and a lack of differentiation for the outlet population (i.e. "hybrids"). The reviewer would have liked to have seen more focus on the inlet stream (land ownership, land use, flow, water quality etc.) as well as that provided to the lake. In the reviewer's opinion, if the inlet habitats became unusable for a short period of time because of low flows or changes in water quality and sticklebacks left the stream for the lake, the species pair might quickly disappear given their likely short lifespan. He further commented that measures to ensure population persistence of the inlet form should include efforts to ensure the integrity of the inlet stream catchment so that streamflow is maintained. In his opinion, any change in drainage caused by road construction (i.e. through forestry activities) in wetlands might alter the summer streamflows in the inlet stream which could impact habitat use and hybridization potential. In a comment on the protection afforded by the Misty Lake Ecological Reserve, the reviewer noted that while the reserve provides protection to the lake, the persistence of the species pair depends on the existence of the inlet stream, which is not protected to any extent by the reserve. More specific documentation on the status of riparian habitats on the inlet stream could also be provided since this is the area where forestry might affect the risk of hybridization. The reviewer pointed out that from Google Earth it appears that the inlet stream is currently in a forested area, although there are substantial newly cut areas in the inlet stream's catchment. He questioned whether the total percent cut (or cover <2 m high) has been established for the catchment as this would serve as a benchmark for forestry impacts.

The reviewer encouraged the author to explicitly distinguish between threats that are supported by data from those that are based on speculation or opinion. Particular questions raised by the reviewer in this regard asked whether there is any water quality data to support claims about colour and pH? Is there data on "a source of chemical runoff" or is this a speculated source of pollution? Is there supporting evidence for the section in the working paper on light transmission? Participants agreed that to comply with the DFO RPA framework, human-induced threats should be categorized in terms of risk (severity and likelihood of occurrence).

The reviewer made a number of additional and specific comments aimed at improving clarity in the working paper including:

- documenting the genetic basis for differentiation among the stream-lake forms;
- additional clarity in the description of the geography of the inlet stream (the term upper inlet was viewed as confusing);
- more detailed geo-referencing of the population range and habitat (latitude/longitude) with a better map and location of the ecological reserve;
- more specific information about the highway and rest stop lake access issue including risks from vehicle and toilet discharge, and the possibility of a vehicle crashing into the lake or streams at one of the crossings;
- estimating the magnitude of the fish removals for scientific research and the implication for population persistence. For example, published literature indicated the removal of 429 fish in one study. This might not be regard as "insignificant" especially given the small size of the habitats involved.

Participants acknowledged the comments of the reviewer and their useful contribution to the peer-review. The author agreed to address the reviewer's comments in revisions to the working paper.

Another reviewer complemented the author in the working paper's summary of the complex evolutionary problem that underlies the conservation status of the Misty Lake lake-stream stickleback pair. He stated that the working paper evaluates the status of the pair and emphasizes a point that is often lost in discussions of stickleback conservation: namely, that it is the existence of parapatric or sympatric forms that is important. Because of the complex balance between two genomes, much of the information that is traditionally used to evaluate the biological status of populations is difficult to obtain and not very informative. The author's emphasis on hybridization as a threat is unusual but critical to understanding this conservation problem. The reviewer commented that the working paper clearly states the purpose of a Recovery Potential Assessment (RPA) and with some minor deviations it followed the three-phase format of the Moncton Protocol; thus, there is a section on Current Status, Threats, and Scenarios for Mitigation and Alternatives. The review noted that as with most non-salmonid species, ecological and population (e.g., abundance and life history) data are limited; however, the amount of genetic data, and especially the linkage of genetic data to ecologically significant traits, is remarkable and in some ways compensates for the lack of traditional data. The working paper notes the data gaps but uses data from other stickleback studies to form a "relative risk assessment". Given the scientific importance of such cases, in the reviewer's opinion, this seemed to be a reasonable course.

Participants acknowledged that the main threat to the persistence of the species pair is habitat related, noting that it is the contrast in habitats that ensures the long-term persistence of the stream-lake forms. There was no information presented to assess the relationship between habitat characteristics and biological function related to persistence of the pair to identify alternative habitat configurations that would ensure a high probability of population persistence apart from the whole lake and inlet/outlet streams and suitable riparian habitat. It was pointed out that a member of the Recovery Team was preparing an analysis of critical habitat for both the parapatric (Misty Lake) stickleback pair and sympatric stickleback pairs in BC lakes[1].

It was noted that the threat of alien species introduction(s) could have catastrophic consequences on pair population persistence through habitat destruction (or population mortality). This has been hypothesized to have caused hybridization and collapse of the sympatric Enos Lake pair as a result of the destruction of macrophyte habitat after the introduction of crayfish. Alien species introduction is considered the highest potential risk in terms of severity and likelihood of occurrence. The main uncertainty for Misty Lake relates to the degree of protection already afforded by the ecological reserve, which prohibits fishing and therefore motivation for the introduction of alien game fish.

The implications of forestry practices are unknown but it is recognized that most drainages have been logged for several decades and the populations have nevertheless persisted. It is not known whether populations fortuitously persisted in the face of past adverse logging practices due to prevailing favorable natural productivity regimes. Although forest practices are better now compared to the previous 60 years, there remains high uncertainty in future stickleback productivity particularly given climate change scenarios. Participants and a reviewer commented that the impact of highway run-off is perhaps more speculative but the probability of runoff is high, as is uncertainty with regard to its consequences, which depend on amount, composition and location. Water extraction, as pointed out by the author, can raise temperatures and eliminate nesting habitat, but the volume of water extraction level is low. The impact of scientific study in unknown but could impact population mortality and not habitat. The level of acceptable removed through scientific collection will need to be assessed through an evaluation of allowable harm in revisions to the working paper.

One participant voiced concern about the potential “ecological” consequences of the collapse of the species pair should that occur, apart from SARA implications. Participants noted that the ecological function of the pair complex has not been evaluated. Specifically, participants acknowledged that there is high uncertainty in the range of ecological functions that may be lost as a consequence of reverse evolution through loss of the pair from hybridization.

[1] A subsequent PSARC assessment of a working paper by Todd Hatfield was undertaken in October 2008 entitled “Identification of Critical Habitat for sympatric stickleback species pairs and the Misty Lake stickleback species pair”.

Conclusions and advice

- The working paper was accepted subject to revisions.

- Revisions should clarify the distinction between factors and threats that are supported by data from those that are based on speculation or opinion.

- Revisions should document threats using risk-based language that categorize threats in terms of severity and likelihood of occurrence.

- Recognizing the severe data limitations of Misty Lake stickleback and the wide range on productivity estimates for different stickleback populations, revisions should attempt to quantify estimates of allowable harm that would result in a high likelihood of population persistence.

- There remains high uncertainty in abundance estimates of the stream and lake forms. There is no evidence that the current population has trended from historical levels.

- The greatest threat in terms of severity and likelihood of occurrence is the potential for the introduction of alien species given the high degree of public access to the lake from Highway 19 and the proximity of the rest stop. Revision should list potential alien species and information on proximity (likelihood of occurrence).

Scientific information in support of a recovery potential assessment for Salish sucker
Brian Harvey

**Working paper accepted with revisions*

A summary of the working paper is in Appendix 3.

The author provided a brief summary of the working paper. He emphasized several points related to information required for the RPA (status, threats and mitigation). He pointed out that the Salish sucker is divergent from the longnose sucker found in western Washington and the lower Fraser Valley. Although genetically distinct from the longnose sucker, it is not yet recognized as a separate species; attesting to the high uncertainty at the basic knowledge base of the Salish sucker. The scientific information for Salish sucker is limited to a few peer-reviewed papers and unpublished reports, and first-hand experience remains confined to a small number of experts. There are insufficient data to estimate population parameters useful for population viability analysis such as mortality and recruitment rates. The author noted that the Salish sucker is presently confined to ten rivers in the Fraser Valley BC. and that it has been extirpated from at least one watershed (Little Campbell River). The distribution is concentrated within a few reaches with a preference for deep pools. The Fraser Valley is located in a region of high urban and agriculture development, consequently, the main cause of human-induced harm is the result of urban and agricultural impacts. Hypoxia from pollution from agricultural fertilizers and manure is the most serious threat. Habitat loss, fragmentation and degradation lead to sedimentation and isolation of sub-populations. Mitigation measures to reduce the treats of human impacts include a nutrient management plan (2001), restoration of riparian habitat, instream flow and groundwater extraction planning.

General Discussion

Two formal reviews were solicited prior to the meeting and a third participant was given an opportunity to present an unsolicited review.

Reviewers acknowledged that there is little quantitative information on abundance or trends. Further, there is a lack of precise information on the causes of declines that may have occurred, or data on the linkages between the identified threats and population responses. A reviewer commented that the working paper is a brief overview of status, threats and remedial actions drawn from the recovery strategy and supporting information. The overall conclusion that there is a limited amount of habitat for this species, and that habit is under threat from human development, thus jeopardizing the species, seems reasonable on the basis of the information provided. Participants acknowledge the lack of data to undertake a standard Population Viability Analysis and to advise on implications of incidental allowable harm for the sucker populations.

A reviewer commented that the calculation of recovery targets in the working paper is based on data that is not explicitly presented in scientific literature or the recovery plan, which makes their evaluation somewhat difficult. It should be stated that it is assumed that densities currently observed ("realistic sucker density of 0.05 /m^2") is in fact an upper potential limit to the population imposed by the amount of physical habitat. If populations were not limited by physical habitat, but by some other threat (invasive species, toxic chemicals etc.) the carrying capacity of the current habitat might be higher than assumed if these impacts could be remediated.

There was considerable debate over the scientific basis for advising on the function of specific riparian widths along Salish sucker streams. Participants acknowledged that the trade-off between specific riparian buffer widths and their biological value to suckers has not been evaluated. The recommended riparian widths for Salish sucker were developed in Pearson (2007[2]) and is based on the Riparian Areas Regulation developed for salmonids. Participants recognized this knowledge gap but supported the recommendation of the Recovery Team and the documentation in Pearson (2007).

One reviewer noted that the use of the Minimum Viable Population (MVP) estimates from Reed et al. (2003) should be qualified. He elaborated that the values presented in that publication are not empirically determined, but reflect model output of a series of case history simulations. The value used in the working paper (7,300) is the mean population size (and in effect habitat carrying capacity) for populations to have a less than 1% risk of extinction in 40 generations. It was pointed out that Reed et al. note that raising the risk threshold to 10% lowers the mean population size to 4,700. Participants acknowledged that the calculations of Reed et al. are for individual populations. It was noted that the risk of a species going extinct in the same time frame, is lower when there are multiple, somewhat independent, populations within the species range. One reviewer questioned whether young suckers are displaced or redistributed after hatching like young salmon. Participants agreed that while there are considerable knowledge gaps in setting MVPs and little confidence in the capacity estimates for individual populations, the focus should be on habitat issues (threats and remediation) rather than on the numerical targets.

[2]Pearson, M.P. 2007. An assessment of potential critical habitat for Nooksack dace (Rhinichthys cataractae ssp.) and Salish sucker (Catostomus sp.). DFO Can. Sci. Advis. Sec. Sci. Res. Doc. 2007/058. 29 pp.

One reviewer was concerned that the need to identify critical habitat under SARA should be considered in a broader context for recovery and restoration. In his opinion, the long-term sustainability of a population of fish, such as the one considered in the working paper, depends on maintaining a configuration of ecological functions and conditions within certain bounds. The maintenance of a stream system such that supports a species goes beyond critical habitat, particularly habitat which is considered, in a structural sense, separate from the rest of the system. Water quality may be functionally critical but not spatially critical even though it may change along the length of a stream. Quality of water may be set by a number of separate, different and cumulative effects across a watershed. For example, water quality in streams near those containing Salish suckers is compromised by widespread and combined impacts. The Brunette River is contaminated with metals, fecal coliforms, and gasoline. Tributaries to Boundary Bay are contaminated with agricultural nutrients, coliforms, and Copper and Cadmium. Low oxygen levels also occur in these streams. The impact of multiple and potentially cumulative effects is implicit in Pearson (2007) who presented a table that itemized seven things that influence the survival of Salish suckers. The reviewer noted that Pearson does not list ground water condition as a factor, but concluded it also is critically involved in stream habitat function. Five of the factors listed, e.g., over application of fertilizer, drainage projects, riparian vegetation removal, excessive water withdrawal, and excessive sediment release may be non-point and or multiple in sources. They may also be cumulative in their impacts. Because of this, sustainability of a species must involve configurations of functionally interconnected habitat elements, critical functions and limits within such groups.

A reviewer commented about the time frames in which recovery and recovery potential are to be considered. He stated that it may be possible to make some short term gains in habitat protection which benefit a species. Given the long term growth prospects for the lower Fraser River area, it may be problematic to maintain stream ecosystem habitats such that fish populations survive. The reviewer cited an anonymous report indicating that in the lower Fraser River valley from Popkum Creek westward to the tip of Point Grey and across Richmond, all streams were indicated as endangered, threatened, or lost by 1998. The reviewer cited another report that projected human population of the Fraser River basin to be about three million by 2000. Most of these people and their activities were predicted to, and indeed do, occur in the lower Fraser valley. The reviewer noted that human numbers, activities, and impacts are currently dense where populations of Salish sucker are found and that such numbers and activities will continue to go up. By 2100, human numbers in the Seattle, Vancouver, lower Fraser valley, and east coast Vancouver Island, are projected to reach four times present levels.

A reviewer commented that the threats listed in the working paper all seem plausible but noted that there is a lack of quantitative information on the risk of each threat (likelihood, consequence and uncertainty) and a failure to acknowledge the degree of evidence or data in their support. For example, there are only unpublished data on hypoxia in the supporting documents. Direct supporting evidence that the cause of hypoxia was inorganic fertilizer use (as opposed to organic inputs and biological oxygen demand) was not identified in the working paper. It would seem that identifying the cause of hypoxia precisely would be of great assistance to recovery action planning. A similar comment applies to the discussion of toxic chemicals, which appears to be speculative.

Reviewers were concerned that the role of invasive species as a threat was downplayed in the paper. The comment in the working paper that invasive species have coexisted with suckers for a decade and are thus only a “moderate concern” seems at odds with the observation that suckers have “coexisted” with agriculture for 150 years yet it is a large concern. The role that largemouth bass and others will have in the next few years is not known given their recent expansion in the Fraser valley region.

It was noted that Nooksack dace and Sucker Recovery Strategies were linked and coordinated, but this was not discussed in the paper. A reviewer pointed out that the same Recovery Team members were on both the Nooksack dace and Salish sucker recovery teams and that the coordination in recovery of the two species was being done.

A number of other specific comments from the reviewers were presented and that the author agreed to consider in revision to the working paper:

- It was pointed out that the tables in the working paper showing abundance and carrying capacity are inconsistent as abundance was often greater than the reported capacity. The author acknowledged the error and agreed to correct the table in revisions to the working paper.

- A reviewer commented that during low prolonged flow periods water quality and temperature may change (dramatically) along the length of the streams, and also from one season to another. Depending on the patterns of land use and water sources, patterns of temperature and water quality may differ in different stream systems.

- A reviewer questioned to what extent is the continuity of flow, or wetted habitat, broken along the lengths of the different streams? If such information was available, it could help to understand the recovery potential of populations. This assumes that the fish do move to some extent.

- A reviewer suggested that the impacts of beavers should be considered more of a beaver management issue rather than a threat as characterized in the working paper. Presumably, there would have been far more beavers historically had we not trapped them all out in the 1800s.

Conclusions and advice

- The working paper was accepted subject to revisions.

- Current estimates of abundance of Salish sucker are highly uncertain, do not cover all of the ten known populations and are insufficient to describe trends in abundance.

- The review of scientific information to support Critical Habitat identification indicates the importance of all reaches in streams currently containing populations with more than 50 m of continuous pool and greater than 70 cm depth at low flow. All aquatic habitat and riparian reserve strips of native vegetation on both banks for the entire length of the reach is included. The importance of mature forest in sucker riparian reaches to provide effective ecological function and protection to instream habitat is emphasized.

- All estimates of current habitat capacity within individual watersheds are below the amount required to support 7000 mature individuals based on guidelines for the Minimum Viable Population (MVP) needed to ensure (with 99% probability) the long-term persistence of an isolated vertebrate population. Only 1 population (Chilliwack Delta) appears to have sufficient habitat capacity to support 4700 adults, the MVP for a 90% probability of long-term persistence.

- The estimates of habitat capacity are highly uncertain, and populations in different streams might not be as isolated from one another as the MVP guidelines assume. In any case, restoring habitat will clearly be an important strategy to achieve the survival or recovery of the Salish sucker.

- The geographic location of potential critical habitat for the known populations of Salish sucker is identified in Pearson (2007[2]). Relationships between buffer width and maintenance of stream ecological function have not been developed that are specific to suckers.

- Recommended riparian buffer widths for potential critical habitat were established using buffer-width ecological function relationships developed for salmonids, as described in the Riparian Areas Regulations methodology. Generalized buffer width-ecological function relationships developed for salmonids can be used for calculating biological and socio-economic tradeoffs until such time as research targeted at developing specific relationships for sucker are undertaken. This would help geo-reference critical habitat in the Recovery Plan required under SARA based on biological and socio-economic trade offs.

- Hypoxia, habitat destruction and habitat fragmentation are the most important factors jeopardizing survival or recovery. Population recovery depends on halting and reversing environmental degradation of Salish sucker habitat. The probability of recovery will be low if the impact on habitats from agricultural, industrial and urban development is not addressed through habitat restoration, particularly in the presence of projected increases in human population growth in the Fraser Valley.

Appendix 1. Agenda

PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE
RECOVERY POTENTIAL ASSESSMENTS

APRIL 8, 2008
SEMINAR ROOM, PACIFIC BIOLOGICAL STATION
NANAIMO, B.C.

TUESDAY – April 08, 2008	
Introduction and procedures	9:00 – 9:15
Recovery Potential Assessment for the Misty Lake Stickleback Pair	9:15 – 12:00
Lunch Break	*12:00 – 1:00*
Recovery Potential Assessment for Salish Sucker (*Catostomus sp.)*	1:00 – 4:30

Appendix 2. List of Attendees

Name	**Affiliation**
Hartman, Gordon	Emeritus, DFO
Harvey, Brian	Consultant
Druce, Courtenay	DFO
Brown, Tom	DFO
O'Grady, Liane	DFO
Schubert, Neil	DFO
Schweigert, Jake	DFO
Kotyk, Mel	DFO
Wood, Chris	DFO
Labonté, Françoise	DFO
Webb, Allison	DFO
Bradford, Mike	DFO
Rosenfeld, Jordan	Province of BC

The reviewers for the PSARC paper presented at this meeting are listed below. Their assistance is invaluable in making the PSARC process work.

Hartman, Gordon	Emeritus, DFO
Bradford, Mike	DFO

Appendix 3. Working Paper Summaries

Scientific information in support of a recovery potential assessment for the Misty Lake stickleback (Gasterosteus sp.) pair

Brian Harvey

Misty Lake drains into the Keogh River on northern Vancouver Island. The lake supports two forms of stickleback, a small coastal fish found in both fresh and salt waters: one form lives in the lake, the other in the inlet and outlet streams. It is one of only three clearly defined lake-stream pairs in Canada and has been studied for decades as a model for understanding the evolutionary process. The Misty Lake stickleback pair was designated Endangered by COSEWIC in 2006 because it is an endemic, highly divergent species pair restricted to a single lake-stream complex. It is presently being considered for listing under the Species At Risk Act (SARA). The B.C. Conservation Data Centre designates the species "S1" (Critically Imperiled and Red-listed). It was afforded some protection from creation of the Misty Lake Ecological Reserve in 1996.

There are insufficient data to describe the species' potential critical habitat (PCH). Any alteration of PCH should consider the biological implications in a risk management context given the uncertainty in the data. The degree to which the species penetrates into inlet and outlet streams requires further study. Given the lack of knowledge of abundance or trends, it is not presently possible to establish population or distribution targets.

The main human-caused threats to the Misty Lake stickleback are introduction of alien species, runoff from the Highway 19 rest stop, and changes in water quality that affect light transmission, dissolved oxygen and productivity. All must be viewed not only in terms of their effect on population numbers, but also for their likelihood of causing hybridization between the lake and stream forms. Hybridization is the reason for the collapse of the Enos Lake stickleback pair on southern Vancouver Island. Because the main importance of the Misty Lake stickleback pair is its existence as a pair, the risk of their becoming a genetically homogeneous single population is as important as the risk of simply losing individuals. PCH thus becomes not only that which is needed to maintain abundance of the two forms, but also that which is needed to keep them from interbreeding.

Options for minimizing human activities and threats to habitat include expanding the ecological reserve to include the full length of the inlet streams; moving the rest stop to another stretch of Highway 19; aggressive signage and other means of raising public awareness concerning invasive species; ensuring that timber harvesting does not alter dissolved organic carbon in the wetland where the inlet enters the lake; instituting a precautionary captive breeding program to preserve the gene pool; and sharing information and research.

Scientific information in support of a Recovery Potential Assessment for Salish Sucker (Catostomus sp.)

Brian Harvey

The scientific information in support of a This Recovery Potential Assessment provides technical advice to the Minister of Fisheries and Oceans concerning the amount of allowable harm to Salish sucker, which is listed as Endangered (Schedule 1) under the Species at Risk Act (SARA). The suckers are a large freshwater family of fish that includes the widely distributed longnose sucker *Catostomus catostomus*. Salish sucker is a divergent form of longnose sucker found in western Washington and the lower Fraser Valley, B.C. It is genetically distinct but not yet recognized as a separate species. Salish sucker have been extirpated from at least one watershed in the Fraser Valley (Little Campbell River), and are presently confined to ten others. In these rivers, its distribution is concentrated within a few reaches. Most home ranges are small.

Small, short-lived and early-maturing, Salish sucker have an opportunistic life history that may facilitate population recovery if disturbances are short-term and confined to small areas. Salish sucker are most commonly found in marshes and beaver ponds where water is deeper than 70 cm. They require deep water with access to spawning riffles and shallower nursery habitat. Potential critical habitat is defined for all reaches currently containing populations of Salish sucker as reaches with more than 50 m of continuous pool that is deeper than 70 cm at low flow. Potential critical habitat includes riparian reserve strips on both river banks. Most of the potential critical habitat has been mapped and presently includes 141.5 km of surveyed channel (approximately 50% of the total surveyed).

Based on limited data to 2004, estimated mean abundances were well below the minimum viable population sizes commonly accepted as a 'rule of thumb' for vertebrates when abundance data are weak. If all potential critical habitat were occupied at a density of .05 fish/m^2, the estimated carrying capacity ranges between 800 and 7,000 fish per stream, also below the accepted vertebrate minimum. This is a strong argument for preserving as much critical habitat as possible.

The main cause of human-induced harm is agricultural and urban development in the Fraser Valley. Hypoxia, which can result mainly from pollution by agricultural fertilizers and manure, is the most serious threat. Habitat loss, fragmentation and degradation lead to sedimentation and isolation of sub-populations.

A Nutrient Management Planning Strategy developed by government agencies and agricultural producers identifies strategies whereby farms can achieve an acceptable nutrient balance and reduce the risk of hypoxia in Salish sucker habitat. Reducing habitat destruction and fragmentation can be achieved using existing regulatory mechanisms to develop reach-specific best management practices, as well as through restoration of damaged habitat. Public awareness materials and a participatory approach will be crucial. Minimum instream flow prescriptions should also be developed, and the licensing of groundwater withdrawal considered.

The opportunity exists to eliminate harmful activities in sections of the watersheds where potential critical habitat is damaged. Portions of actively farmed riparian land could be removed from production. A model is the Conservation Reserve Enhancement Program (CREP), a land retirement program administered by the United States Department of Agriculture. In Canada, similar objectives can be achieved through land trusts, some of which operate in a way analogous to CREP. The BC Environmental Farm Plan initiative also offers some immediate opportunities for protecting fish habitat.

Appendix 4: Terms of Reference

Recovery potential assessment under SARA for:
Misty Lake Stickleback designated by COSEWIC as "Endangered"
and
Salish Sucker designated by COSEWIC as "Endangered"

April 8, 2008
Pacific Biological Station, Nanaimo BC,
Chair: Alan Cass

Background

In 2002, the Committee on the Status of Endangered Wildlife in CANADA (COSEWIC) has recommended that Salish Sucker in British Columbia be listed as "Endangered" under Canada's *Species at Risk Act* (SARA).

In 2006, the Committee on the Status of Endangered Wildlife in CANADA (COSEWIC) has recommended that Misty Lake Stickleback in British Columbia be listed as "Endangered" under Canada's *Species at Risk Act* (SARA).

Canada's *Species at Risk Act* (SARA) requires that habitats '*necessary for the survival or recovery of listed species*' be identified to the extent possible and proposed for designation (and protection) as critical habitat. For aquatic species, like Salish sucker and Misty Lake stickleback, SARA prohibits the destruction of any part of designated critical habitat wherever it occurs.

SARA is intended to protect species at risk of extinction in Canada, and promote their recovery. SARA includes prohibitions on killing, harming, harassing, capturing or taking individuals of species listed as threatened or endangered on schedule 1. SARA also prohibits sale or trade of individuals of such species (or their parts), damage or destruction of their residences, or destruction of their critical habitat. SARA also specifies that a **recovery strategy and action plan** must be prepared for species that are listed as threatened or endangered, or a management plan must be prepared for species of Special Concern.

The provisions of these recovery strategies and action plans will have to address all potential sources of harm, including harvesting activities, in a way that do not jeopardize the survival and recovery of the populations concerned, and promote recovery, where feasible and socially and economically desirable.

A Recovery Strategy and Action Plan must include a description of recovery goals for population size and distribution. The designation of recovery targets and times for species listed under SARA is not exclusively a scientific issue, but should be informed by science advice. In that context scientific guidelines have been developed for the biological properties of suitable **recovery targets** and **recovery times** (http://www.dfo-mpo.gc.ca/csas/Csas/status/2005/SAR-AS2005_054_e.pdf).

A Recovery Strategy and Action Plan must also address **all sources of human-induced mortality**, including commercial or subsistence harvesting and bycatch, and threats to habitat. SARA allows exemptions to the prohibitions on harm when specific activities are permitted in the recovery plan. However, activities causing harm can be included in the Recovery Plan only when there is high confidence that the recovery goals can be met at the levels of those activities specified in the Recovery Plan. SARA also requires consultation with Canadians who may be affected economically, socially, or culturally by the provisions of a Recovery Strategy and Action Plan, or otherwise are interested in the listing of the species. These consultations also require information on levels of human activities that permit recovery goals to be met. These are usually presented as different scenarios of how human induced mortality is apportioned among sources, from which economic impacts are estimated. Therefore, if activities such as bycatches, subsistence fisheries, or undertakings affecting critical habitat are to continue after designation, levels of these mortality sources consistent with achieving the recovery goals have to be established. If economic, social, and cultural impacts are to be assessed, alternative extents and durations of necessary restrictions on status quo activities also have to be evaluated in the Recovery Potential Assessments.

Thus, for different assumptions about levels of the major sources of mortality and habitat quantity and quality, including the status quo, the Recovery Potential Assessment should include a scientific evaluation of the likelihood that the recovery goals will be achieved in biologically reasonable time frames. Where mitigation measures are expected to reduce the harm caused by an activity, the effectiveness of the **alternative mitigation measures** should also be assessed.

Specific Objectives

To inform decisions relating to listing and recovery planning for Salish sucker, and Misty Lake stickleback. The meeting will review analyses prepared to meet the objectives stated below.

Phase I: Assess Current Species Status

1. Evaluate present species status for abundance and range
2. Evaluate recent species trajectory for abundance and range
3. Estimate **amount of critical habitat** currently available (using critical habitat descriptions defined in the pre-COSEWIC RAP, and considering information in COSEWIC Status Report).
4. Evaluate expected **population and distribution targets** for recovery, according to DFO Guidelines
5. Evaluate expected **general time frame for recovery to the target**, assuming only natural mortality, and estimate how time to recovery targets would increase at various levels of human-induced mortality
6. Evaluate **Residence Requirements**, if any.

Phase II: Scope for Human – Induced Mortality

7. Evaluate **maximum human-induced mortality** which the species can sustain without jeopardizing survival or achievement of recovery targets for the [species][population]
8. **Quantify** to the extent possible the magnitude of each major potential source of mortality/harm identified in the pre-COSEWIC RAP, and considering information in COSEWIC Status Report.
9. **Aggregate total mortality** / harm attributable to all human causes and contrast with that determined in tasks 5 and 7.
10. Evaluate to the extent possible the likelihood that critical habitat is currently limiting to the species' abundance or range, or would become limited before the recovery goals were reached.

11. Inventory to the extent possible the **threats to critical habitat**, and estimate their current levels of impact on habitat quantity and quality

Phase III: Scenarios for Mitigation and alternative to activities

To the extent possible with the information available,

12. Develop an inventory of all reasonable **alternatives to the activities** in tasks 8 and 11, but with potential for less impact. (e.g. changing gear in fisheries causing bycatch mortality, relocation of activities harming critical habitat)
13. Develop an inventory of all feasible measures to minimize the impacts of activities in task 8 and 11.
14. Document the expected harm after implementing **mitigation measures** as described in 13 and determine whether survival or recovery is in jeopardy after considering cumulative sources of impacts
15. Repeat 14 for some alternative distributions of human-induced mortality among the sources of harm identified in task 8 and 11.
16. 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 of listing the [species/population].

Working papers

Itemize the specific working papers that have been requested. One or more papers will be needed on, as a minimum:

- recovery goals (abundance, distribution, and timeframes)
- mortality sources and levels
- amount of and threats to critical habitat
- modelling of recovery scenarios

Output of the meeting

A Science Advisory Report (SAR), a Proceedings, and one or more Research Documents of the Canadian Science Advisory Secretariat (CSAS) will be produced for each species (sometimes separate SARs may be produced for different populations of a species).

The scientific information/advice issued from this meeting might be used by people who are involved in the recovery process for the [*give species*]. This information will also be used in further steps of the SARA process (e.g. socio-economic studies) and will inform the Minister who will have to decide whether or not those populations should be added to the legal list. The conclusions regarding biologically-based recovery targets and timeframes may also be useful for those who are involved in the recovery process for other species.

Participation

DFO experts from Science, FAM, OHM,
Experts nominated from British Columbia and holders of First Nations,
Invited participants from academia, relevant industries, ENGOs, and community organizations