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Pacific Region

Framework for Reviewing and Approving Revisions to Wild Salmon Policy Conservation Units

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

In 1998, Fisheries and Oceans Canada (DFO) announced a new direction for Pacific salmon fisheries, stating that conservation of Pacific salmon stocks was its primary objective and would take precedence in managing the resource (DFO, 1998). The first published list of Conservation Units (CUs) was for Fraser River Chinook Salmon (*Oncorhynchus tshawytscha*) (Candy et al. 2002). With the adoption of the Wild Salmon Policy (WSP) for the Pacific Region of Canada in 2005, methods for identifying CUs and a list of CUs were created for five of the Pacific salmon species (Holtby and Ciruna 2007). This list was the result of much research and consultation. Since the development of the 2007 list, adjustments have occurred as new information has become available, as CU-specific biological expertise and aboriginal expertise has been sought, and as historic information has been re-examined.

There has been recognition of a need for a formalized process for reviewing and updating CUs which could guide the review process in a standardized and consistent manner. Such a process would also resolve various issues such as establishing a repository for all information related to and used to define CUs and establish a process for communicating change. The need for such a process has also been precipitated by the retirement of Dr. Holtby, a DFO scientist and original architect of the CU list, who had maintained the information and data used to define CUs. This work aligns with a key element of the WSP Implementation Plan (DFO 2018) through the establishment of a process to review and approve revisions to CUs (Activity 1.1).

This paper proposes a framework to review and approve changes to CUs. It also proposes guidelines for data management, governance of the authoritative list of CUs and their attributes, and communication both within DFO and to the public.

1. INTRODUCTION

The Wild Salmon Policy (WSP) (2005) for the Pacific Region of Canada defines a Conservation Unit (CU) as a group of wild salmon sufficiently isolated from other groups that, if lost, is very unlikely to recolonize naturally within an acceptable timeframe such as a human lifetime or a specified number of salmon generations. After the WSP was adopted in 2005, methods for identifying CUs were refined and a list of CUs was developed for five of the Pacific salmon species (Holtby and Ciruna 2007). Each CU consists of one or more spawning sites considered to represent a significant component of the biodiversity of the species (Holtby and Ciruna 2007).

The CU list published in 2007 was the result of much research and consultation stimulated in part by DFO's New Direction for Canada's Pacific Salmon Fisheries (DFO 1998) which stated that conservation of Pacific salmon stocks was its primary objective and would take precedence in managing the resource. Shortly thereafter, the 2002 approval of Canada's Species at Risk Act (SARA) gave legal status to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) that could recommend protection of biological units other than taxonomic species (Irvine et al. 2005). The first published CU list was for Fraser River Chinook Salmon (*Oncorhynchus tshawytscha*) (Candy et al. 2002). CUs were reviewed at various times during the six years leading to the release of the 2005 WSP (Irvine 2009) and in particular during consultations in the fall/winter of 2006 when DFO staff visited numerous communities and First Nations with putative CU lists and maps showing known or suspected freshwater distributions (J.R. Irvine, DFO, Nanaimo, British Columbia, pers. comm.). As a result, there were some significant changes made to the previous lists, such as in Haida Gwaii, which were included in Holtby and Ciruna (2007).

Since Holtby and Ciruna (2007), the CU list has continued to develop. Adjustments have occurred as new information has become available, as CU-specific biological expertise and aboriginal expertise has been sought, and as historic information has been re-examined. CU modifications were first formalized through two Canadian Science Advisory Secretariat (CSAS) review processes, first for Fraser River Sockeye Salmon (*O. nerka*) CUs (Grant et al. 2011), followed by southern British Columbia (BC) Chinook Salmon CUs (DFO 2013).

Both Grant et al. (2011) and DFO (2013) identified several CU modifications to Holtby and Ciruna (2007) including the creation of new data management categories, which corrected errors in site allocation to the appropriate CU, and merged CUs. However, the framework for defining CUs remained the same. For Fraser River Sockeye Salmon, a standardized naming convention established by Holtby and Ciruna (2007) was largely maintained for CUs; however, some changes to the names occurred to correct errors and to incorporate updated expert information (Grant et al. 2011). For southern BC Chinook Salmon, a standardized naming convention for CUs, reflecting known life history characteristics and the most common age of mature spawners was also envisioned but not included in DFO (2013). It was later adopted on an *ad hoc* basis and the names of 35 CUs in southern BC were revised. These changes have been made both in the New Salmon Escapement Data System (NuSEDS) and to the authoritative list of CUs.

The two CU review processes that have occurred revealed a need for detailed knowledge on the CU review process, local CU-specific knowledge, and how to combine these two sources of information when considering future updates. There has also been recognition of a need for a formalized framework for reviewing and updating CUs which could guide the review process in a standardized and consistent manner and resolve various issues such as establishing a repository for all information related to and used to define CUs and a process for communicating

changes. The need for such a framework has also been precipitated by the retirement of Dr. Holtby, a DFO scientist and original architect of the CU list, who had voluntarily maintained the information and data used to define CUs. Finally, a key element of the WSP Implementation Plan (DFO 2018) recognizes the need for this work, and includes the establishment of a framework for reviewing and approving revisions to CUs (Activity 1.1).

2. OBJECTIVES

The objectives of this working paper are to:

1. Provide guidelines on how to review data and information used to characterise CUs;
2. Propose a procedure, including roles and responsibilities, methods, and frequency on which to review CUs;
3. Provide recommendations regarding governance of the authoritative list of CUs and their associated attributes and data;
4. Propose how information and data used to characterize and define CUs can be maintained and;
5. Suggest how changes can be communicated within DFO and to the public.

This working paper will not prescribe an approach to assessing CU structure as this has been completed in Holtby and Ciruna (2007), but rather a framework for reviewing and approving revisions to CUs. Revision of CU structure will take place only when new analyses indicate that biodiversity within a species should be partitioned differently. This should occur relatively infrequently once the errors of site location, life history designation, etc. that occurred in the initial definition of CUs have been rectified. Biological status assessments of CUs are a separate process conducted to routinely track the abundance and distribution of spawners over time compared against established benchmarks; revisions to CUs should precede biological status assessments.

A glossary of frequently used terms and acronyms is provided in Appendix I; definitions of data management categories are provided in table 2.

3. SCALE OF THE ISSUE

The information used to support Holtby and Ciruna (2007) is held in an Excel file created by Dr. Holtby called the “Decoder Ring” (see Section 5.1 for a description of the file). The file contains definitions for each data management category presented in table 1; definitions and examples are provided in table 2. These categories and their definitions have not been formally reviewed.

Not all of the data management categories identified in table 1 refer to CUs. “Deprecated” and “deleted” categories are not CUs (see table 2 for definitions); “bins” are not necessarily CUs but rather a category to hold sites that for some reason are not assigned to a CU. There may be situations, however, where they refer to CUs. Reasonable uses of the bin category are: a) sites where migratory dropouts are counted that cannot be reliably assigned to CUs; b) sites where transplanted fish, perhaps in locations of an extinct CU, are enumerated to confirm that a persistent spawning population has been established; and c) sites where transplanted fish are enumerated that are outside the ecotypical zone of the source fish and where no claim to recreating an extinct CU has been made. There are currently 13 bins plus an additional 62 bins which have been identified as requiring verification (VREQ) (all of which are Sockeye Salmon) and two deprecated bins. The definition of bins is provided in table 2.

The majority of CUs are lake-type Sockeye Salmon (n=174) followed by Chinook Salmon (n=78), Chum Salmon (*O. keta*) (n=45), Coho Salmon (*O. kisutch*) (n=44), river-type Sockeye Salmon (n=19) and odd year Pink Salmon (*O. gorbuscha*) (n=19) and even year Pink Salmon (n=13) (table 1).

Since 2011, updates to CUs have been provided for Fraser River Sockeye Salmon (Grant et al. 2011) and southern BC Chinook Salmon CUs (DFO 2013). Holtby et al. (in prep.) have identified CUs for Pacific salmon in the Yukon and these were adopted in NuSEDS after public consultation. Updates to north and central Sockeye Salmon CUs have occurred and were incorporated into NuSEDS but were not peer reviewed.

Entering, validating and maintaining the data defining CUs as well as reviewing CUs is an enormous task which is not currently the responsibility of any one person or work unit.

Table 1. Summary of data management categories for the five species of Pacific salmon considered under the Wild Salmon Policy (original data from various sources, data extracted from the New Salmon Escapement Database System). Definitions can be found in table 2. Shaded categories (Deprecated to VREQ (Bin)) do not typically include Conservation Units. The CU data management category is a sum of current, VREQ (current), VREQ (extirpated) and extirpated data management categories. New/DeNovo categories identified by Grant et al. (2011) were subsequently assigned to one of the categories below. VREQ= Verification Required, CU= Conservation Unit.

Species	Current	VREQ (Current)	VREQ (Extirpated)	Extirpated	CU	Deprecated	Deleted	Bin	Deprecated (Bin)	VREQ (Bin)
Chinook Salmon	76	2			78	5		6	2	
Chum Salmon	42	3			45		2	1		
Pink Salmon (Even Year)	13				13			1		
Pink Salmon (Odd Year)	19				19					
Coho Salmon	43	1			44	4				
Sockeye Salmon (Lake Type)	165		3	6	174	6	11	5		60
Sockeye Salmon (River Type)	19				19		3			2
Total	**377**	**6**	**3**	**6**	**392**	**15**	**16**	**13**	**2**	**62**

Table 2. Definitions of data management categories utilized in the Decoder Ring File and New Salmon Escapement Database System. Examples are provided for illustrative purposes. CU= Conservation Unit.

Category	Definition	Examples
Current	CU is extant and is either accepted or has been proposed.	CK-01-Okanagan_1; CK-03-Lower Fraser River_FA_0.3
Extirpated	There are no known sites with fish spawning successfully in the wild and there are no known hatchery sites.	**SEL-03-07-Alouette_Early Summer:** Anadromous sockeye are known to have reared in Alouette and Coquitlam lakes prior to the construction of hydro dams in the two systems in the 1920's. Both systems were noted for the very early timing of river entry, reported to have been May. In both systems, the kokanee populations of the two lakes occasionally produced smolts. Stewardship groups in both systems are attempting to use that residual behavior to re-establish anadromous Sockeye Salmon in these systems, apparently with some success to date. However, since there are no dam passage structures in either system, adults have to be transported above the dams. Without passage, self-sustaining populations cannot exist, and the CUs cannot be recovered or new anadromous populations established. Since these "new" Sockeye Salmon populations originated from the indigenous kokanee that are presumably closely related to the extirpated Sockeye Salmon, if a self-sustaining population was established in either lake it might be considered a CU recovery. However, consistency in designation would favor typifying any such CU as "DeNovo."
Bin	Not a CU but a category to hold sites that for some reason are not assigned to a CU.	**CK-9006-Fraser-Cross-CU Supplementation Exclusion**: Sites that were stocked or supplemented with fish from outside their presumed CU. Many of these sites were home to a now extirpated "population". This is a bin for Fraser watershed sites that are not in a CU. **SEL-03-xx- Fraser River Migratory Counts:** Numbers are often reported from along the Fraser River where exhausted migrants are holding. Since their destination is seldom known, the sites and their associated counts are placed here. Some of the sites are under investigation and may be assigned to an existing CU at a later date. This place marked catchall for counts in unusual places in the Fraser was added. Numerous sites were moved from CUs here on the advice of Fraser Area biologists.

Category	Definition	Examples
Deprecated	An extant CU was merged with another CU or CUs. The CU should no longer be used. A deprecated CU is neither deleted nor extirpated because at least one of its populations persists or is believed to, and has been assigned to another CU. This category is used to manage changes to CUs, and is not a CU.	**CO-02-Lower Fraser-A**: Considering differences between the -A and -B lower Fraser, merging of the two Lower Fraser CUs was more in keeping with the CU procedures as they have changed since the initial work. Large number of sites where Salmon Enhancement Program (SEP) records indicate enhancement but there are no NuSEDS records of broodstock removals. There are few or no recent NuSEDS records (last 10 years). Extent and intensity of enhancement needs investigation. **L-06-08-McKinley-Summer Timing**: Damming of Quesnel Lake outlet between 1898 and 1921 in conjunction with impact of Hell's Gate slide and blockage nearly wiped out Quesnel system Sockeye Salmon and therefore very few spawners on the grounds in the '30's and '40's. McKinley Lake was naturally recolonized by the expanding Quesnel Lake population, an indication that the historical populations were part of the Quesnel CU. Consequently, the McKinley Lake CU has been merged with the Quesnel CU (SEL-06-10).
Deleted	The CU was deleted after confirmation that no persistent populations were ever present within recorded history within the area of the CU. This category is used to manage changes to CUs, and is not a CU.	**R-01-Boundary Bay**: No evidence of current or historical presence of persistent ocean-type Sockeye Salmon. **CM-47-Old Crow**: Rejected through consultation. The Vuntut Gwichin (First Nation of Old Crow) have no oral history related to Chum Salmon in the system and those familiar with the river were doubtful about the presence of Chum Salmon.

4. CRITERIA FOR IDENTIFYING A CU

4.1 HISTORICALLY

Canada's WSP (DFO 2005) introduced the biological concept of the CU for Canadian Pacific salmon. The WSP indicates that biodiversity in wild Canadian Pacific salmon will be partitioned into geographically and/or ecologically-based sub-specific groups termed Conservation Units. Each CU comprises a sufficiently distinctive component of salmon biodiversity that, if lost, is unlikely to recolonize within a human lifetime. The genetic distinctiveness categorized in biodiversity analyses to designate sub-specific groups deserving of conservation effort (such as WSP CUs) is generally recognized as arising from two forces: 1) isolation from conspecific groups (the isolation axis) and; 2) natural selection that causes a group to develop specific genetic adaptations to their environment that are not shared with other groups (the adaptation axis). Highly isolated groups (those that receive few immigrants from other groups) and/or highly adapted groups (those that experience environments that are very distinctive) are unlikely to receive enough immigrants, or sufficiently well-adapted immigrants, from other groups to prevent extirpation when their abundances reach low levels. Hence, such a group (the salmon comprising a CU) is not expected to recover quickly, if at all, if the entire CU is lost.

Canadian Pacific salmon CUs were defined by Holtby and Ciruna (2007) who adapted a method outlined by Waples (2001) for partitioning biodiversity using three sources of information (biogeographic zones, genetics, and life-history characteristics) to identify genetic isolation and adaptation in salmonid populations. Specific ecological conditions and/or life history traits associated with a group of salmon were considered likely to be indicative of genetic adaptation in that group. Similarly, differentiation at neutral (non-adaptive) genetic markers such as microsatellite markers was considered to be a good indication of isolation among salmonid groups. Holtby and Ciruna (2007) therefore identified Canadian CUs on the basis of apparent ecological specialization and/or neutral genetic distance among groups based on the best available data at the time.

Until 2013 when Dr. Holtby retired, all revisions to CUs were conducted and changes to the Decoder Ring file (see Section 5.1 for a description of the file) were made by Dr. Holtby. The last dataset defining CUs was received by the Salmon Data Unit (SDU) in August 2013. An updated Decoder Ring file was received in 2017 (revision 4) from Dr. Holtby when he was temporarily on staff with DFO, but this has not yet been adopted or incorporated into NuSEDS. However, the GIS files DFO received from Dr. Holtby in 2017 form the basis of the current CU maps.

4.2 RECENTLY

Two CSAS processes have resulted in changes to CUs. One process focused on Fraser River Sockeye Salmon (Grant et al. 2011), and the other focused on southern BC Chinook Salmon (DFO 2013).

The re-evaluation of Fraser River Sockeye Salmon was undertaken as the original CU list (or subsequent revisions) defined by Dr. Holtby did not entirely align with Fraser River Sockeye Salmon stock assessment expert knowledge. The first step in the evaluation was to review mis-assignments of populations to CUs, and other types of errors. CU delineations were then evaluated based on original genetics, life history, and ecology information, combined with the inclusion of Fraser River Sockeye Salmon expertise. After reviewing data held by experts, incorporating historical knowledge of systems, and creating new data management categories of CUs (VREQ, Extirpated, and *DeNovo*/New), consensus was reached within the group on the

new revised CU list. CUs could be categorized as VREQ for one of two reasons. This category could include CUs where observations of fish had been recorded in NuSEDS in areas not adjacent to rearing lakes, and it was not confirmed whether or not these were a unique river-type CU; or, they could be fish that do not reach their natal stream. *DeNovo* CUs were those that were previously extirpated and re-established by historical hatchery transplants. Extirpated CUs historically had escapement records, and historical knowledge indicated they were previously CUs. Most of these became extirpated due to anthropogenic reasons, such as the Hells Gate landslide, dams, or other freshwater activities (Grant et al. 2011).

The review of southern BC Chinook Salmon CUs (DFO 2013) began by gathering the information from the last official update of the Decoder Ring file and requesting updated genetic information from DFO's Molecular Genetics Lab (MGL). Additional data were obtained both internally and externally through the auspices of a technical working group, to inform verification of life history characteristics such as age structure, escapement records and run timing (see DFO (2013) Appendix A for a list of data sources). These data were reviewed, discussed and consensus was reached regarding proposed changes to CU assignments of individual populations/sites as well as changes to CUs themselves (new additions, merges, CU naming conventions etc.). The changes to CUs that were deemed appropriate were formally described along with the supporting data and rationale in a CSAS document. The final step in the process was the expectation that these changes would be made in the Decoder Ring file and updated in NuSEDS. This final step was only partially realized.

4.3 ISSUES

- There is a gap in expertise on the CU review process with the retirement of Dr. Holtby.
- Prior to the most recent CU revisions, the final decision regarding changes to CUs was made by one person, Dr. Holtby. Going forward, decisions regarding changes to CUs should be made by an informed group in a formal peer-review process.
- As the CU identification process is applied and reviewed over time, additional issues may arise that will need to be resolved. For example, the understanding and data treatment for enhanced populations has evolved over time and will need additional consideration in the future for some Chinook Salmon CUs. Other issues may arise relating to the treatment of data-limited CUs.

5. DATA MANAGEMENT

5.1 HISTORICALLY AND CURRENTLY

The escapement data and associated information on run timing, geographic coordinates, and qualitative and quantitative information used in the determination of CUs is stored in an Excel file (termed the "Decoder Ring file" created by Dr. Blair Holtby) which is currently maintained by the SDU. The Decoder Ring file includes the original information from Holtby and Ciruna (2007) as well as four revisions, the last one in 2013. This Decoder Ring file holds all the information used to support the master CU list. It represents an extensive and time consuming effort to capture CU information. Most of the content of the 2013 Decoder Ring file has been included in NuSEDS. A new version of the Decoder Ring file was provided in 2017 by Dr. Holtby; this updated information has not been incorporated into NuSEDS.

Until 2013, Dr. Holtby would make changes to the Decoder Ring file and provide an updated list of changes to the SDU. New shapefiles for the affected CUs would be created and the SDU would then update the CU maps in Geographic Information System (GIS) software. In 2017, to

help streamline the process, Coastal Resource Mapping (CRM, Nanaimo, BC) developed a template for CU maps for DFO as well as an automated process for exporting the maps and associated site tables into PDFs (Portable Document Format). Instructions for creating MXD (Map Exchange Document) files are available upon request from the SDU. Instructions for updating CU maps have been provided by CRM and are included in Appendix II.

The SDU has created a file to document the record of decisions regarding changes to CUs. This file is maintained as a table in NuSEDS and can be provided upon request.

5.2 ISSUES

- The Decoder Ring file has been the source of information, both historic and current, for information used to define CUs. The file was maintained by one person who made changes without a formal review process.
- CU information and data are provided to the SDU for updating in NuSEDS. The updating process is not automatic and requires significant effort to ensure updates are carried through in all the output forms. To date, updates have been conducted on an *ad hoc* basis.
- There is a need for standardized CU maps for consistency in reporting and to eliminate confusion. For example, the last update of Chinook Salmon CU GIS files included only narrow boundaries around the CU's waterbodies, rather than previously existing watershed-level boundaries. Consequently, data in NuSEDS (2013) and the shapefiles (2017) are not perfectly aligned, particularly for southern BC Chinook salmon CUs.
- Currently, the GIS software cannot link to the NuSEDS database in order to export the summary information for the CUs within NuSEDS and the CU maps. The GIS files are not standardized so that they can be updated easily and in alignment with the NuSEDS database.
- Differences in CU boundaries between the 2017 Decoder Ring file and NuSEDS data have not yet been resolved.
- Records of changes to CUs should be referenced with the appropriate document and incorporated into NuSEDS. Changes should also be documented, for example in CU profile descriptions (Appendix III).
- Data management categories and definitions (tables 1 and 2), as well as CU profile headings, have not been formally reviewed or approved.

6. FRAMEWORK

The following criteria and procedural recommendations are intended to be tested on existing CUs and updated periodically. They are intended to be applied to all WSP populations in the Pacific Region equally. They have been written to allow for adaptability based on the situation or CUs, while maintaining core criteria.

The goals are to:

- Develop a systematic, inclusive and transparent way of reviewing the information and assessing any changes to CUs.
- Maintain the authoritative list of CUs in a single consolidated location; the NuSEDS database is being proposed as the best solution.

- Merge the Decoder Ring file information into NuSEDS to streamline updates of CU information; eliminating the use of the Decoder Ring file.
- Develop an accepted and approved process to review, document and update CUs, reducing uncertainty in CU revisions, versions and approvals.
- Ensure all relevant data for CU determination is in NuSEDS and is updated in a systematic manner to produce consistent maps and reports.

It is recognized that there is a need for adequate resources to support the assemblage of information and, collection and preparation of data. Without increased funding, reviewers must rely on historical information which may not be comprehensive and may be out of date. Also, the process will require personnel support within DFO to participate in the working groups and complete the reviews. The amount of support required will depend on the type of CSAS review and the number of reviews.

6.1 DESCRIPTION OF THE FRAMEWORK

There is a need to standardize decisions regarding CU reviews or revisions to eliminate inconsistencies or omissions so that they are not made *ad hoc* by various assessors. In general, there are two different types of revisions which may arise from the review of CU information:

1. Changes to entire CUs- which may include merging, creating, deleting or deprecating CUs.
2. Changes to the census sites or populations within CUs- which may include moving census sites from one CU to another, exclusion of a census site from any CU or addition of a previously unknown census site to a CU.

All new CUs should be the result of applying the methods described in Holtby and Ciruna (2007). The approval and communication of these new CUs should follow the procedures outlined in the framework. When new information with respect to the profile of a CU becomes available, a review may require CUs to be modified or updated by merging with another CU, or deleting altogether. Merging CUs is a fundamental type of change and therefore requires 'retiring' of CUs and subsequent creation of new CUs. Retired CUs become the Deprecated data management category in order to retain the history of the CU, and should no longer be used to ensure that the new CU and Deprecated CU are not mistakenly considered duplicates. Deprecated CUs are neither Deleted nor Extirpated since at least one of its populations persists, and has been assigned to another CU (see table 2 for definitions).

A census site is moved from its original CU to another CU when local knowledge, updated genetics or geographic information indicates that it had been incorrectly assigned during the original identification process (Holtby and Ciruna 2007). DFO (2013) described a procedure for making changes to CUs as a result of the re-examination of census site information. A summary of the changes is provided in table 3 of DFO (2013); this table provides the level of detail the SDU needs in order to make the appropriate changes to the database. At no point will information be deleted in NuSEDS, notes are added to the files in order to maintain a record of decision. The guidance described below for each of these two situations has been outlined to include various nuances covering all five Pacific salmon species as much as possible. It is recognized that there may need to be deviations from these guidelines but when such differences are identified, these deviations should be substantiated and documented (see Procedure section for documentation details). The framework consists of four main steps: 1) review; 2) submission; 3) adjudication and; 4) analysis and response. Each of these steps will be discussed separately in relation to the process flow diagram (figure 1).

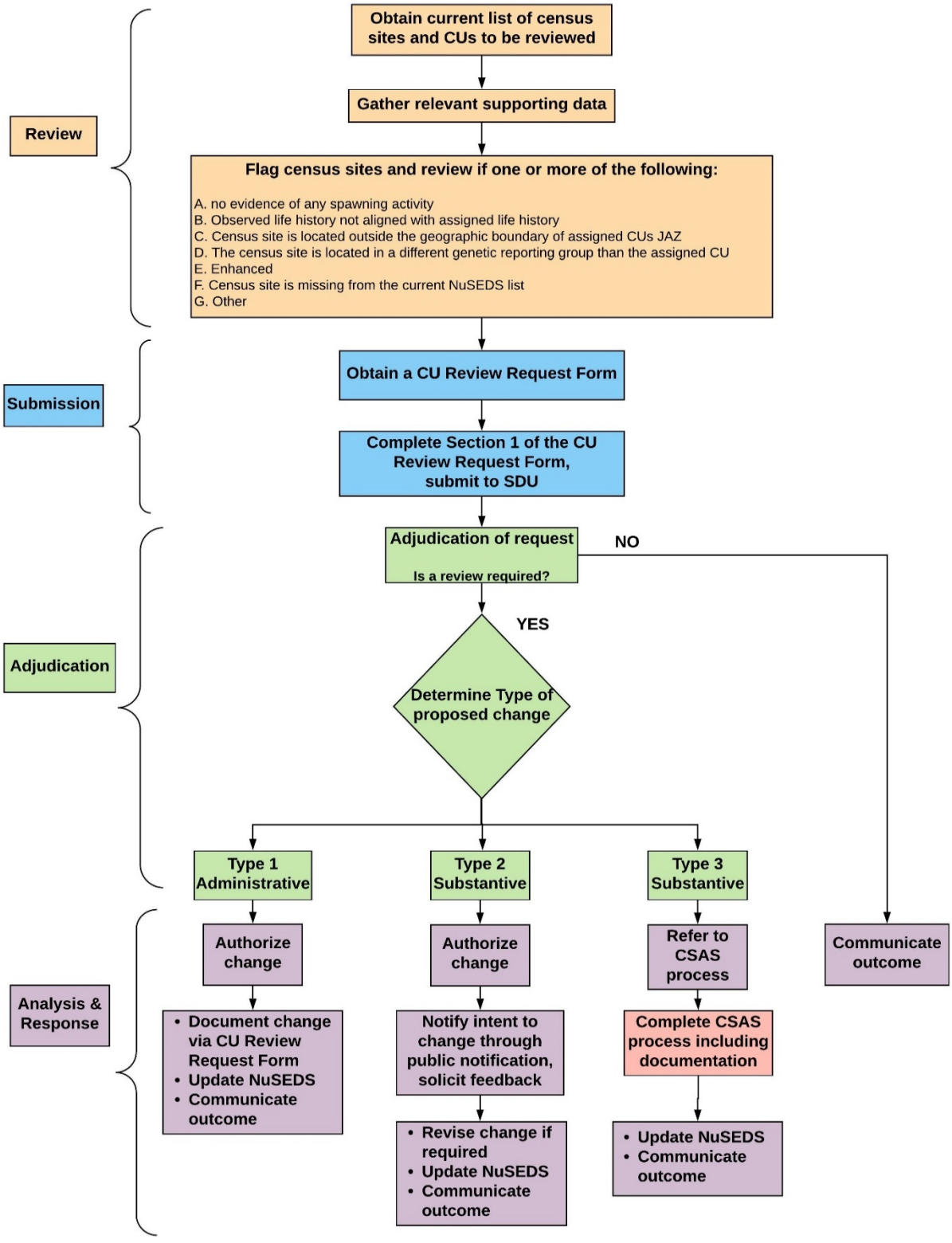

Figure 1. Process flow for the framework to review, adjudicate, analyze, and respond to requests for changes to Conservation Units (CUs) and census sites.

6.1.1 Review

Experts both internal and external to DFO can conduct a review to recommend if a CU or census site change is warranted.

In general, reviews of CUs will occur when significant new information emerges or in association with a status review process if the reviewers have accumulated information indicating that revisions may be needed. Modifications to CUs are not anticipated to happen frequently or to require periodic consideration because the emergence of new information will be infrequent.

The review procedure described in DFO (2013) has been generalized for any Pacific salmon species in the following steps.

1. Obtain the recent list of census sites and CUs relevant to the review to be conducted (available from the SDU).
2. Gather all relevant supporting data and information from various sources including but not exclusive to: Pacific Salmon Commission reports, Enhancement Planning and Assessment Database (EPAD), Pacific Ageing Database System (PADS), Molecular Genetics Lab (MGL), Mark Recovery Program (MRP), Indigenous Knowledge Systems (IKS), Local Ecological Knowledge (LEK), Pacific Salmon Explorer (PSE), Traditional Ecological Knowledge (TEK).
3. Flag census sites for review if one or more of the following occur:
    a. No evidence of any spawning activity
    b. Observed life history is not aligned with assigned life history
    c. Census site is located outside the geographic boundary of the assigned CU's JAZ
    d. Known genetic relationships do not support placement of the census site within the CU.
    e. Enhanced (see below)
    f. Census site is missing from the current NuSEDS list
    g. Other (to be explained by proponent)

Data and information from both inside and outside DFO should be sourced, summarized and validated. All documents used in the review should be provided to the SDU with the submission form (see below).

CUs by definition consist of wild salmon populations. No consistent approach to including or excluding populations subjected to supplementation with fish from hatchery facilities or managed spawning channels in CUs has been developed. Hatchery enhancement can provide conservation benefits for wild populations at low abundance but also poses risks to wild populations. We outline the considerations and previous advice that has been developed for enhanced populations with respect to wild salmon management in BC in Appendix IV and propose that definitive advice be developed for future CU review purposes.

6.1.2 Submission

All proposed changes to CUs or census sites must be reviewed and approved through the submission of a CU Review Request Form (Appendix V). This form will be located on the Federal Government's Open Data portal, with a hyperlink to it on both the WSP and DFO Pacific salmon websites.

Based on the information gathered during the review (Section 6.1.1), complete Part 1 of the submission form and submit to the SDU for processing. Further details regarding completion of this form are indicated in the Instructions to Proponents section of the form.

6.1.3 Adjudication

All submissions will be reviewed by an Adjudication Committee composed of, at a minimum:

- A DFO science staff member with expertise in conservation biology and previous experience defining or revising CUs. Ideally this person would chair the Adjudication Committee.
- Scientist and/or biologist and/or technician (DFO) with biological and ecological expertise in the groups of CUs being reviewed.
- The proponent of the CU Review Request Form.
- Additional local technical expertise on CUs under consideration, internal and/or external to DFO, depending in part on the type of review (e.g., as required more for Type 2 and 3 than Type 1 reviews).

Depending on the details of the change, a DFO geneticist familiar with Pacific salmon genetics and the genetic tools used in CU reviews may be warranted.

The role of the Adjudication Committee is two-fold: determine if a review is required and; what Type of proposed change is likely the outcome of a review. If the adjudication results in no review warranted, parts 2 and 3 of the CU Review Request From will be completed and the outcome posted on the SDU website (figure 1). If a review is deemed warranted the Adjudication Committee will determine which of the following three Types of changes are likely to result (table 3):

Table 3. Description of Types 1, 2 and 3 changes to Conservation Units (CUs) and/or census sites utilized during adjudication of change requests.

Type		Description/ Example
Administrative	1	Clerical error (e.g., information miscoded in NuSEDS)
		Misinterpretation of existing data
		Changes to existing CU/census site name(s) to match current naming conventions
		Other
Substantive	2	Creation of new census site(s), with supporting life history/ecotypology/genetic information
		Changes to CU/census site(s) **name(s)** due to new/updated information (e.g., run timing information)
		Large-scale CU/census site review based on existing methods
		Other
	3	Local-scale changes to CU/census site(s) **assignment(s)** due to new/updated information (e.g., PNI estimate, genetics, etc.)
		Large-scale CU/census site review based on new method(s) for characterizing/classifying CUs or census sites (e.g., first review of Chinook Salmon census sites/CUs impacted by enhancement).
		Other

A review may be initiated for many reasons, for example because of upcoming stock assessments, WSP biological status assessments, pre-COSEWIC assessments, or other CSAS processes requiring CU reviews. A review may also be initiated if an error in naming convention or data management is discovered. The scale of the review is reflected in the Types described

in table 3 where Type 1 are administrative changes and Types 2 and 3 are substantive changes. Type 2 changes would result in moderately substantive changes to CUs while Type 3 would likely result in major changes. These Type categories have been created to streamline the adjudication of information and allow for consistent analyses and responses to similar requests.

The rationale for the Type designation will be recorded on the CU Review Request Form by the Adjudication Committee.

6.1.4 Analysis and Response

The analysis and response to a request has been summarized by Type in table 4. The reviewing body is the group which reviews the information and makes the final decision on the proposed change. For Type 1 proposed changes, the reviewing body is restricted to the Adjudication Committee (see section 6.1.3); for Type 2 proposed changes, the Adjudication Committee may require additional participants to review the request. The reviewing body for Type 3 proposed changes defers to the CSAS process.

Additional input is not required for Type 1 proposed changes but may be used as warranted; for Type 2 proposed changes public notification will be posted on the Federal Government's Open Data portal for public feedback; for Type 3 proposed changes additional input will be at the discretion of the CSAS office.

The Adjudication Committee has the authority to sign off on both Types 1 and 2 proposed changes. For Type 3 proposed changes, the Adjudication Committee will adopt the recommendations of the CSAS process.

For all Types of proposed changes, the CU Review Request Form will be completed and held on file; the outcome will be summarized on the Federal Government's Open Data portal. In addition, Type 3 proposed changes will also be documented through CSAS documents (types of documents dependent on Terms of Reference) and posted on the CSAS website once finalized.

The outcome of all reviews will be updated in NuSEDS, the authoritative list of CUs and the Decoder Ring file (to be phased out). The process of which is discussed in the following section. The SDU will both notify NuSEDS users of updates to CUs as well as indicate whether a change has been made to the authoritative list on the Federal Government's Open Data portal.

Table 4. Summary of the analysis and response actions of Types 1, 2 and 3 proposed changes. SDU= Salmon Data Unit, CU= Conservation Unit, NuSEDS= New Salmon Escapement Database System, ENGO= Environmental Non-Governmental Organization; Canadian Science Advisory Secretariat (CSAS).

Action	Administrative	Substantive	
	Type 1	Type 2	Type 3
Reviewing body	Direct authorization via Adjudication Committee	• Adjudication Committee • Additional participants with local technical expertise on the CUs under consideration as warranted (i.e. First Nations, ENGOs, non-DFO experts etc…)	CSAS process
Additional input	None required	Public notification on SDU website for feedback	As determined through CSAS Terms of Reference
Authority	Sign off on change by Adjudication Committee	Sign off on change by Adjudication Committee	Adjudication Committee adopts the recommendation of the CSAS process without further review
Documentation and Communication	• Completion of CU Review Request Form • Posted on SDU website	• Completion of CU Review Request Form • Posted on SDU website	• CSAS documentation • Completion of CU Review Request Form after CSAS complete • Posted on SDU website
Outcome	Update of NuSEDS	Update of NuSEDS should change be required	Update of NuSEDS should change be required

6.2 GOVERNANCE OF THE AUTHORITATIVE LIST OF CUS AND THEIR ASSOCIATED ATTRIBUTES AND DATA

6.2.1 Authoritative CU list

The authoritative list of CUs will be held by the SDU in the Stock Assessment and Research Division of the Pacific Region Science Branch (DFO). It will be stored in NuSEDS on the DFO Oracle database server, which is on the internal network and is therefore not publicly accessible. The associated attributes and data, including the Decoder Ring file, until it is phased out, will also be held and maintained by the SDU.

6.2.2 Data and information management

Once a CU has been reviewed, whether revisions were recommended or not, the Chair of the Adjudication Committee will notify the SDU. The chair will provide the SDU with a copy of the document(s) outlining the changes to be made (or decisions and rationale for not making

changes). All changes identified in the decision document(s) are considered final and will be updated in NuSEDS. The relevant fields will be updated with a comment to capture the review process and its outcome. Previous comments in NuSEDS tables will remain in order to maintain a record of changes.

The SDU will update the CU data in NuSEDS (see steps in Appendix VI) after reviewing it for data quality issues. Changes will be made to individual data tables within NuSEDS, the authoritative CU list will be updated, and an updated map will be produced. The data will subsequently be updated in databases such as the Pacific Ageing Database System (PADS), Enhancement Planning and Assessment Database (EPAD), and the NuSEDS Query Tool, each of which are linked to NuSEDS.

The SDU will update the escapement data at least once a year and CU data as required, on the Federal Government's Open Data portal.

6.2.2.1 Authoritative CU maps

In order to ensure that CU maps are based on the current data and information in NuSEDS and to ensure the consistent communication of these maps both internally and externally, the SDU will produce one form of map. Only Current and VREQ (Current) data management categories will be displayed on maps. All maps will be made available on the Federal Government's Open Maps site. CU data are available on the Federal Government's Open Data portal and includes all data management categories (table 1).

Currently, there exists within the SDU the expertise to make changes to existing maps but not to create new maps or change boundaries.

The SDU will therefore produce standardized CU maps according to the following criteria:

1. All maps will be composed of broad-based watershed polygons using the CRM methods (Appendix II).
2. Maps will only be updated as new information is provided to the SDU.
3. All maps will have the following field headings (See Data Dictionary on Open Maps portal)
    a. CU status: CU_INDEX; CU_NAME; CU_TYPE; WSP_STATUS; CU_LAT; SP_QUAL; CU_LONG; FID
    b. CU boundary: CU_INDEX; SP_QUAL; CU_TYPE; FID; CU_NAME
    c. CU counting sites: CU_NAME; SITE_NAME; CU_TYPE; CU_INDEX; GFE_ID; YLAT; XLONG; FAZ_ACRO; MAZ_ACRO; JAZ_ACRO; SP_QUAL; POP_ID; GEO FEATURE TYPE; WATERSHED CODE; FID

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

The framework for managing revisions to CUs addresses all objectives outlined in Section 2. Development of the framework also identified several additional issues specific to the review of CUs as well as the need for data management to be an explicit component of the framework. The status of these issues and how they are addressed by this framework are described in table 5.

Table 5. Status of issues identified in Sections 4.3 and 5.2 and how they are addressed by this framework.

Review of Conservation Units (CUs)

Issue	Outcome	Comment
There is a gap in expertise on the CU review process with the retirement of Dr. Holtby.	Partially resolved	The expertise is challenging to replace, but with time and a formal, transparent process more individuals can gain experience.
Prior to the most recent CU revisions, the final decision regarding changes to CUs was made by one person, Dr. Holtby.	Resolved	Changes will be made by an informed group in a formal peer review process.
As the CU identification process is applied and reviewed over time, additional issues may arise that will need to be resolved.	Ongoing	

Data Management

Issue	Outcome	Comment
The Decoder Ring file was the source of information, both historic and current, for information used to define CUs. The file was maintained by one person who made changes without a formal review process.	Partially resolved	2017 changes to the Decoder Ring file need to be approved before changes to NuSEDS are made. Approved changes will be updated in NuSEDS, and the Decoder Ring file will be obsolete.
CU information and data are provided to the SDU for updating in NuSEDS. This update is not automatic and requires significant effort to ensure the update is carried through in all the output forms. To date, updates have been conducted on an *ad hoc* basis.	Partially resolved	Introduction of form and protocol for proposing and implementing changes helps. The work load issue cannot be addressed through this process.
There is a need for standardized CU maps for consistency in reporting and to eliminate confusion.	Resolved	All maps will be standardized.
Currently, the GIS software cannot link to the NuSEDS database in order to export the summary information for the CUs within NuSEDS along with the CU maps. The GIS files are not standardized so that they can be updated easily and in alignment with the NuSEDS database.	Partially resolved	Linking of GIS software to NuSEDS remains unresolved. The GIS files will be standardized.
Differences in CU boundaries between the 2017 Decoder Ring file and NuSEDS data have not yet been resolved.	Partially resolved	Once changes to the 2017 Decoder Ring file are

Issue	Outcome	Comment
		approved, standardized boundaries will be applied.
Records of changes to CUs should be referenced and incorporated into NuSEDS.	Resolved	All approved changes will be documented in NuSEDS.
Data management categories and definitions (tables 1 and 2), as well as CU profile headings, have not been formally reviewed or approved.	Recommendations provided	To be addressed through implementing recommendations.

7.2 RECOMMENDATIONS

- Not all of the issues in table 5 could be addressed within the scope of this paper. It is recommended that these issues be further considered during work planning in order to minimize issues in data management and review of CUs.
    - Review and formally approve data management categories and associated definitions.
    - Formally review and update NuSEDS with approved 2017 revisions to the Decoder Ring file. It is recommended that this action be considered a priority for work planning.
- Establish Salmon Data Management Working Group to review and approve:
    - CU data management categories and associated definitions, including methods to utilize Bin and VREQ categories
    - CU naming convention
    - CU profile fields (see Appendix III for example)
- Create CU profiles when reviewing CUs. Profiles would increase the efficiency of future reviews, provide metadata and document the history of changes to CUs.
- Extract and publish relevant portions of the unpublished document entitled “All Things CU” (B. Holtby, retired DFO, Squamish, British Columbia, pers. Comm.) as a DFO Technical Report.
- Consider advice summarized in Appendix IV based on Withler et al. (2018) on the inclusion/exclusion of hatchery-supplemented populations when reviewing sites and populations within CUs.

8. ACKNOWLEDGEMENTS

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10. APPENDIX I- GLOSSARY

Table 6. Glossary of terms and acronyms commonly used in this document.

Term/ Abbreviation	Definition/ Description
Assigned life history	Life history features as they are currently known (may include run timing, dominant years, spawning time etc…depending on species)
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSAS	Canadian Science Advisory Secretariat
CU	Conservation Unit
DU	Designatable Unit. Intraspecific (q.v.) entities for assignment of conservation status.
Ecotypology	Characterization of the structure of an ecosystem without reference to dynamic processes; typically including abiotic and biotic components.
ENGO	Environmental Non-Governmental Organization
EPAD	Enhancement Planning and Assessment Database (DFO)
Escapement	The number of mature salmon that pass through (or escape) fisheries and return to fresh water to spawn.
FAZ	Freshwater Adaptive Zone. An area within which individuals of the same taxon are ecologically interchangeable (*q.v.*) or within which such interchangeability is presumed possible because of the similarity of the abiotic and biotic environments.
Flag	Identify for further inquiry
GIS	Geographic Information System
IKS	Indigenous Knowledge Systems
JAZ	Joint Adaptive Zone. Zones formed by the intersection of Freshwater and Marine Adaptive Zones (*q.v.*). These zones are the basis for the ecotypic classification used to describe Conservation Units (*q.v.*).
LEK	Local Ecological Knowledge
MGL	Molecular Genetics Lab (DFO)
MRP	Mark Recovery Program (DFO)
NuSEDS	New Salmon Escapement Database System
MXD	Map Exchange Document
Observed life history	Life history features different from assigned features (may include run timing, dominant years, spawning time etc…depending on species)
PADS	Pacific Ageing Database System (DFO)
PNI	Proportionate Natural Influence
PSC reports	Pacific Salmon Commission reports
PSE	Pacific Salmon Explorer
SDU	Salmon Data Unit (DFO)
SEP	Salmon Enhancement Program (DFO)
TEK	Traditional Ecological Knowledge
WSP	Wild Salmon Policy

11. APPENDIX II-INSTRUCTIONS FOR UPDATING MAPS

Instructions provided by Coastal Resource Mapping in 2017.The script requires the following inputs:

a. Location of input MXD (created from existing MXD template)

b. Location of feature class used to create table

c. Fields participating in output table.

d. Python script

e. Output file Name field

f. Output Location

1. Create an updated MXD using the template provided. Make sure that the MXD has been saved after any changes.
2. In Arc GIS please ensure that the data driven pages are setup and everything is set up exactly as it is intended to look in the output. Data Driven Pages allow you to quickly and easily create a series of layout pages from a single map document. A feature layer, or index layer, divides the map into sections based on each index feature in the layer and generates one page per index feature.
3. Confirm the location of a feature class (fc) (i.e., shapefile or geodatabase fc) to be used to create the output table. For example, the Sample Sites point feature class can be joined with the Population Summary table and saved as an output point feature class to a new location to make the join permanent (this is an important step).
4. Put the python script and the toolbox containing the script tool in a project folder that can be accessed in Arc Catalog. Ensure that the script and script tool are in the same folder.
5. In Arc Catalog, double-click on the toolbox, then double-click on the script tool. Descriptions have been added to the script tool input parameters to help with the set-up. If the code needs to be viewed or altered in the future, this can be done in any Integrated Development Environment (IDE) such as IDLE which comes with the ESRI install.

Note: The script can also be run in command line mode as long as the input parameter locations are known.

12. APPENDIX III- CU PROFILE HEADINGS AND DESCRIPTIONS

Table 7. Conservation Unit (CU) profile headings and descriptions as provided by B. Holtby (retired DFO, Squamish, British Columbia, pers. comm.) to be used as a guide in finalizing a profile template.

Heading	Description
Species name	
CU name	Full, acronym, index
CU type	
Basis	The criteria used to establish that this population group is a CU
Designatable unit	Category is required if COSEWIC's DUs are not in a one-to-one relationship with CUs. If they are, this is not required.
Revision history	
Map	Showing location, geographical extent, all known populations.
Life history characteristics	Age profile at maturity, size at maturity, sex ratio at maturity, fecundity, freshwater habitat use and movements, marine distribution (catch distribution and movement patterns).
Census sites	"Populations", including data availability and data reliability
Fisheries	Qualitative and quantitative information as available
Habitat description	Status and threats
Transplant/enhancement history	
First Nation significance	Information to include nation/band and fishing locations
Ecological significance	
Current biological production and conservation status	Unified= Green, Amber, Red and if Red then how deep, using a consistent and small set of metrics
Most recent quantitative assessment	Based on SR models, if modelled include parameter estimates
References and sources	

13. APPENDIX IV- ENHANCED POPULATIONS WITHIN THE GEOGRAPHIC BOUNDARIES OF CUS

A Pacific salmon CU is a group of wild salmon sufficiently isolated from other groups that, if lost, is very unlikely to recolonize naturally within an acceptable timeframe, e.g., a human lifetime or a specified number of salmon generations (DFO 2005). Wild populations of Pacific salmon in Canada have been defined as those not affected by enhancement for two or more generations (Withler et al. 2018). Enhanced salmon (those originating from hatcheries or spawning channels) are not wild salmon and their ability to reproduce and survive in that natural environment is often reduced as the result of adaptation to the modified spawning and rearing environment. Moreover, wild salmon in enhanced populations may become less fit in the natural environment if the enhancement is conducted at sufficiently high levels and/or over a multigenerational time period.

CUs have associated geographical boundaries encompassing the freshwater and marine ecological adaptive zones occupied by fish of the CU (Holtby and Ciruna 2007). Hatchery-supplemented populations that contain reduced proportions of wild fish often exist within the geographic boundaries of CUs but may not belong in the CU due to a predominance of enhanced fish. Currently, enhanced spawning populations within CU boundaries have been assigned census site and population IDs in NuSEDS. In some cases, these have been included in CUs, whereas in other cases they have been assigned to 'bins' awaiting a standardized process of identifying populations to be excluded from CUs due to the predominance of enhanced fish.

Several large CU-based status assessments and CU revision processes have been hindered by the absence of a standardized approach for assessing populations for inclusion on the basis of enhancement activity and history. We recommend that such an approach be developed and applied in future CU assessment and revision efforts. As a starting point, advice on the inclusion/exclusion of hatchery-supplemented populations in WSP status assessments was provided by Withler et al. (2018) and may also be applicable to inclusion/exclusion of sites and populations within CUs. The recommendations below are consistent with both the analysis of Withler et al. (2018) and the Wild Salmon Policy 2018-2022 Implementation Plan.

1. Adopt the definitions of wild and hatchery-supplemented populations provided in table 3 of Withler et al. (2018). These include the definition of a wild population as one not affected by enhancement for two or more generations combined with a low immigration rate (<3%) of stray fish from hatchery-influenced populations over the two-generation interval.
2. In WSP assessment processes, include/exclude populations in their entirety rather than trying to apportion components of a population to 'wild' and 'enhanced' categories because even wild fish arising from two generations of natural spawning in a population subjected to high levels of enhancement are likely to have reduced natural fitness. Hatchery populations excluded from the WSP assessment processes should correspond to those excluded from CU membership based on enhancement levels.
3. Include hatchery 'integrated-wild' populations within CUs because the natural environment has the stronger adaptive influence on them and they are determined to contain a predominance of wild fish.
4. Include populations in conservation enhancement programs which are currently being managed to PNI values <0.72 because of low abundance when the medium to long term goal of enhancement is to restore the population to a self-sustaining or 'integrated-wild' state.

5. Develop methods to evaluate the risk to 'wild-hatchery stray influenced' sites within CU boundaries and develop assessment metrics to reflect the expected impacts on sites known or expected to contain stray fish from hatchery-influenced populations. Hatchery stray fish originating from both within and external to the CU pose risk to wild populations. Spawning abundances in small natural populations receiving hatchery strays may be inflated such that they exceed the productivity of the natural environment as well reduce overall fitness due to introgression of hatchery-influenced genetics.
6. Develop guidelines for the appropriate level and distribution of enhancement within a CU to be consistent with the WSP designation of a CU as an aggregation of wild salmon adapted to the natural environment and constituting an important element of intraspecific genetic diversity.

14. APPENDIX V- CU REVIEW REQUEST FORM

REQUEST FORM FOR PROPOSED CHANGES TO CONSERVATION UNITS AND/OR CENSUS SITES

Context

This template is to be used to propose changes to Conservation Units (CUs) or their component census sites. The resulting recommendations will serve as authoritative guidance to the Salmon Data Unit to implement approved changes in NuSEDS. Proposed changes that are not adopted will be documented through this form for future reference.

Step 1. Submission

Proponent Name:

Proponent Contact Info:

CU Name(s) (Existing/New):

Census Site(s) (All/List by POP_ID):

Description of Proposed Change (part of subsequent project/date required):

Description of Information Available to Support Proposed Change

- Life History:
- Ecotypology:
- Genetics:

Once complete, this section is submitted to Salmon Data Unit for Step 2 processing.

Step 2. Adjudication

Category of Change Type 1, 2 or 3:

Type		Description/ Example
Administrative	1	Clerical error (e.g., information miscoded in NuSEDS)
		Misinterpretation of existing data
		Changes to existing CU/census site name(s) to match current naming conventions
		Other
Substantive	2	Creation of new census site(s), with supporting life history/ecotypology/genetic information
		Changes to CU/census site(s) **name(s)** due to new/updated information (e.g., run timing information)
		Large-scale CU/census site review based on existing methods
		Other
	3	Local-scale changes to CU/census site(s) **assignment(s)** due to new/updated information (e.g., PNI estimate, genetics, etc.)

		Large-scale CU/census site review based on new method(s) for characterizing/classifying CUs or census sites (e.g., first review of Chinook Salmon census sites/CUs impacted by enhancement).
		Other

Adjudication Decision (Action Required):

Type	Action
1	Document change on this form, update/refresh NuSEDS, communicate update
2	Document change through published notification with period to provide public feedback, update/refresh NuSEDS, communicate update
3	Refer to CSAS process. Initiate with Request for Science Information and Advice (RSIA)

Rationale for Decision:

Adjudication Committee Members:

Proposed Contributors:

Date for Completion:

Step 3. Analysis and Response

1. Complete as proposed in Step 1. Include future recommendations and uncertainties in the "Rationale for change/ additional comments" column.
2. A) Revise CUs as follows (specify):

CU Index	CU Name	Run Timing	Life History	JAZ (FAZ+MAZ)	Number of census sites	Rationale for change/ additional comments

B) Revise census sites as follows (specify):

POP_ID	Census Site Name	CU Index	CU Assignment	Rationale for change/ additional comments

3. Defer changes (reason):
   - Proposed change not substantiated with available data.
   - Science advice required (refer to CSAS process)
   - Other (specify):
4. Approved by (contributors, including organization):

Date Approved:

5. Communication:

   Proponent informed:

   Revision Updated in NuSEDS (if applicable):

   Posted on Open Government (if applicable):

15. APPENDIX VI- UPDATING CU INFORMATION IN NUSEDS

In NuSEDS, there are four (4) main tables that contain Conservation Unit information:

Subjects Table: This table contains information on Salmon Populations and also includes Conservation Unit information. To query this table for Conservation Unit information the following script can be run in sql: select * from subjects where sbj_typ='CU' and end_dt is null.

Subject_Areas Table: This table contains information that links a specific salmon population to a specific stream or geo_feature location.

Subject_Associations Table: This table is specific to Conservation Unit information and links a specific salmon population to a specific Conservation Unit in the Subjects Table.

Conservation_Unit_System_Sites: This Table was created in NuSEDS to hold a summary of all Conservation Unit information. It includes all Conservation Units and Site specific CU information.

When updating CU information in NuSEDS always start with the TEST database. Once all of the information has been added, check to make sure that everything is correct before adding the CU information into the Production database. In the past, CU information was received from Blair Holtby in an excel workbook format that was dubbed the Decoder Ring file. This excel file has several worksheets that contain information on CUs and Sites within the CUs for the following species: CK: Chinook, CM: Chum, SEL: (Sockeye-Lake Type), SER: (Sockeye-River Type), CO: Coho, PKE: (Pink-Even Year), PKO: (Pink-Odd Year).

A series of steps were created to compare CU information in the new version of the Decoder Ring file with information that was currently in NuSEDS. MS ACCESS is used to do the comparisons. The following Folder located on the Esc Data Mgmt Drive outlines the steps to update the Subjects, Subject_Areas and Subject_Associations tables. Contact SDU for the Read me File.

Step 1. Start with Subjects.mdb

- If necessary, replace: NuSEDS_V2_0_SUBJECTS table by ODBC. The table is currently linked.
- Delete records in Decoder Ring Tables and append new records from the most recent version of the Decoder Ring file
- Follow queries to find new Conservation Units by Species
- Update NuSEDS with new Conservation Units using insert statements found in: Step 2_Insert CU into Subjects_new.xls

Step 2: Start with Subject_Areas.mdb

- If necessary, replace: NuSEDS_V2_0_SUBJECTS, NuSEDS_V2_0_SUBJECT_AREAS, NuSEDS_V2_0_GEO_FEATURES tables by ODBC. The tables are currently linked.
- Delete records in existing tables and append new records into tables from most recent version of the Decoder Ring file using the queries.
- Update NuSEDS with new Subject_Area information using insert statements found in: Step 3_Build Subject_Areas.xls

Step 3: Start with Subject_Associations.mdb

- If necessary, replace: NuSEDS_V2_0_SUBJECTS, NuSEDS_V2_0_SUBJECT_ASSOCIATIONS tables by ODBC. The tables are currently linked.
- Follow sql statements found in the README file and update tables.
- Run queries to compare what is in NuSEDS vs the latest version of the Decoder Ring file.
- Update NuSEDS with new Subject_Associations information using insert statements found in: Step 4_Build Subject_Associations.xls

Step 4: Update Conservation Unit System Sites Table

- Contact the SDU for the folder located on the Esc Data Mgmt Drive which outlines the steps to update the Conservation _Unit_System_Sites (CUSS) table.