Development and Implementation of Analytical Tools to Support WCVI Chinook Hatchery Management and Reform in Canada

Final Report to the Pacific Salmon Commission's Northern Endowment Fund Committee

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INTRODUCTION

Hatchery production of Chinook salmon in British Columbia is a major contributor to nearshore and offshore Pacific salmon fisheries in Southeast Alaska, Northern BC and West Coast Vancouver Island (WCVI). Effective design, management and implementation of hatchery programs is essential to ensure fishery objectives can best be met while minimizing potential negative interactions with wild salmon populations. The purpose of this project was to implement an analytical tool, the All-Hatchery Analyzer and In-Season Implementation Tool (AHA-ISIT), to support WCVI Chinook hatchery management and reform in Canada. The AHA-ISIT tool was developed to assist managers in implementing the strategies described in the HSRG Framework Paper (2017). The tool has three primary purposes:

- AHA-ISIT can be used to evaluate implications of different management policies on harvest and conservation goals for a single population/hatchery program.
- In addition, the tool can be used to evaluate the region-wide implications of management policies.
- Finally, it can be used as part of annual decision making process(es) to set annual management targets that optimize long-term outcomes (e.g., in terms of harvest and/or conservation goals). Use of this tool will provide decision-making support and will identify opportunities for increased harvest of existing hatchery Chinook surpluses, as well as potential increases in production of certain stocks to further contribute to fisheries.

The analytical tool that was implemented by Fisheries and Oceans Canada (DFO) documents assumptions about hatchery production, harvest, habitat and passage through hydroelectric dams (HSRG 2017). The tool allows managers to compare scenarios where hatchery management, harvest rates, natural production and passage survival are varied. The tool also allows the user to estimate the proportion of the population that is natural versus hatchery-influenced.

PROJECT OBJECTIVES

This project's objective was to undertake a one-time set of activities to support the development and implementation of analytical tools designed to allow for improved Chinook hatchery program design and operation in British Columbia. The project built on recent science and policy work in both Canada and the US HSRG process to support Chinook hatchery planning work so that it may better meet the harvest and conservation goals of managers and stakeholders. Specific project objectives included:

1) Training of CDFO analytical staff in the use and operation of the AHA-ISIT Tool.
2) Compilation of required data from priority BC Chinook stocks and population of this data within the tool (West Coast Vancouver Island, Fraser, Central and North Coast).
3) Use of tool outputs for the facilitation of improved management and enhancement of BC Chinook stocks.

This project's overall outcome was to address how hatchery management, along with harvest and habitat management, can best be applied over time to maintain progress toward recovery or maintenance of natural populations, while achieving enhancement production objectives.

MILESTONES, OUTCOMES & PROJECT EVALUATION

All milestones and deliverables described in the PSC Cost-Sharing Agreement (PSC Application #2018-EF-SEP-052) were met on time and within budget (Tables 1 and 3). Project resources were allocated efficiently and effectively. The project was slightly over budget due to an unexpectedly high US-CAN exchange rate. This amount was absorbed by DFO. The allocations of resources were considered appropriate and will be taken into consideration for planning of similar projects.

The project's purpose was to address hatchery management, while taking into consideration harvest and habitat management targets, in order o compare scenarios or actions that could be implemented over time to meet population goals. This could include progressing towards recovery or maintenance of a natural population and/or meeting harvest objectives. The collaboration met this purpose because the AHA-ISIT tool learned by DFO enhancement planning staff allows for the identification and comparison of hatchery, harvest and habitat scenarios that will facilitate decision making for Chinook management options.

Table 1 - Project Milestones, Responsibilities and Outcomes.

Date	Milestones	Responsible Party	Completed? (Y/N)	Outcome
April-May 2018	Establish cost sharing agreement between the PSC and DFO.	DFO/ PSC	Y	Cost sharing agreement was established between PSC and DFO.
July 2018	AHA-ISIT Tool Training Session. This will involve technical training on use and operation of AHA-ISIT tool delivered by a contractor.	DFO	Y	Training session for DFO staff and stakeholders was conducted by contractor and held in Vancouver, BC in August 2018
June-October 2018	Pertinent data for priority Chinook stocks will be compiled in appropriate format for entry into AHA-ISIT Tool.	DFO	Y	Data was compiled for Vancouver Island Chinook populations, including Burman, Bedwell, Cowichan, Nahmint, Puntledge, Quinsam, and Robertson, to name a few. Data compilation is ongoing for other populations.
November 2018	Submission of mid-season report with financial summary to PSC.	DFO	Y	Mid-season report was submitted and approved.
Sept-March 2019	Use of tool in production planning process during 2018 (planning for 2019	DFO	Y	Tool has assisted with production planning and hatchery management for

	production). Opportunities for program adjustments identified and recommended in integrated DFO hatchery and fishery management process.			Nahmint, Sarita, and Puntledge Chinook thus far. This is ongoing and will be used for other populations.
April 2019	Final Report to PSC. Final Report outlining outcome of each component/activity.	DFO	Y	Final Report was submitted to PSC.

RESULTS

The project ran smoothly and within estimated timelines. The training workshop provided by DJ Warren & Associates in August 2018 was well received by both DFO staff as well as external stakeholders. DFO enhancement planning staff continued learning how to populate and manipulate the tool throughout the fall of 2018 and the AHA-ISIT tool was implemented as part of the 2019 production planning for priority Chinook stocks. The implementation of the tool will continue into planning for 2020 and will serve as a vital support tool in the balancing of maximizing harvest benefits while minimizing impacts on wild salmon populations.

Future implementation of the AHA-ISIT LCM tool will be documented in the annual Integrated Fisheries Management Plan (IFMP), with specific fishery objectives for hatchery programs identified, as well as clear stock recovery objectives for hatchery programs aimed at restoring abundance and productivity in depressed populations.

Appendix 1 shows a basic example of the type of outputs and scenario comparisons that can be performed in the AHA-ISIT tool. This example is for the Puntledge River summer Chinook population.

A scenario comparison was done for Puntledge summer Chinook to compare various ocean survival rates to calculate the change in proportion natural influence of the population. With increased ocean survival it was possible to increase the proportion of natural origin fish returning to the spawning grounds and the number of natural fish in the fisheries.

Setting up the current state (i.e. Current Scenario) for Puntledge summer Chinook, the natural productivity was based on habitat productivity estimates. These estimates were then modified within the model to match the actual natural production observed in recent natural recruitment.

Based on the Current Scenario, the ocean survival is by far the greatest limiting factor to natural and hatchery production. The population's proportion of natural influence is also relatively low at 0.20, largely driven by the low natural ocean survival and the average annual smolt release of 475,000. The overall harvest rate is 25%.

As expected, doubling both the natural and hatchery origin ocean survival (Scenario 1) increases the number of fish in all categories. There is only a minor increase in the proportion of natural influence from 0.20 to 0.24. Tripling the ocean survival (Scenario 2) also has a relatively minor effect on the proportion of natural influence increasing it to 0.29. Under increased ocean survival conditions more fish are caught in each fishery (Figures 1 to 3, and Table 2).

APPENDIX I

Puntledge River Chinook AHA-ISIT Example Results

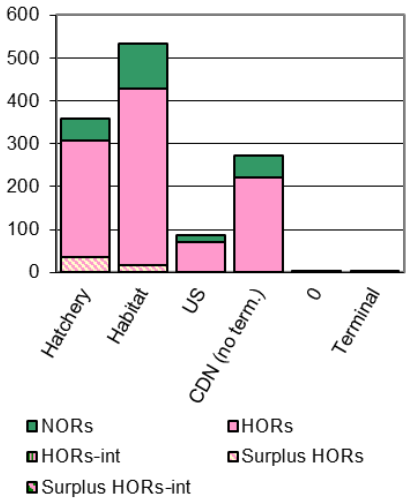

Figure 1 - Current Scenario

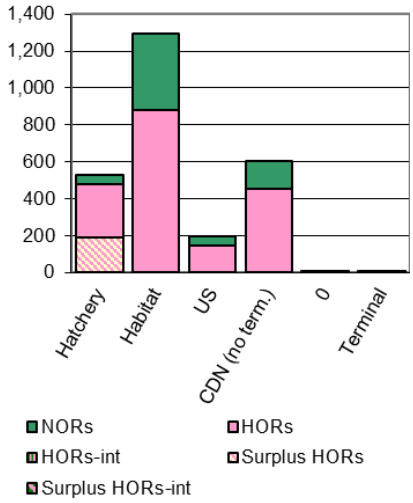

Figure 2 - Scenario 1

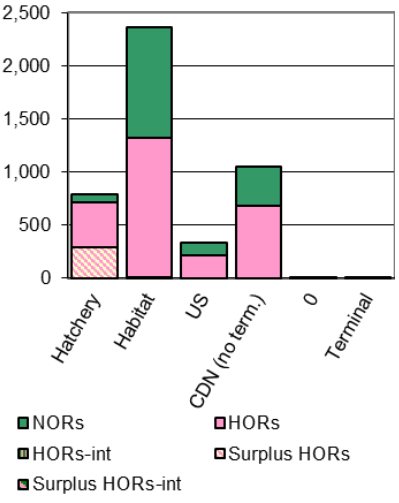

Figure 3 - Scenario 2

Table 2 - Abundance of Natural Origin Recruitment (NOR) and Hatchery Origin Recruitment (HOR) in each Fishery, Spawning Habitat and Hatchery.

	Fish Origin	Current Scenario	Scenario 1 (2x ocean survival)	Scenario 2 (3x ocean survival)
Hatchery	NOR	50	50	75
	HOR	308	476	714
Habitat	NOR	105	413	1,047
	HOR	428	880	1,321
US Catch	NOR	16	49	119
	HOR	70	144	216
CDN Catch	NOR	52	154	374
	HOR	220	452	678
Terminal Catch	NOR	0	0	0
	HOR	0	0	0

APPENDIX II

Financial Expenditure Summary

Table 3 - Details of expenditures registered in the DFO financial system at fiscal year-end ($CND).

Funding Total	**$ 87,415**

DJ Warren & Associates Contract	$ 47,775[1]
Biologist Salary (BI02)	$ 29,700
Employee Benefits Payment	$ 5,940
External Stakeholder Travel Costs	$ 4,000
Total Costs	**$ 87,415**

Balance *(refunded to PSC)*	**$ 0**

[1]Due to US-CND exchange rates being higher than anticipated, the costs of the DJ Warren & Associates contract was $52,313. The additional cost was absorbed by DFO.

REFERENCES

Hatchery Scientific Review Group (HSRG). 2017. Implementation of hatchery reform in the context of recovery planning using the AHA/ISIT tool. Prepared for the Washington Department of Fish and Wildlife as a training aid for users of the AHA/ISIT tool (July 2017). pp. 64. http://hatcheryreform.us/wp-content/uploads/2017/08/Final-Training-Framework-Paper-and-Appendices-7-14-17.pdf