

McLoughlin Creek Enhanced Chum Assessment project: Year 3 of 6

Final Report to the Northern Endowment Fund Committee

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Introduction

Production from the Heiltsuk Community Economic Development Project (CEDP) hatchery at Bella Bella has sustained the McLoughlin Creek Chum stock to a point where it has been able to consistently support both a commercial and FSC harvest in recent years. Starting in brood year 2008, production from this facility was doubled to 2M fry released. Returns in recent years have suggested outer coast chum may be surviving at a higher rate than inner coast chum stocks. Through a low cost fin clipping program, this project will estimate the survival and exploitation rate of this stock, which can inform both hatchery production as well as fishery management decisions for both inner and outer Central Coast chum stocks. Years 1 and 2 of this project have consisted solely of juvenile salmon marking; low-cost escapement and fishery sampling will occur in years 3-6 to complete assessment of marine survival.

Project Objectives

This project primary objective for this year was to fin clip mark a minimum of 160K McLoughlin Creek 2013 brood juvenile chum salmon from enhanced production at the McLoughlin Creek CEDP Hatchery and conduct sampling in the commercial fishery and escapement to establish incidence of marked returning adults for survival rate estimation of 2011 brood at age three.

Methods

A minimum release group of 160K chum will be anaesthetized and marked with an adipose fin clip prior to release. A portion of the marked group will be re-examined for a clip quality check prior to release. All mark and release data will be entered into the Salmonid Enhancement Program (SEP) release database. Fin clip marking is done by removal of the adipose fin using microsurgical iris scissors. Fry are processed through a marking table specially designed and outfitted for this purpose. Small net loads of unmarked fry are anesthetized and then placed in net "baskets". The docile fry are then picked up, and with the aid of a magnifying light the scissor blades are placed in line with the back of the fish snug up against the adipose fin and closed. Marked fry are placed in a short term recovery net by the marker and moved to larger recovery bucket as this net fills. A hand tally counter is set up by each basket so crew can record each fish that is clipped. Marked fish are checked for clip quality on a regular basis and mortalities at the table or in the rearing trough are recorded. DFO Community Advisor, Sandie MacLaurin and technician Shirley Willson were on-site March 31-April 4 to set-up the table and work with crew to refresh skills.

In the fall of 2014, both the escapement and terminal fisheries were sampled for mark rate, as well as for age composition. Given the small size of the spawning creek and limited distribution of chum spawners, stream walks and use of a carcass weir by hatchery staff allow for a large and temporally representative sample of adult spawners. All adults removed from the creek for broodstock are

examined for marks and records kept of unmarked and marked adults by sex. These fish are not introduced back into the creek so cannot be examined twice. Adults that die in the creek, either pre-spawn or post spawned are examined for marks and cut in two as part of the dead-pitch program. The information is recorded and will be used to obtain mark incidence throughout the run and an estimate of total escapement to the river.

2014 was the first year with expected returns of marked chum from the 2011 brood year release from McLoughlin hatchery. JO Thomas was contracted to provide sampling of commercial seine and gillnet fisheries in Area 7 that were likely to intercept McLoughlin chum. McLoughlin chum are targeted in near-terminal fisheries in Area 7. Sampling of catch from Area 7 chum fisheries will target a 20% sampling rate to calculate a precise mark rate estimate. Due to the nature of the terminal spawning grounds, sampling of escapement at a level >20% will be feasible. 100% of hatchery removals will be sampled for mark status. Biological sampling of both catch and escapement will allow for an estimate of age composition in both samples. Sample data will be coupled with an estimate of total catch and escapement to estimate total return of marked fish by age class. Using this data, an estimate of survival and enhanced contribution to catch can be calculated. The methodologies used follow a standard set of procedures that DFO has used successfully at Snootli Creek hatchery since 1978 to estimate survival and enhanced contribution to harvest for Area 8 chum.

The 161,721 juvenile chum that were marked and released in 2014 were part of a 1,801,646 total release of the 2013 brood. Culture of this brood started with egg-takes in McLoughlin Creek between September 18th and October 3, 2013. Primary incubation (to eyed stage) was done in Atkins bulk incubators and secondary incubation occurred in Kitoi style bulk incubators (these were installed with PSC northern funds in 2008 NF-2008-E-4) and Keeper Box style incubators. At the swim-up stage fry were ponded to Capilano rearing troughs at the hatchery and held for a few days to initiate feed. Once feeding began, all but approximately 200,000 fry were transferred to nearby salt water net pens for final rearing. The fry kept at the hatchery were used to accomplish the marking project and were then transferred to the net pens for final rearing. Rearing in the net pens continued for all fry until a 1.0 gram average weight was attained.

During broodstock collection and carcass dead-pitch of the 2013 brood, 100 scale samples were collected and processed to generate a profile of age class composition. The scale sampling program will continue through the length of the project with costs being absorbed by the CEDP contract and DFO. Age composition in adult returns is needed to allow for determining contribution by brood year when the same mark is used each year.

Results

Juvenile Chum Marking

During the period March 31 – April 25, 2014 a total of 176,407 juvenile chum from the 2013 McLoughlin Creek Hatchery brood were marked by removal of the adipose fin. Live inventory of marked chum transferred to the net pens for final rearing in McLoughlin Bay was 168,987. Survival from marking to release was 95.7% giving a total release of 161,721. These healthy fry were released on the 14 of May 2014. Adult returns from the 2013 brood would be expected between 2016 (age 3) and 2018 (age 5) with most returning at age 4 in 2017. Tables 1 to 3 summarize the juvenile releases from 2011-2013 broods years.

Table 1 – 2011 McLoughlin Creek brood year releases.

| | Marked | Unmarked | Totals | Mark rate |
|------------------------|---------|-----------|--------------|-----------|
| Seapen Release | - | 1,911,520 | 1,911,520 | 0% |
| Hatchery Release | 161,622 | - | 161,622 | 100% |
| Total Release | 161,622 | 1,911,520 | 2,073,142 | - |
| Total Mark Rate | - | - | 7.80% | - |

Table 2 - 2012 McLoughlin Creek brood year releases.

| | Marked | Unmarked | Totals | Mark rate |
|------------------------|---------|-----------|--------------|-----------|
| Seapen Release | 160,000 | 1,707,284 | 1,867,284 | 8.57% |
| Hatchery Release | - | 146,657 | 146,657 | 0.00% |
| Total Release | 160,000 | 1,853,941 | 2,013,941 | - |
| Total Mark Rate | - | - | 7.94% | - |

Table 3 - 2013 McLoughlin Creek brood year releases.

| | Marked | Unmarked | Totals | Mark rate |
|------------------------|---------|-----------|--------------|-----------|
| Seapen Release | 161,721 | 1,632,860 | 1,794,581 | 9.01% |
| Hatchery Release | - | 168,786 | 168,786 | 0.00% |
| Total Release | 161,721 | 1,801,646 | 1,963,367 | - |
| Total Mark Rate | - | - | 8.24% | - |

Adult Assessment - 2014 Escapement

This fall, the first marked returns of age three fish from the 2011 brood were expected. The 2011 brood year chum releases totaled 2,073,182. Of these, 1,911,520 were released from a sea pen and were unmarked. There were 161,622 adipose fin clipped chum released from the hatchery site itself for an overall mark rate of 7.8%.

Adult assessment in fresh water consists of examining fish taken for broodstock (egg-takes) and in a carcass pitch (called a dead-pitch) for incidence of marks, enumeration of adult chum in the river and collection of scales samples to obtain age composition in the escapement (Table 4a-c). A total of 119 usable scale samples were collected with a mix of male, female (Table 4c). It was noted by hatchery crew that a very high percentage of females were pre-spawn mortalities in the 2014 dead-pitch.

Table 4 – 2014 McLoughlin Creek chum river return.

| Source | Males Unmarked | Males Marked | Females Unmarked | Females Marked | Unknown Sex & Mark | Grand Total |
|--------------|----------------|--------------|------------------|----------------|--------------------|--------------|
| Broodstock | 1,012 | 16 | 1,094 | 4 | 0 | 2,126 |
| Deadpitch | 1,664 | 15 | 1,612 | 7 | 100 | 3,398 |
| Other | 0 | 0 | 0 | 0 | 850 | 850 |
| TOTAL | 2,676 | 31 | 2,706 | 11 | 950 | 6,374 |

Table 4b - 2014 McLoughlin Creek chum river return mark rate.

| Source (n=5524) | Male Mark Rate | Female Mark Rate | Total Mark Rate |
|---------------------|----------------|------------------|-----------------|
| Broodstock (n=2126) | 1.56% | 0.36% | 0.95% |
| Deadpitch (n=3398) | 0.89% | 0.43% | 0.67% |
| TOTAL | 1.15% | 0.40% | 0.78% |

Table 4c – 2014 McLoughlin Creek chum river return age composition.

| Source (n=119) | European | Gilbert-Rich | Brood Yr. | Frequency | Percent |
|----------------|----------|--------------|-----------|------------|----------------|
| Deadpitch | 4 | 51 | 2009 | 8 | 6.70% |
| Deadpitch | 3 | 41 | 2010 | 85 | 71.40% |
| Deadpitch | 2 | 31 | 2011 | 26 | 21.80% |
| TOTAL | - | - | - | 119 | 100.00% |

Adult Assessment - 2014 Area 7 Fishery

2014 was the first year with expected returns of marked chum from the 2011 brood year release from McLoughlin hatchery. JO Thomas was contracted to provide sampling of commercial seine and gillnet fisheries in Area 7 that were likely to intercept McLoughlin chum. A total of 163,469 chum were recorded as catch in the fishery which spanned statistical weeks 084 through 092 (Table 5). Of that catch, a total of 29,783 chum were sampled for marks and 74 were found to be marked (Table 6). A total of 71 of these were subsequently determined to be marked (3 were mislabeled as marked). To determine age composition of the catch, all marked fish were sampled to determine age (Table 7) and an additional 550 chum were sampled for age to determine the age composition of the entire catch. Of these, 534 returned usable age data (Table 8).

Table 5 - 2014 Area 7 commercial chum fishery total catch and sample rate.

| Statistical Week | Area | Gear | Catch | Sample Size | Sample Rate |
|------------------|--------------|----------------|----------------|---------------|---------------|
| 084 | 7 | Seine | 30,224 | 5,000 | 16.54% |
| | | Gillnet | 11,218 | - | 0.00% |
| | Total | | 41,442 | 5,000 | 12.07% |
| 091 | 7 | Seine | 62,603 | 16,169 | 25.83% |
| | | Gillnet | 14,110 | - | 0.00% |
| | Total | | 76,713 | 16,169 | 21.08% |
| 092 | 8 | Seine | 29,600 | 6,065 | 20.49% |
| | | Gillnet | 15,714 | 2,549 | 16.22% |
| | Total | | 45,314 | 8,614 | 19.01% |
| 084 - 092 | 7 | Seine | 122,427 | 27,234 | 22.25% |
| | | Gillnet | 41,042 | 2,549 | 6.21% |
| | | All | 163,469 | 29,783 | 18.22% |

Table 6 – 2014 Area 7 commercial chum fishery mark rate.

| | Sub-sample Size | Marked Male | Marked Female | Marked Unknown Sex | Grand Total |
|-----------|-----------------|-------------|---------------|--------------------|-------------|
| Catch | 29,783 | 36 | 27 | 8 | 71 |
| Mark Rate | 29,783 | 0.12% | 0.09% | 0.03% | 0.24% |

Table 7 - 2014 Area 7 commercial chum fishery age compositions of **Marked Catch.**

| Species | Gilbert-Rich | Brood Yr. | Males | Females | Unknown | Total | Total % |
|---------------|--------------|-----------|-----------|-----------|----------|-----------|---------|
| Chum | 51 | 2009 | 0 | 0 | 0 | 0 | 0% |
| Chum | 41 | 2010 | 6 | 5 | 3 | 14 | 21% |
| Chum | 31 | 2011 | 28 | 22 | 4 | 54 | 79% |
| Total: | | | 34 | 27 | 7 | 68 | 100% |

Table 8 - 2014 Area 7 commercial chum fishery age compositions of **Unmarked Catch.**

| Species | Gilbert-Rich | Brood Yr. | Males | Females | Total | Males % | Females % | Total % |
|---------------|--------------|-----------|------------|------------|-------|---------|-----------|---------|
| Chum | 51 | 2009 | 4 | 8 | 12 | 33% | 67% | 2% |
| Chum | 41 | 2010 | 200 | 187 | 387 | 52% | 48% | 72% |
| Chum | 31 | 2011 | 62 | 73 | 135 | 46% | 54% | 25% |
| Total: | | | 266 | 268 | 534 | 50% | 50% | 100% |

The hatchery reported an estimate of 1,250 for FN FSC fisheries. No sampling occurred on this catch and the catch data is not incorporated into this report.

Discussion

This is the first year that adult chum from the AFC marked 2011 brood year returned to McLoughlin Creek. On average, this population is comprised predominantly of 4 year old adults (~75% in 2014). Complete estimates of brood year-specific survival rate and contribution to catch and escapement will not be available until all cohorts have recruited to the fishery and escapement, which will be 2016 for the 2011 brood year and 2018 for the 2013 brood year.

Analysis of the 2014 return year data provides an estimate of the contribution of the enhanced 2011 brood year to the commercial fishery as well as escapement. As age 3 recruits comprise only a small proportion of the total recruitment from McLoughlin Creek hatchery, the estimated contribution of 2.33% of the total Area 7 commercial catch from brood year 2011 McLoughlin is not unexpected, nor is the contribution of 10.0% to spawning return. The higher contribution to the terminal escapement indicates that other stocks likely comprise a significant component of the Area 7 catch. Future years analyses will examine contribution to catch on a finer geographic scale to determine which fisheries are predominantly comprised of enhanced McLoughlin chum, and which are more mixed stock.

This data did allow us to detect an issue that will need to be addressed in future years. Any marked fish in the 2014 fisheries would be from 2011 as this was the first year chum were fin clipped and thus could return as 3 year olds. However, 21% of marked fish were 4 years olds (Table 7). This is due to either natural fin loss, misidentification of fin status in fishery and escapement samples, or errors in scale ageing. This could be problematic when trying to estimate contribution of enhancement from specific brood years. This issue will not be visible in future years as multiple age cohorts which are marked will be returning to the system and masking this "ageing error". An adjustment factor should be considered in future years' analyses to compensate for this bias.

Table 9 – Summary of contribution to Area 7 commercial fishery from McLoughlin Creek chum enhancement (2011 brood year only).

| 2011 BROOD YEAR | |
|--|-----------|
| 2011 total Release | 2,073,142 |
| 2011 Marked | 161,622 |
| 2011 Mark Rate | 7.80% |
| 2014 AREA 7 FISHERY | |
| 2014 Catch | 163,469 |
| 2014 Catch @ age 3 Composition | 25% |
| 2014 Catch @ age 3 | 40,867 |
| 2014 Catch Mark Samples | 29,783 |
| 2014 Marks @ age 3* | 54 |
| 2014 Catch Mark Rate | 0.18% |
| 2011 ENHANCED CONTRIBUTION TO FISHERY | |
| 2014 Estimated Marks @ age 3 | 296 |
| Expanded Age 3 McLoughlin Enhanced Catch in 2014 | 3,802 |
| Contribution of BY 2011 McLoughlin to Area 7 catch | 2.33% |

* 14 marked fish came back as age 4. These are not used in this analysis.

Table 10 – Summary of contribution to McLoughlin Creek chum escapement by enhancement (2011 brood year only).

| 2011 BROOD YEAR | |
|--|-----------|
| 2011 Total Release | 2,073,142 |
| 2011 Marked | 161,622 |
| 2011 Mark Rate | 7.80% |
| 2014 ESCAPEMENT | |
| 2014 Escapement | 6,374 |
| 2014 Escapement@ age 3 Composition | 21.8% |
| 2014 Escapement @ age 3 | 1,390 |
| 2014 Escapement Mark Samples | 5,382 |
| 2014 Marks | 42 |
| 2014 Escapement Mark Rate | 0.78% |
| 2014 ENHANCED CONTRIBUTION TO ESCAPEMENT | |
| 2014 Estimated Marks @ age 3 | 49.74 |
| Expanded Age 3 Enhanced Escapement in 2014 | 638 |
| Contribution of BY 2011 McLoughlin to Escapement in 2014 | 10.01% |

APPENDIX I

Financial Expenditures Summary

The total PSC funding for this project was \$26,770. Heiltsuk had \$10,570 provided directly to them which was used directly to hire fin-clippers. The \$16,200 that was provided to DFO is reported below.

Pacific Salmon Commission McLoughlin Creek Enhanced Chum Salmon Assessment 2014-2015 Expense (PC 57352)

| Row Labels | Sum of AMOUNT |
|--|------------------|
| Aircraft Rental | 1112.25 |
| Funds received from PSC | -16200.00 |
| H01486C12 | -15000.00 |
| PACIFIC SALMON COMMISSION | -15000.00 |
| H01840C24 | -1200.00 |
| PSC MCLOUGHLIN CREEK CHUM SAL | -1200.00 |
| Scientific Consultant | 15000.00 |
| F1007-110003 | 15000.00 |
| J.O THOMAS & ASSOCIATES LTD | 15000.00 |
| Protective & Other Clothing | 87.52 |
| Return of funds to PSC | 0.23 |
| Grand Total | 0.00 |