Alaska Hatchery Research Group **Technical Document:**[1] 9

Title: Region 1 Scale Aging Laboratory: Data flow and scale aging procedures **Version:** 1.0
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Background of AHRP

Extensive ocean-ranching salmon aquaculture is practiced in Alaska by private non-profit corporations (PNP) to enhance common property fisheries. Most of the approximately 1.7B juvenile salmon that PNP hatcheries release annually are pink salmon in Prince William Sound (PWS) and chum salmon in Southeast Alaska (SEAK; Vercessi 2014). The large scale of these hatchery programs has raised concerns among some that hatchery fish may have a detrimental impact on the productivity and sustainability of natural stocks. Others maintain that the potential for positive effects exists. To address these concerns ADF&G convened a Science Panel for the Alaska Hatchery Research Program (AHRP) whose members have broad experience in salmon enhancement, management, and natural and hatchery fish interactions. The AHRP was tasked with answering three priority questions:

I. *What is the genetic stock structure of pink and chum salmon in each region (PWS and SEAK)*?
II. *What is the extent and annual variability in straying of hatchery pink salmon in PWS and chum salmon in PWS and SEAK*?
III. *What is the impact on fitness (productivity) of natural pink and chum salmon stocks due to straying of hatchery pink and chum salmon*?

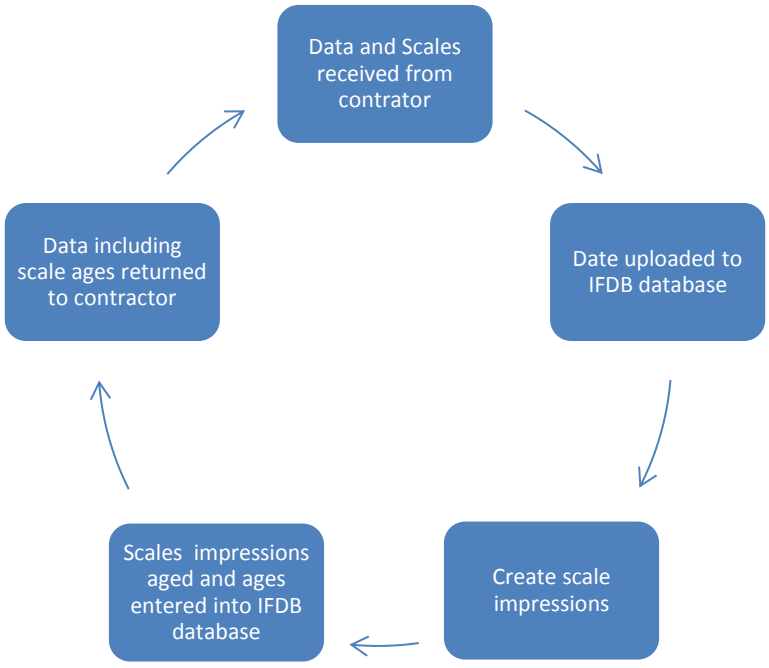
[1] This document serves as a record of communication between the Alaska Department of Fish and Game Commercial Fisheries Division and other members of the Science Panel of the Alaska Hatchery Research Program. As such, these documents serve diverse ad hoc information purposes and may contain basic, uninterpreted data. The contents of this document have not been subjected to review and should not be cited or distributed without the permission of the authors or the Commercial Fisheries Division

Introduction

To answer the third question, we need to know the origin and pedigree of each fish captured in select streams across multiple generations. Origin refers to the type of early life-history habitat (hatchery or natural) that a fish experienced. Pedigree refers to the family relationship among parents and offspring. 'Ancestral origin' refers to the origin of an individual's ancestors (e.g., two parents of a single origin [hatchery/hatchery or natural/natural] or two parents of mixed origin [hatchery/natural]). These ancestral origins can be determined by combining information from three sources: identification of hatchery origin from otolith marks, pedigree from genetic data, and age from scales (for chum salmon from SEAK).

This document is to provide information regarding the data flow and the lab scale aging procedures for chum salmon in SEAK to allow the Science Panel to assess this portion of the program.

Data flow

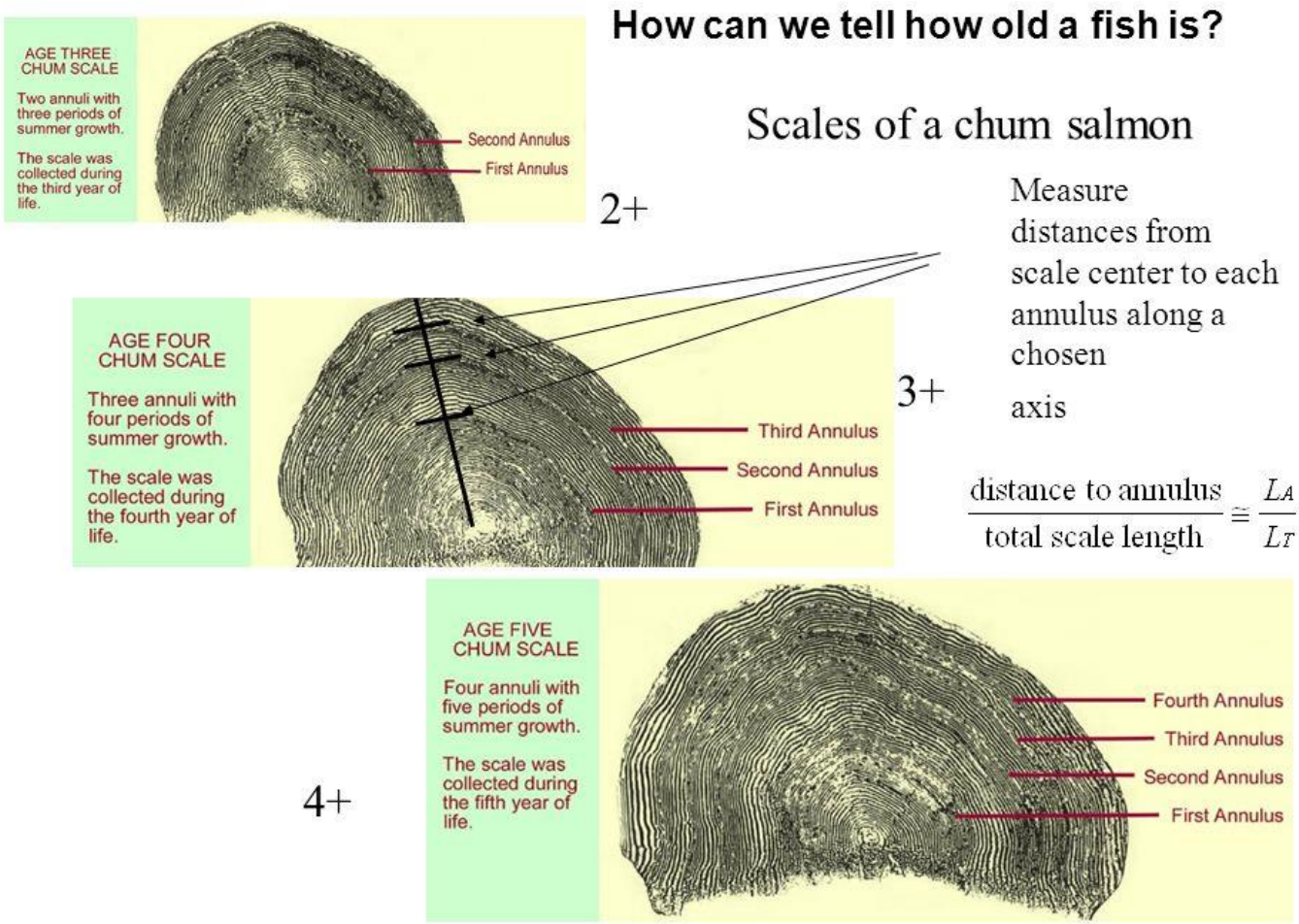


Scale Aging Procedures

1. Scale samples should be collected from the left side of the fish; two rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin.

2. Scales are mounted, ridged side up, on numbered gum cards with forceps. This gum card corresponds to a data point with other biological information (sex, length) recorded digitally on an Android tablet. Scale samples collected from Southeast Alaska chum salmon escapement systems as part of the AHRP are received from contractor in the fall at the ADF&G Region I Scale Aging Laboratory.
3. Data arrives electronically some weeks to months later. Data is uploaded to the Integrated Fisheries Database (IFDB) by ADF&G IT staff.
    a. Senior Scale Structure Analyst (Iris Frank) reviews the uploaded electronic data and compares it to scale samples (gum cards) to insure the individual data points match the gum cards received.
    b. Gum cards are labeled with ADF&G statistical code
    c. Data/samples are logged in master data log
4. Scale impressions are created
    a. Scale gum cards are attached to a .010" clear cellulose acetate
    b. Six scale gum cards with attached acetates are then placed in a compressed air operated automatic heat press and pressed to create scale impressions. The impressions are made with the following settings.
        i. 255° Fahrenheit
        ii. 100psi
        iii. For 2.45 minutes
    c. Once the impressions have been made the scale gum cards are removed from acetate and acetates are labeled. The label contains the following information.
        i. ADF&G statistical code
        ii. Species
        iii. Card number
        iv. Sample site
        v. Date of sample

5. Scale impressions were then examined under moderate (70x) magnification to determine age (similar to those of Mosher (1968)).
   <u>For chum salmon</u>:
   a. No Freshwater growth. There is no freshwater growth to analyze to age chum salmon (if FW growth is present----it is not a chum salmon scale and an age would not be assigned)
   b. Identification of grouping of circuli that represent an annulus in marine growth
      i. An annulus contains a grouping of summer growth circuli and winter growth circuli
         1. Summer growth circuli are thicker and more widely spaced than winter growth circuli
         2. Winter growth circuli are thinner and more closely spaced than summer growth circuli



   c. Identified annuli are counted and the resulting age is entered into the IFDB
      1. Age is recorded using the European notation (Koo 1962)

2. This is a 2 digit numerical format where:
    a. First digit represents freshwater growth
    b. Second digit represents marine growth

d. Senior Scale Structure Analyst (Iris Frank) reviews all scale samples submitted from this project for correct age assignment twice (2-3 weeks apart).

6. Data including matching ages is returned to contractor (usually via email)
7. Gum card and acetate impressions are archived

Staff experience and training

Since 1982 Alaska has used scale pattern analysis for annual sockeye stock identification in boundary and trans-boundary area fisheries. This work has been conducted in the Region I Scale Aging Laboratory. Scale patterns change somewhat from year to year based on differences such as weather and other environmental factors and an annual baseline of escapements need to be sampled to determine current year patterns. Visual scale patterns analysis is still conducted by Ms. Frank in-season to determine the presence of Chilkoot and Chilkat sockeye in the harvest of salmon from the Lynn Canal drift gillnet fishery. Age estimations provided by Ms. Frank are extremely consistent and have been relied upon by fishery managers and researchers in Southeast Alaska as well as Northern B.C. Canada for three decades. Age estimations by Ms. Frank have been used in the Pacific Salmon Treaty process for sockeye salmon since the Treaty was signed in 1985. At present there are two scale agers at the Region I Scale Laboratory and one ager in training. Typically a new ager will review the previous 3-5 years of data depending on the species, gear, and fishery area. New agers shadow experienced staff on current year data for 6 months to a year. New agers review questionable scales and/or age determinations with experienced agers over the course of their career and vice versa.

Quality control processes

At this time there is no set protocol for second reads of scale samples at the ADF&G Region I Scale Aging Laboratory. Ms. Frank spot checks age estimations by other agers for sockeye and chum samples. Discrepancy rates are typically very low after 2-3 years of aging scales. If a discrepancy is noted the agers will look at the sample together, apply the criteria for aging that species and determine the age. If an age cannot be determined the sample is not aged. The age error rate for chum salmon is extremely low especially for samples that do not have any resorption. Most of the samples collected as part of the AHRP are not resorbed. Pacific salmon start to resorb their scales as they get close to or into fresh water or have spawned. Escapement samples early in the season are not very resorbed and most if not all of the marine growth is

visible in the acetate impression. There is no known correlation between fish length and age for chum salmon as there is with sockeye salmon.

Age validation for chum salmon scale samples in Southeast Alaska is not a formal process conducted by the ADF&G Region I Scale Aging Laboratory. For sockeye samples it is common practice that age estimations of scale samples are accepted over age estimations by otoliths.

Questions for the AHRP

1. Are the aging methods appropriate for this study?
2. Is the level of training appropriate for this study?
3. Are the quality control procedures appropriate for this study?

AHRP Review and Comments

This technical document has been reviewed.

This document covers some of the long and well established procedures for scale aging in Southeast Alaska. There were no comments from the AHRG.

This document is acceptable to the AHRG.

References

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