

California Salmon Council  
Genetic Stock Identification Study Proposal

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The Pacific Fishery Management Council's (PFMC) Scientific and Statistical Committee previously reviewed proposals for Genetic Stock Identification (GSI) and non-retention at-sea sampling in November 2007 (Agenda item F.2.a) and March 2013 (Agenda item G.1.c). The current proposal was discussed during the Methodology Review, November 2015, and once again during the Scientific and Statistical Committee March 2019 (Agenda item D.4.a).

Here we propose examination of "Fine scale ocean distribution patterns of Klamath River Chinook salmon, in comparison to other stocks of interest, including the ESA-listed California Coastal Chinook." This work is funded by a 2015 Saltonstall-Kennedy grant to the California Salmon Council. The project summary from the proposal is attached. The goal of this project, which is part of the larger West Coast Salmon Genetic Stock Identification (WCS-GSI) Project, is to improve resolution of the ocean distributions of Klamath River Chinook (KRC) and California Coastal Chinook (CCC), with emphasis on geographic differences that may be useful for developing management regulations. This will be accomplished through at-sea sampling of Chinook salmon during both normal commercial fishing activity and non-retention sampling during times and areas closed to commercial fishing. Samples will be analyzed with genetic identification and scale analysis methods to assign a stock of origin and age to each fish. Laboratory results and at-sea data (location of capture, length, etc) will be combined to produce fine-scale stock-specific distribution information that is not obtainable with current dockside sampling methods. These data will be available to develop methodology to incorporate both genetic data and fine-scale harvest data in management decisions.

The original proposal included retention sampling during normal commercial harvest, combined with non-retention sampling in closed times and areas. Retention sampling was completed in 2016; results are attached. Though sampling in the Fort Bragg management zone and northern portion of the San Francisco management zone was robust, season structure did not permit sufficient sampling in the Klamath Management Zone. With prevailing season restrictions, retention sampling alone in the KMZ has been insufficient to allow statistical comparisons to other management zones.

Funds for non-retention sampling will expire after the 2020 commercial salmon season. Additional funds have been awarded for retention sampling in open areas for the 2020 season; this proposal is a unique and valuable opportunity for a direct comparison of samples from the KMZ, Fort Bragg, and the northern portion of the San Francisco management zones.

The sampling plan has changed significantly to increase the number of samples per area-week stratum in response to concerns that sample sizes would be insufficient to address statistical analysis requirements. The geographic and temporal focus has been narrowed to cover the time from mid-July through mid-September, as past data indicate that the largest difference between KRFC and CCC occurs later in the commercial season. Total sampling numbers over the season are decreased; impacts to stocks of concern are therefore lower than with the previous sampling plan.

Specifically, we propose doubling the sampling targets per area-week stratum (from 100 to 200) while focusing on times and areas (from the OR-CA border to Point Reyes) that 1) are most likely to show a catch per unit effort difference in the stocks of interest, and 2) provide data with the most utility for management.

The proposed project continues work from previous years (2010-2019), where data suggest a late-season difference in stock distributions between the ESA-listed California Coastal stock and the Klamath River hatchery fish that are used as their management proxy. Depending on the final season structure adopted by the PFMC, the WCS-GSI Project proposes targeting collection of approximately 4800 samples, including 1200 non-retention samples in closed times and areas. The exact location of non-retention sampling will be determined by 2020 season structure, management and scientific priorities, and availability of sampling vessels. Table 1 describes the proposed sampling plan, formulated with the understanding that the final sampling plan may be altered to accommodate the final, approved PFMC commercial season.

The fraction of Central Valley fall Chinook encounters varies considerably by area-week and by year. We have observed stock fractions in the focal areas of between 43-73%, with an annual average of 54%. Fractions of CCC vary from 2-10%, with an annual average of 5%; fractions of KRC vary from 4-11%, with an annual average of 7%. At these rates we expect to observe at least a few individuals of each stock of interest in samples of 200 fish per area-week stratum.

Management zone	Port	1-15	16-31	1-15	16-29	1-8	9-27
		July		August		September	
OR-KMZ	Brookings						
KMZ	Crescent City		200	200	200	200	
	Eureka		200	200	200	200	
Fort Bragg	Fort Bragg		400	400	400	400	
San Francisco-N	Bodega Bay		400	400	400	400	
San Francisco-S	San Francisco						
	Half Moon Bay						

Table 1. Proposed sample targets, 2020. Previously observed stock concentrations indicate sample targets of 200 fish per area-week stratum. Red cells are times and areas anticipated to be closed to commercial fishing. Green cells are anticipated to be open.

*Estimated Impacts.* It is proposed to collect 1200 non-retention samples. Mortality during catch-and-release sampling is estimated at 31%, resulting in 372 mortalities. Actual mortality estimates for all stocks, including SRFC, will be provided by the STT during the PFMC 2020 salmon preseason management process.

**Project Summary** 2014/2015 Saltonstall Kennedy (2014/15 S-K)

**Application Organization:** California Salmon Council

**Title:** Fine scale ocean distribution patterns of Klamath River Chinook salmon, in comparison to other stocks of interest, including the ESA-listed California Coastal Chinook

**S-K Priorities:** Theme #2.A: improve the cost effectiveness, accuracy, timeliness, and methods for the collection, reporting, and dissemination of fishery-dependent data; provide advanced sampling techniques to improve data collection in otherwise inaccessible habitats, and improve current stock assessments by refining estimates of population dynamics; and improve current sampling methods for fisheries not included in existing surveys.

Theme #3.B: improve stock assessments, as high uncertainty in fisheries stock assessments leads to lower allowable catches; and improve stock definitions and understanding of stock boundaries.

**Award dates:** January 1, 2016 –April 30, 2020

**Principal investigator:** David J. Goldenberg, CEO, California Salmon Council

**Collaborating partners:**

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John Carlos Garza, Supervisory Research Geneticist, NMFS Southwest Fisheries Science Center, and Adjunct Professor of Ocean Sciences, UCSC

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Will Satterthwaite, Research Ecologist, NMFS Southwest Fisheries Science Center

Jeff Feldner, PFMC Board member

**Species addressed:** Chinook salmon (*Oncorhynchus tshawytscha*)

**Resources addressed:** California and Oregon ocean troll fisheries

**Proposed activities:**

The west coast commercial Chinook salmon (*Oncorhynchus tshawytscha*) fishery is managed on a stock-specific basis. Access to the fishery has been severely constrained in the past decades due to concerns about harvest of fish from stocks considered weak or listed as Threatened under the U.S. Endangered Species Act (ESA). Even in years when other stocks are healthy and abundant, conservation objectives for a single stock may limit harvest in the mixed-stock ocean fishery. Since 2006, fisheries have been limited or closed entirely when conservation objectives were not met for Klamath River fall run Chinook (KRFC), California Coastal Chinook (CCC), or Sacramento River fall run Chinook (SRFC). The constraining stock changes from year to year, but the need to understand stock-specific ocean distribution patterns throughout the historical fishing season (May-September) remains. Current fishery management strategy responds to changes in population numbers on a stock-specific basis by limiting effort in certain times and areas; this strategy inherently requires a stock-specific temporal-spatial understanding of ocean distribution.

Data from previous years (2010-2014) suggest 1) a late-season difference in stock distributions between the ESA-listed California Coastal stocks and the Klamath River hatchery fish used as a management proxy; and 2) major differences in the relative catch rates of Klamath River fall run Chinook and Sacramento fall run Chinook north and south of Point Reyes, a potential new management boundary. The work proposed here will address geographic areas where more data are needed, refine sampling methods to obtain data that are more representative of the commercial fishery, and construct cohort-specific data for sampled fish. Through a targeted sampling effort to distinguish the distributions of KRFC, CCC, and SRFC stocks

between Humbug Mountain and Pigeon Point (Klamath Management Zone in Oregon and California, Fort Bragg Management Area, San Francisco Management Area), we will conduct a spatiotemporal analysis of stock distributions in the commercial ocean fishery.

Genetic methods assign stock of origin for all fish independently of coded wire tag (CWT) insertion, allowing naturally-spawning CCC stocks to be evaluated separately from the KRFC proxy stock. At-sea sampling methods produce fine-scale geographic and depth data which are not possible with current dockside sampling methods; combined with stock identity and age information derived from laboratory analyses, we can produce high-resolution, time-scaled maps of age-specific catch probabilities. These data and visualizations will be available to develop methodology to incorporate both genetic identification data and fine-scale harvest data in management decisions.

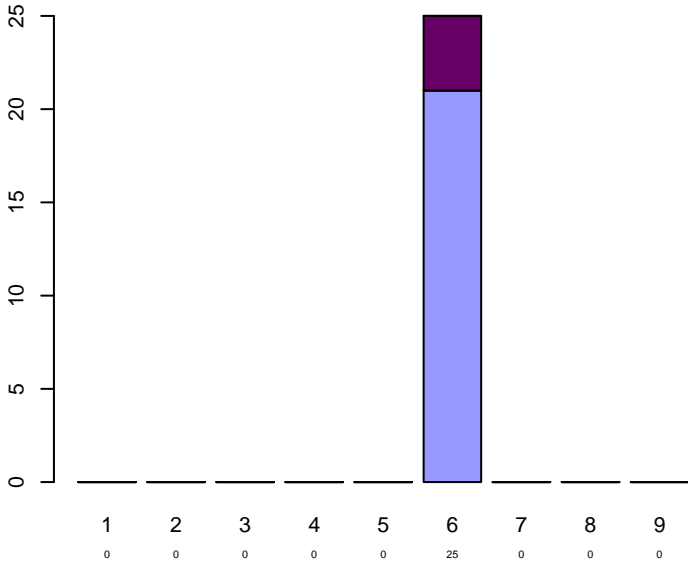
Since 2007, our collaboration of fishermen, scientists, and managers has been collecting samples and associated metadata during normal fishing operations. We will build upon past work and our collaborative network to continue at-sea sample and data collection. We will contract with commercial fishermen in California and Oregon to collect at-sea samples and associated metadata during normal fishing operations. Sample and data collection will be conducted during the commercial season in 2016; we have experience obtaining the necessary permits to conduct non-retention sampling as allowed by the Pacific Fishery Management Council. Tissue samples will be analyzed with genetic methods to assign the stock of origin of each fish; scale samples will be analyzed to determine age cohorts. Stock-specific catch per unit effort estimates will be generated for each management zone on a monthly basis. In the case of the San Francisco Management Zone, Point Reyes will be added as a theoretical management boundary, dividing the management zone into two areas for analysis.

We will work in partnership with Fish Trax Inc. to include all data in a comprehensive fishery informatics network. This system will allow for quick data upload to a secure online database; data sharing between fishermen, scientific partners, and managers; generation of weekly reports for distribution to the fleet; and analysis of fine-scale, stock-specific harvest models.

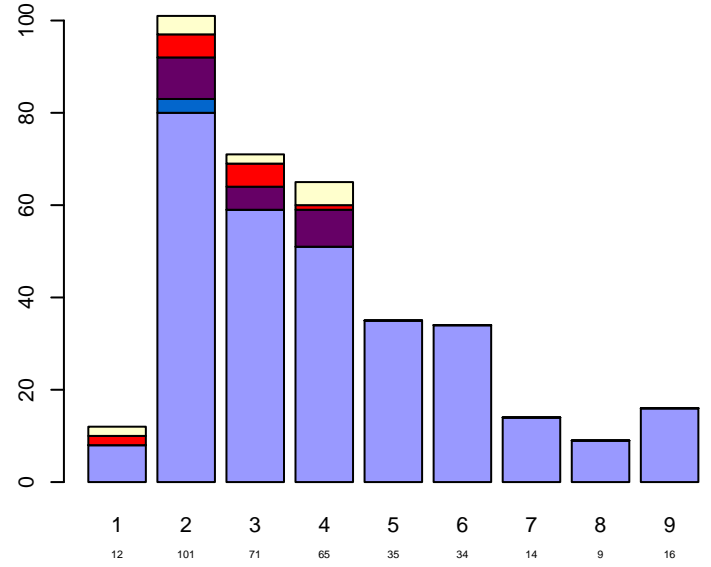
**Anticipated benefits:**

This project directly engages fishermen in data collection activities and the management process. The fine-scale stock distribution models will reduce the geographic uncertainty surrounding commercial ocean harvest of Chinook salmon. Identifying catch probability patterns of ESA-listed stocks will reduce the bycatch of those stocks in the commercial fishery. Reduced uncertainty potentially can lead to reduced precautionary harvest restrictions and increased fishing opportunities. In contrast to CWT datasets, GSI has the promise of delivering catch composition estimates to fishermen and managers within a week of harvest.

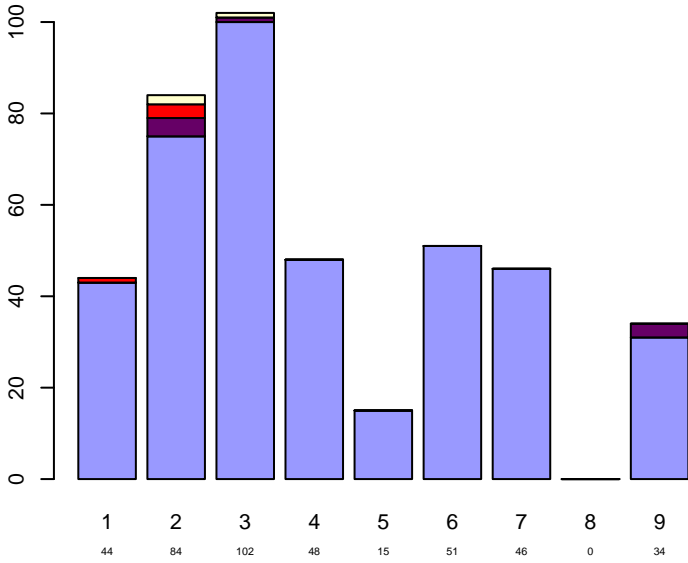
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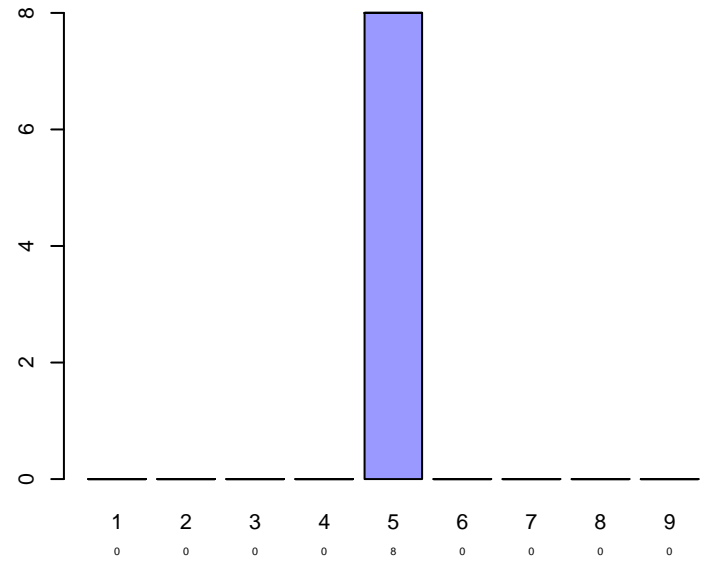
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**BB**  
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**SF**  
n = 8



Results from 2016 at-sea retention sampling  
806 Chinook salmon were sampled in 3 management zones from the first week of August through the last week of September, 2016. Stock compositions were more mixed in the first weeks of August compared to the later weeks of September.

Note that the small sample size in San Francisco was a test sampling.