PRESEASON SALMON MANAGEMENT SCHEDULE FOR 2008

To plan, announce, and meet *Federal Register* deadlines for public hearing sites and the entire preseason salmon management process, staff needs to confirm details of the process prior to the end of November. The proposed 2008 process and schedule are contained in Agenda Item F.1.a, Attachment 1.

For 2008, Council staff recommends one salmon management option hearing per coastal state, the same schedule as in 2007 except for moving the California hearing back to Eureka. The hearings would be:

March 31, 2008	Westport, Washington and Coos Bay, Oregon
April 1, 2008	Eureka, California

In 2008, the March Council meeting will occur in Sacramento, California and the April Council meeting in Seattle, Washington. Therefore, the public comment period on Tuesday of the April meeting in Seattle also serves as a public comment opportunity. If the states desire to have additional hearings, we suggest they organize and staff them as was done in past years. The table below provides the public attendance at the hearing sites since 1995 for Council reference.

Hearing Site Location[1/]	Public Attendance												
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Westport	49	30	22	4	18	24	30	11	16	16	25	26	34
Astoria	28	23	16	-	14	-	-	-	-	-			
Tillamook	-	-	-	28	-	13	16 [2/]	18 [2/]	-	-			
Coos Bay	22	30	27	15	31	36	18	40	26	26	105	146	43
Eureka	30	45	27	16	18	37	12	25	46	-			
Ft. Bragg	-	-	-	-	-	-	-	-	-	27	38	-	
Sacramento	16	-	-	13	-	-	-	-	-	-			
Santa Rosa	-	-	-	-	-	4	-	-	-	-		500	35
Moss Landing[2/]	-	-	-	100	51	50	33	14	-	-			

1/ Sites in bold are proposed for Council staffing in 2008.
2/ Hearing staffed by state personnel.

Council Action:

1. **Confirm Council-staffed hearing sites and state intentions for additional hearings.**
2. **Approve staff's overall proposed schedule and process for developing 2008 ocean salmon management measures.**

Reference Materials:

1. Agenda Item F.1.a, Attachment 1: Pacific Fishery Management Council Schedule and Process for Developing 2008 Ocean Salmon Fishery Management Measures.

Agenda Order:

a. Agenda Item Overview — Chuck Tracy
b. Agency and Tribal Comments
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action**: Approve 2008 Preseason Management Schedule and Hearing Sites

PFMC
10/17/07

PACIFIC FISHERY MANAGEMENT COUNCIL SCHEDULE AND PROCESS FOR DEVELOPING 2008 OCEAN SALMON FISHERY MANAGEMENT MEASURES

Nov. 5-9, 2007	The Council and advisory entities meet at the Hyatt Regency Mission Bay, San Diego, California to: (1) adopt the management process and schedule for 2008 ocean salmon fisheries; (2) consider any changes to methodologies used in the development of abundance projections or regulatory options, and; (3) consider an exempted fishing permit for genetic stock identification sampling in 2008.
Jan. 22-25, 2008	The Salmon Technical Team (STT) and Council staff economist meet in Portland, Oregon to draft *Review of 2007 Ocean Salmon Fisheries*. This report summarizes seasons, quotas, harvest, escapement, socioeconomic statistics, achievement of management goals, and impacts on species listed under the Endangered Species Act. (February 8 print date, available to the public February 15.)
Feb. 19-22	STT meets in Portland, Oregon to complete *Preseason Report I Stock Abundance Analysis for 2008 Ocean Salmon Fisheries*. This report provides key salmon stock abundance estimates and level of precision, harvest and escapement estimates when recent regulatory regimes are projected on 2008 abundance, and other pertinent information to aid development of management options. (February 27 print date, available to the public and mailed to the Council February 28.)
Feb. 25 through Mar. 8	State and tribal agencies hold constituent meetings to review preseason abundance projections and range of probable fishery options.
Feb. 28	Council reports summarizing the 2007 salmon season and salmon stock abundance projections for 2008 are available to the public from the Council office.
Mar. 9-14	Council and advisory entities meet at the Doubletree Hotel Sacramento, Sacramento, California, to adopt 2008 regulatory options for public review. The Council addresses inseason action for fisheries opening prior to May 1 and adopts preliminary options on March 11, adopts tentative options for STT analysis on March 12, and final options for public review on March 14.
Mar. 17-20	The STT completes *Preseason Report II: Analysis of Proposed Regulatory Options for 2008 Ocean Salmon Fisheries*. (March 21 print date, mailed to the Council and available to the public March 24)
Mar. 17 though Apr. 6	Management agencies, tribes, and public develop their final recommendations for the regulatory options. North of Cape Falcon Forum meetings are usually scheduled for around March 17 (Portland area), March 18-19 (Olympia area) and April 1-3 (Seattle area).

Mar. 24	Council staff distributes *Preseason Report II: Analysis of Proposed Regulatory Options for 2008 Ocean Salmon Fisheries* to the public. The report includes the public hearing schedule, comment instructions, option highlights, and tables summarizing the biological and economic impacts of the proposed management options.
Mar. 31 and Apr. 1	Sites and dates of public hearings to review the Council's proposed regulatory options are: Westport, Washington (March 31); Coos Bay, Oregon (March 31); and Eureka, California (April 1). Comments on the options will also be taken during the Council meeting on April 8 in Seattle, Washington.
Apr. 6-11	Council and advisory entities meet to adopt final regulatory measures at the Seattle Marriott Hotel Sea Tac, Seattle, Washington. The *Preseason Report II: Analysis of Proposed Regulatory Options for 2008 Ocean Salmon Fisheries* and information developed at the Council meeting is considered during the course of the week. The Council will tentatively adopt final regulatory measures for analysis by the STT on April 8. Final adoption of recommendations to National Marine Fisheries Service (NMFS) are scheduled to be completed on April 10.
Apr. 11-17	The STT completes *Preseason Report III: Analysis of Council-Adopted Regulatory Measures for 2008 Ocean Salmon Fisheries*. (April 17 print date, mailed to the Council and available to the public April 25)
Apr. 18-24	Council and NMFS staff completes required National Environmental Policy Act documents for submission.
Apr. 25	Council staff distributes adopted ocean salmon fishing management recommendations, and *Preseason Report III* is made available to the public.
May 1	NMFS implements federal ocean salmon fishing regulations.

PFMC
10/17/07

SALMON METHODOLOGY REVIEW

Each year, the Scientific and Statistical Committee (SSC) completes a methodology review to help assure new or significantly modified methodologies employed to estimate impacts of the Council's salmon management use the best available science. This review is preparatory to the Council's adoption, at the November meeting, of all anticipated methodology changes to be implemented in the coming season, or in certain limited cases, of providing directions for handling any unresolved methodology problems prior to the formulation of salmon management options in March. Because there is insufficient time to review new or modified methods at the March meeting, the Council may reject their use if they have not been approved the preceding November.

This year the SSC is expected to report on recovery exploitation rate development for Endangered Species Act listed lower Columbia tule Chinook, new base period development methods for the Coho Fishery Regulation Assessment Model (FRAM), and a genetic stock identification (GSI) study proposal, which includes a request for consideration of an exempted fishing permit (EFP) (Agenda Item F.2.a, Attachment 1).

The SSC also received updates on adding stocks to the Chinook FRAM and changing the coded-wire-tag (CWT) representation for lower Columbia natural tule Chinook and coho in Chinook and Coho FRAMs, respectively.

At the September 2007 meeting, the Council provided guidance regarding the level of SSC review necessary for some of the proposed methodology changes, as reflected in the SSC recommendations. Council Staff has drafted a modified Council Operating Procedure 15, Salmon Estimation Methodology Updates and Review, based on the discussion at the September meeting (Agenda Item F.1.a, Attachment 2). The modifications distinguish between methodology changes warranting review by the SSC and more specialized issues appropriate for review by the Salmon Technical Team (STT) and/or the Model Evaluation Workgroup (MEW). Allowing the STT and MEW to review issues such as the years in base periods, CWT representation, and stock additions will also help ensure consistency between Council and Pacific Salmon Commission (PSC) coho models. The PSC typically implements such modifications for upcoming seasons after its January or February meetings, which does not integrate well with the Council process for approving methodology changes the preceding November. Coordinating PSC and Council model updates will help ensure impacts to critical stocks are modeled consistently in both forums. Preliminary action on this item would be considered at this Council meeting with final action at the March 2008 Council meeting.

Council Action:

1. **Approve methodology changes as appropriate for implementation in the 2008 salmon season.**
2. **Provide guidance, as needed, for any unresolved methodology issues.**
3. **Adopt EFP application for GSI study as appropriate for public review.**
4. **Preliminary action to consider modifications to COP 15.**

Reference Materials:

1. Agenda Item F.2.a, Attachment 1; Strategies to Minimize Catch of Klamath River Chinook Salmon in West Coast Mixed Salmon Fisheries.
2. Agenda Item F.2.a, Attachment 2; Draft Council Operating Procedure 15, Salmon Estimation Methodology Updates and Review.
3. Agenda Item F.2.b, Supplemental SSC Report.
4. Agenda Item F.2.d, Supplemental STT Report.
5. Agenda Item F.2.d, Supplemental MEW Report.

Agenda Order:

a. Agenda Item Overview — Chuck Tracy
b. Report of the Scientific and Statistical Committee (SSC) — Bob Conrad
c. Agency and Tribal Comments
d. Reports and Comments of Advisory Bodies
e. Public Comment
f. **Council Action**: Adopt Final Salmon Methodology Changes for 2008 Salmon Seasons

PFMC
10/16/06

STRATEGIES TO MINIMIZE CATCH OF KLAMATH RIVER CHINOOK SALMON IN WEST COAST MIXED SALMON FISHERIES.

Project Summary

This project is in response to the second program priorities item: Strategies to Minimize Catch of Klamath River Chinook Salmon in West Coast Mixed Salmon Fisheries.

The goal of this proposal is to apply genetic stock identification technology to determine fine-scale stock distribution patterns in space and time for Klamath-origin and other associated stocks. Fisherman, scientists and managers from California, Oregon and Washington propose a collaborative project to assemble data on time, location, and stock of origin for Chinook salmon sampled across management regions in California and Oregon. Fish will be collected by commercial salmon trollers using protocols developed in 2006 and 2007 by Project CROOS and also applied in California. Stock origin of fish encountered will be determined by amplifying 13 microsatellites from fin-clip samples and comparing genotypes with the GAPS baseline; a catalog of allele frequencies for primary Chinook stocks distributed from California through to Alaska. We will relate stock encounters to fishing effort determined from global positioning system-derived fishing boat track logs to map stock distribution patterns independent of relative stock abundance. Our primary objective in this proposal is to analyze samples collected from times and areas that are closed to fishing in 2008. Many of these areas have been largely closed to fishing for the past two decades. Data collected will complement other sampling programs anticipated to be conducted in open areas to create a broad-scale distribution map of Chinook stocks. Results will be used to update baseline stock distributions used to by fisheries managers to design fishing seasons. To achieve our primary objective we will require an exempted fishing permit (EFP) from the National Marine Fisheries Service through the Pacific Fishery Management Council. Failing EFP authorization we will focus attention on unfished locations in open areas. Through use of alternate funding we already plan to sample catch from commercial troll fishing, but such fishing is not uniformly distributed. We would direct vessels to sample randomly from areas not being utilized by the fleet in order to determine the underlying distribution of Chinook independent of the fishery. In this way we would provide as complete an assessment of fine-scale stock distribution as possible. Data from this study combined with information collected in other sampling efforts can be used to assess the relationship between stock distribution patterns and physical and biological oceanographic patterns over time. This information could potentially be used to by fisheries managers to direct fisheries towards stocks of harvest intent and away from stocks of conservation concern including Klamath River fall Chinook.

STRATEGIES TO MINIMIZE CATCH OF KLAMATH RIVER CHINOOK SALMON IN WEST COAST MIXED SALMON FISHERIES

Principal Investigator: David Goldenberg

Narrative Project Description

PROJECT GOALS AND OBJECTIVES

Goal 1: Determine the distribution of Klamath River Chinook (KRC) and other Chinook stocks in times and areas closed to salmon commercial fishing due to restrictions on ocean harvest of Klamath River Fall Chinook and ESA-listed stocks, including some times and areas that have been closed for over 20 years.

Objective 1-A: Employ commercial salmon fishermen to collect tissue and scale samples of Chinook salmon from ocean fisheries for genetic and ageing analysis.

Objective 1-B: Collect head samples of adipose-clipped fish to screen for presence of coded-wire tags (CWTs); if a fish is marked with a CWT, use data from this fish for scale-age and genetic stock identification validation.

Objective 1-C: Obtain ancillary data for each sample including time and location of capture and associated fishing effort.

Objective 1-D: Analyze samples to identify stock of origin, age, and contribution rates to time and area fisheries.

Objective 1-E: Determine stock-specific ocean distributions by comparing sample catch per unit of fishing effort (CPUE) ratios across the range for each time period. Standardizing results by CPUE adjusts for the uneven distribution of effort that would be confounded with the uneven distribution of fish.

Objective 1-F: Determine fine-scale distribution patterns of KRC in relation to other stocks over their range in Oregon and California, especially in times and areas that have been closed to salmon commercial fishing for many years.

Goal 2: Provide information that may allow fishery managers to design fisheries that provide greater harvest of strong (abundant) stocks while limiting weak stock impacts to ensure compliance with allowable fishery impacts on weak stocks.

Objective 2-A: Provide information that can be used to update baseline distribution data on Chinook stocks in fishery management models, for example, the Klamath Ocean Harvest Model (Mohr 2006).

Objective 2-B: Contribute to a coast-wide database of KRC and other Chinook stock distributions.

Objective 2-C: Provide data that potentially can be used by managers to identify local differences in stock distributions. In other fisheries these differences in distribution have made it possible to develop fishing regimes that allow for the reduction of impacts to weak stocks while providing additional harvest of strong stocks.

A broader third goal is to establish a uniting collaborative process among fishermen, scientists and fisheries managers on the West coast by working together to achieve goals and objectives as outlined in this proposal.

The Pacific Northwest is renowned for a large diversity of salmon stocks. Although population sizes vary from year to year, some relatively productive stocks can sustain considerable commercial fishing pressure while other stocks, whose productivity may be depressed for various reasons, cannot withstand high fishing pressure. These stocks intermix in the ocean in varying proportions. As a result, fish are harvested in proportion to their relative abundance in the mixture. Fishery closures to protect weak stocks often constrain fishermen's access to more abundant stocks. For example, the 2006 regulations to protect Klamath River fall Chinook (KRFC), resulted in some of the most extensive closures ever experienced off the coasts of California and Oregon and limited harvest of the Central Valley fall Chinook stock which was abundant that year.

Historical information about the ocean distribution of Chinook stocks is based on coded-wire tags (CWTs) recovered from fish sampled in ports of landing along the coast. As a result, the spatial resolution of stock distribution data is on the order of 100 kilometers. Coast-wide, about five percent of Chinook and coho salmon caught in the ocean have CWTs and about 20% of the landed catch is sampled, so substantial statistical sampling and expansion problems make it difficult to detect locally rare stocks in small fisheries. This sampling problem can be partially mitigated by marking stocks of interest at a higher rate to increase the likelihood of CWTs being recovered in samples. While the CWT program has provided valuable information on the ocean distribution of Chinook salmon stocks, most CWTs are applied to hatchery-origin fish and it must be assumed that the ocean distribution of hatchery-origin fish is the same as their natural-origin counterparts. For most of these "indicator stocks" this assumption has not been well tested. However the use of GSI along with CWT's may provide a basis for such an analysis. An expert panel convened by the Pacific Salmon Commission in 2005 recommended including genetic technologies to in the Pacific Salmon Treaty-required tagging system (Hankin et al. 2005).

When fisheries are closed, no information is typically collected. Several times and areas off the coasts of California and Oregon have been largely closed to salmon commercial fishing since the mid 1980's to limit ocean fishery impacts on KRFC and ESA-listed stocks. As a result, there is little recent data from these times and areas regarding Chinook ocean distributions. Ocean harvest management models are premised on well-informed characterizations of the distributions

of stocks, and for these times and areas, distributional assumptions must be invoked based largely on the data collected prior to the mid 1980s (when the salmon commercial fisheries were largely unrestricted). If stock distributions have changed over the past two decades, however, estimates of KRFC contribution rates and fishery contact rates per unit effort in these areas may be inaccurate. An updated distribution database may help improve the performance of these harvest management models.

The technique of genetic stock identification (GSI), along with new mapping tools, global positioning systems (GPS) and satellite remote sensing have promise to provide data on relationships between stock distribution patterns in time and space and biological and physical parameters in near-real-time. These techniques and data can be employed to develop management measures that result in greater harvest of strong stocks while monitoring weak stocks impacts to ensure compliance with allowable fishery impacts. For example, GSI is being used in Chinook salmon troll fisheries off the Queen Charlotte Islands in Canada where fisheries are permitted only when the contribution rate of West Coast Vancouver Island Chinook (WCVI) stocks are below a threshold as determined by a test fishery (Winther and Beacham 2006, Beacham in review). GSI-determined patterns of abundance in this fishery have resulted in an increased overall harvest while decreasing fishery impacts on WCVI stocks. We are in the process of developing the data and methodologies necessary to explore whether similar management strategies might prove successful off the coasts of Oregon and California. Successful completion of the work in this proposal will be an important step toward this evaluation.

GSI technology can complement data collected from CWTs for applications to fishery management. Every single Chinook salmon (both hatchery and wild) has a genetic "tag" that can be used to identify the stock of origin for that fish. This is in contrast to CWTs which are placed in only a small percentage of fish and almost entirely in hatchery stocks. Thus, while GSI identification errors do occur at modest rates, this method does not suffer from the expansion problem resulting from having to draw inference from a tag that occurs, typically, in only 5% of any catch. Genetics labs from Alaska to California have collaborated through a consortium called Genetic Analysis of Pacific Salmonids (GAPS) to create a coast-wide genetic database that includes more than 40 reporting groups comprising over 165 individual Chinook stocks. This GAPS microsatellite database allows for the identification, from a small piece of tissue, the origin of most Chinook salmon in the northeast Pacific. As a result we can now determine the stock composition of ocean fishery harvest with much greater resolution than with CWT data alone.

The advent of the GAPS database, combined with GPS technology, provides an opportunity for describing stock distribution and aggregation patterns in a way not previously possible. Project CROOS (Collaborative Research on Oregon Ocean Salmon, CROOS 2007, www.ProjectCROOS.com) and a similar collaborative California Salmon GSI project (Garza 2007) have, in 2006 and 2007, developed and tested sampling protocols that link genetic information from individual fish with GPS-determined time and location of catch and associated data. These two projects were both restricted, by budgetary and regulatory constraints, to sampling conducted only during open times and areas during the commercial Chinook salmon

fishing season. These projects successfully described the distribution of stocks to certain fisheries from Cape Falcon, Oregon south to Pigeon Point, California, during the open fishing season. However, the lack of data on stock distributions from closed times and areas poses a serious gap in our efforts to understand the current distribution of Chinook stocks off the coasts of California and Oregon. Furthermore, two years of data are not sufficient to completely characterize stock distributions, as these are expected to change in response to fluctuating abundance and varying oceanographic conditions.

The long-term goal of this project is to increase the information available to managers on the temporal and spatial distribution of specific West coast salmon stocks including KRC within the Pacific Fishery Management Council (PFMC) management area. If it is shown that substantial variation in temporal and spatial distribution exists, and we are able to discern predictable relationships between stock-specific distributions and physical and biological parameters, concordant management strategies may provide commercial fishermen with additional access to strong stocks while adequately protecting weak stocks. The first step in evaluating the utility of GSI technology for application in fisheries management is to explore and determine the distributions of the stocks.

We propose sampling in closed areas and during closed times throughout the commercial salmon fishing seasons south of Cape Falcon, OR. Data from the proposed project will complement separate projects conducted in 2006-2007 in California and Oregon, which are anticipated to continue in 2008. Samples collected in the proposed collaborative project will be used to fill in "blanks" in closed areas and times not sampled in the other projects. Results from 2008 will be pooled to describe fine-scale stock distributions from Cape Falcon, OR, to Point Sur, CA, which includes almost all of the range of Klamath Fall Chinook as determined by CWT recoveries in open fisheries. Distribution data will be compared with the historical CWT database and potentially used to modify existing fisheries models as appropriate. Sampling in closed areas and during closed times in the commercial Chinook fishing season will require an exempted fishing permit (EFP) issued by the National Marine Fisheries Service (NMFS) through the Pacific Fishery Management Council (PFMC). The PFMC will consider the merits of an EFP for this project in March and April of 2008 as they develop fishery management measures for 2008. While it appears highly likely that the PFMC/NMFS will issue an EFP for this project in 2008, there is no absolute assurance.

In the event that an EFP is not issued we propose to charter boats to survey portions of open times and areas to supplement those areas and times sampled by the fleet, referred to as "Plan B", rather than "Plan A" which requires the EFP. Both plan A (with an EFP) and B (without an EFP) are detailed in the project design description (below).

PROJECT IMPACTS

Successful completion of the project in association with concordant sampling in open areas would be the largest-scale application of GSI to ocean fisheries management yet accomplished. It would provide the first comprehensive set of data on the ocean distribution of KRC and other Chinook stocks concentrated off the coasts of Oregon and California in more than two decades.

Improved understanding of these distributions and their relationship to Chinook biology, climate, and oceanic conditions may provide a means for management to increase the overall harvest of Chinook off the coasts of California and Oregon without increasing the fishery impacts on the weak stocks in this area. These data will enable us to examine migration routes, evaluate "hot spots" and see how long they persist, relate fish distributions to ocean conditions, and generally expand the range of information available to fishery managers. Over time, we expect to develop a database similar to the CWT database but with fewer assumptions (e.g.; fewer hatchery indicator stocks representing natural production) and much higher resolution of stocks in space and time. Compilation of such a database will require several years. We anticipate providing preliminary results to fishery managers after 3 years of sampling, with continuing improvement in the information in future years. This would likely improve the efficiency and economic benefits of salmon fisheries to coastal communities, and in the long term constitutes a step toward ecosystem-based management.

This work will support the first inter-state collaboration among fishermen, fisheries managers, and scientists, in a genetic stock identification project. Data will be gathered at a biologically relevant scale, as the actual distribution of the Klamath River Chinook. The proposed project will benefit the GSI scientific community; this inter-state collaboration is a major step towards the broader goal of an entire West coast GSI collaboration. In a broad sense, this project will impact a third GSI collaboration among Washington Department of Fish and Game, Oregon State University, and Columbia River Inter-tribal Fish Commission. This collaboration, scheduled for the 2008 commercial Chinook salmon fishing season, will focus on obtaining tissue samples from salmon harvested in open times and areas from Cape Falcon, OR north to Leadbetter Point, WA. In all, these GSI projects will encompass three states bordered by the Pacific Ocean and include three state fisheries management agencies, federal, universities, and tribal representatives. The stock distribution data from the proposed project also will benefit other members of the scientific community, including physical and biological oceanographers.

This project will provide immediate benefit to the fishing community by employing fishermen with commercially licensed salmon vessels to sample during times while the season is closed. The distribution of funds during closed times will provide stability to coastal communities. Furthermore, this project seeks to strengthen collaboration among the fishing industry and managers by uniting towards a common goal; access to sustainable fisheries without adversely impacting less abundant stocks.

EVALUATION OF PROJECT

The success of the project will be evaluated in terms of how well we meet our goals and objectives. Specifically, we will provide an accounting of fishermen employed, areas sampled, numbers of samples collected and completion of analysis of tissues and scales. We will provide maps of distributions and summaries of catch compositions , distribution of effort and catch, and standardized distributions of stocks of interest including KRC.

An indicator of success will be the degree to which the information we collect is incorporated in fisheries management. The most likely initial application with be a revision of baseline data for

the Klamath Ocean Harvest Model. We will also test the hypothesis that there are local differences in stock distributions that can be used in fisheries management. Success will also be judged by the continued acceptance of the concepts embodied in the project and the cooperation and support of fishermen, mangers, scientists, and the general public,

Other expected products from this project include (1) a data base of effort, catch locations, stock identifications, and ancillary data for analysis, (2) synthesized and summarized data available over the internet to fishermen, fisheries managers, scientists, and the public, (3) a final report to the granting agency, (4) presentations to local fishermen's organizations, civic groups and watershed councils, (5) technical presentations to scientific and management meetings, (6) technical white papers and memoranda for use in management, and (7) at least one paper in a peer-reviewed journal.

NEED FOR FINANCIAL ASSISTANCE

In Oregon, sampling has been supported by grants from the Oregon Watershed Enhancement Board (OWEB) in 2006 and 2007 and a grant from the federal salmon disaster relief bill (2007 only). OWEB funds will not be available in the future. California sampling in 2007 was fully supported through a grant paid from the federal salmon disaster relief bill. There will likely be some funds made available from Federal disaster relief (administered separately in each state) to sample in open times and areas during 2008. Projects already initiated in Oregon and California (Project CROOS 2007, Garza 2007) will likely be funded at levels comparable to prior years. Sampling closed areas is difficult and expensive due to regulatory requirements and the need to compensate fishermen fully for their time and cost of operation. At the same time, there is a need for comprehensive distribution maps that include both open and closed areas. Funds from this proposal will be used specifically to sample closed times and areas in 2008 to augment the data that will be collected from the open areas and thus provide a complete distribution data set for 2008 off California and Oregon; the first such complete dataset in more than two decades and the largest-scale application of GSI technologies to ocean fisheries yet attempted.

FEDERAL, STATE AND LOCAL GOVERNMENT ACTIVITIES AND PERMITS

It is expected that the 2008 salmon commercial fishery off Oregon and California will be restricted in times and areas similar to that of 2007. An experimental fishing permit (EFP) will be required to allow sampling to proceed in the closed times and areas. The additional mortality caused by sampling in these closed times and areas may be minimized through the use of catch and release. We have notified the PFMC of our intent to apply for an EFP for the 2008 project work, and they have scheduled a review of our application by their Scientific and Statistical Committee and Salmon Technical Team to be completed in October 2007. The PFMC will then consider the application at their November 2007 meeting. If approved, final details will be determined as 2008 fishing seasons are negotiated in March and April 2008. Details of the procedure are available in the PFMC Council Operating Procedure 18; Protocol for Industry Sponsored Salmon Test Fishery Proposals, included in the supplemental materials for this proposal.

PROJECT STATEMENT OF WORK

Project design

The exact sampling design for 2008 depends on the shape of the open fishing seasons and the availability of an EFP with sufficient KRFC impacts to conduct testing in closed areas. An EFP would be needed to permit sampling in the closed times and areas. All fish sampled in closed times and areas would be released (i.e., non-retention fisheries), except for the adipose fin clipped fish retained for CWT screening. Techniques to minimize stress while handling live fish have been developed for use in hooking mortality studies (e.g. Grover et al. 2002) and will be adapted for project sampling. The total mortality associated with this type of sampling is expected to be approximately 31% of the non-adipose fin clipped fish contacted, and 100% of the adipose fin clipped fish. Modeling based on the 2007 fishing season indicated that these mortalities would represent an age-4 ocean harvest rate on KRFC of less than 0.1 percent (M. Mohr, unpublished). The total allowable age-4 ocean harvest rate on KRFC was 16 percent in 2007. Thus, mortalities related to project sampling are not expected to significantly reduce the overall opportunity of the commercial fishing fleet in 2008. During the PFMC's season-setting process in March and April of 2008, fisheries would be designed to allow for these mortalities while keeping overall exploitation rates within the allowable limits. Issuance of this permit by the PFMC/NMFS is highly likely given the low level of anticipated mortalities, and high interest within the PFMC for the information to be collected. A final determination will not be available until April of 2008, when the PFMC will determine if the allowable fishery impacts are sufficient to support the commercial fleet's activity in open areas and proposed sampling in closed areas. In the event that an EFP is not permitted, we will switch from Plan A to an alternative Plan B. (see below)

Plan A: Project design with experimental fishing permit granted by PFMC

The proposed study will collect fish samples in the times and areas otherwise closed to salmon commercial fishing between Cape Falcon, OR and Point Sur, CA during the May through August of 2008. We anticipate having funds from other sources to support collection of samples by fishermen fishing in open times and areas; these samples would be collected under normal fishing operations, i.e. without being directed away from where the fleet would ordinarily fish. Those data would complement the data we propose to collect for this project, providing a broad-scale dataset encompassing the ocean-distribution of Klamath River Chinook.

The primary sampling strata that will be used are the PFMC ocean salmon major management areas (Table 1) at weekly intervals.

Table 1. Project sample area geographic stratification. The PFMC San Francisco area is subdivided into North and South sections for the purposes of this study.

Sample area stratum	Stratum boundary
Northern OR	Cape Falcon to Florence S. Jetty
Coos Bay	Florence to Humbug Mountain
KMZ-OR	Humbug Mountain to CA/OR Border
KMZ-CA	CA/OR border to Horse Mountain
Fort Bragg	Horse Mountain to Point Arena
San Francisco-North	Point Arena to Point Reyes
San Francisco-South	Point Reyes to Pigeon Point
Monterey	Pigeon Point to Point Sur

The division of the San Francisco management area into North and South sections is an effort to identify whether a distribution gradient of KFC exists within the larger management area, as previously suggested (Garza, 2007). The temporal stratification employed will be weekly intervals.

There are 18 weeks in the May through August time period for a maximum of 8 areas x 18 weeks/area = 144 weekly strata, or 8 areas x 4 months = 32 monthly strata. In 2007, 51 of these weekly strata were closed offshore from California and Oregon. For each stratum (area x week) the sampling goal is to collect and process 240 samples. Based on our experience in 2006 and 2007 this will enable us to obtain at least 200 valid samples from each stratum. In combination with the sampling in open times and areas this will provide 800 valid samples for each major management area for each month. Based on the 2007 season time and area closures we expect to collect 51 x 240 = 12,240 total tissue samples in this study, with a goal of obtaining 10,200 valid stock identifications. While under reasonably normal salmon fishing season we would expect to achieve our target sampling, achieving this sample number is dependent on catch rates success and weather, therefore these numbers are not guaranteed. This sample size is sufficient to provide the following statistical resolution for each sample stratum under random sampling (M. Mohr, unpublished):

1. The probability of detecting any stock comprising at least 1 percent of the stock mixture being sampled will be greater than 99.9% for each area-month, and greater than 86.6% for each area-week.

2. The coefficient of variation of the resulting stock proportion estimate will be less than 20% for stock proportions exceeding 3 percent in each area-month, and exceeding 11 percent in each area-week.

Plan B: Project design if an experimental fishing permit is not granted by the PFMC

If the EFP is not permitted, sampling would be limited to open areas during open times. Since fishing effort within open areas is not uniform, samples from commercial fisheries are not sufficient to determine the distribution of fish within an area (CROOS 2006, Garza 2007). Therefore, we would charter boats to survey areas not being explored or exploited by the commercial fishery in order to more fully determine local fish distributions. First we would determine the distribution of traditional fishing effort from GPS track logs of fishermen hired by this project or other, parallel sampling efforts. From maps of effort distribution we would identify un-fished or under-sampled blocks and assign vessels to fish in these areas using a stratified random sampling design. Catch rates in these areas is expected to be lower than in areas where the fishery is operating, so a greater amount of effort would need to be expended to collect adequate sample sizes.

While this study design would limit our coast-wide distributional inferences, it would provide fine-scale distributional information important to the longer-term goals of determining times and areas of potentially lower KRC impacts. It would also provide an opportunity to conduct specific tests of fine-scale distributions that would not be feasible if the project was limited to collecting only the broad-scale information. The division of the San Francisco catch area into North and South areas is an example of an effort to identify distributional gradients of KRFC within this large management area. Genetic data from 2007 suggests that KRFC are more abundant in the northern portion of this management zone.

Length Criteria

Within each month, it is anticipated that a uniform commercial fishery minimum size-limit will be set by the PFMC in the California and Oregon areas open to commercial fishing. For the closed strata, the same size limit will be used as in the neighboring open areas at that time with respect to fish included in the sample. Samples from fish of "legal" size will be counted towards the 240 fish target sample size per stratum. Below-legal-sized fish will be sampled, but samples will be archived in a database and genetically analyzed and aged pending future funding. If 240 "legal" fish per strata are not sampled we will use sub-legals to make up the difference provided they are from the same age class as the legal-size fish.

Sample Collection and Transfer

Samples will be collected by salmon commercial fishermen using their traditional fishing gear. Each sample will include the time and precise location of capture, a fin clip for genetic stock identification, a scale sample for ageing, and the head from adipose fin clipped fish for CWT screening. Other ancillary biological and physical data may also be collected at no extra cost to the proposed project, such as fish length, depth of capture, stomach for content analysis, sea surface temperature, and temperature/depth profiles. These ancillary data are not vital to the proposed project, but if collected, could be used to broaden our understanding of how fish behavior relates to oceanographic conditions. Fishing effort will be approximated by GPS recorded track-logs automatically recorded in five-minute intervals. Most of these data can be

collected during the normal fishing operation. The basic technique involves a hand-held GPS unit that records the vessel location every 5 minutes when the boat is actively fishing to track the fishing effort. When a fish is caught a "waypoint" is entered on the GPS. The fish is measured, a small fin clip is placed in an envelope along with a scale sample, and the envelope is labeled with the waypoint number and other associated data (depth, sea surface temperature, external marks, etc.). Sampling protocols were developed by Project CROOS in 2006 and 2007 and can be accessed online at www.ProjectCROOS.com.

Each time a participant returns to port after sampling they will be required to check in with a port liaison who, in turn, will be responsible for downloading GPS track-logs and fish-encounter information and transferring these data, along with tissue and scale samples, to the fleet manager (CA) or genetics laboratory (OR). Upon the receipt of samples at each laboratory, data entry will be performed and entered into a centralized database accessible to all participants.

All heads taken from legal-sized adipose fin clipped Chinook will be screened for CWTs. Heads will be individually identified so they can be associated with GSI and other data using materials and methods in use by the respective state agencies responsible for sampling fisheries in open areas. Port liaisons will be responsible for collecting the heads at the end of the trip and transporting them to the respective state "head lab" for dissection, decoding, and data reporting. The port liaisons will arrange the donation of heads-off carcasses to the local food-banks. The CWT data will be uploaded by the respective state reporting agency to the PSMFC's RMIS data warehouse and made available through their web-based system.

Scale samples will be taken from all fish contacted using standard scale collection techniques. The scales will be placed on paper and placed in the envelopes containing the fin clips for DNA analysis. Only fish receiving individual assignment probabilities $\geq 90\%$ will be aged. Fish caught in California will be sent by the genetics laboratory to California Department of Fish and Game (CDFG). There, scales will be cleaned, mounted, and electronic images of up to ten scales from each fish will be recorded. Electronic images will be made available to all parties in the study. Scale samples collected in Oregon will be sent to the Oregon Department of Fish and Wildlife (ODFW) the aging lab in Oregon. The determination of age structure will be calibrated using scales from known (CWT) fish for each stock to correct for reader bias in assigning ages. If necessary, additional scale samples from known-age fish will be collected during the regular fishing season using dock side sampling. The accuracy of ageing stocks without associated CWT known-aged fish such as California coastal Chinook is not known so these scales will not be processed.

Three genetics laboratories will participate in genotypic analysis: NMFS Santa Cruz, NMFS Montlake, and Oregon State University (OSU). Only the OSU laboratory will receive funding from the grant. The work that NMFS will perform is within their normal duties. These laboratories have led Industry/Scientist GSI collaborative projects and also have contributed substantial resources to develop the GAPS baseline. The NMFS Santa Cruz genetics laboratory collaborated with the California Salmon Council on GSI projects in 2006-2007, and they are scheduled to continue working together in 2008. There are no other laboratories in California with comparable levels to their expertise with the GAPS microsatellite database. Furthermore, it

is essential that NMFS laboratories participate because they are an integral component in developing a collaborative relationship among state and federal fisheries managers, fishermen, and scientists. The NMFS Santa Cruz laboratory will be responsible for data entry and genotyping all samples collected in California, while Oregon State University will be responsible for data entry for all samples collected in Oregon, and the majority of genotyping. The NMFS Montlake laboratory will genotype a portion of samples collected in Oregon. Genotyping will commence as soon as samples are received by the laboratory. Genotypic data should be updated into the central database as soon as possible. At least 60% of all fish will be genotyped will be entered into the centralized database by September 1 to provide time for analyses by scientists to report to the PFMC at the September or November 2008 council meeting. All genotyping will be complete by November 15th, with all data entered into the central database no later than November 30th.

Database Management

Each laboratory will be responsible for entering sample locations, GPS track-logs, genotypic data, age data, CWT data, and any other ancillary data collected using funds from the proposed project into a centralized database. This database, developed for this project, will be accessible to all partners and subcontractors in this project. Data will be entered expeditiously, as numerous status updates and reports will be conducted throughout the duration of this project. Each laboratory is responsible for updating new data within a month of receipt.

Laboratory Genetic Analysis

Tissue samples will be digested and DNA extracted using silica membrane-based plates following manufacturer's protocols. Genomic DNA will be arrayed into either 384- or 96- well plates for high throughput genotyping. The polymerase chain reaction (PCR) will be used to amplify 13 microsatellite loci standardized by GAPS: *Ogo2, Ogo4* (Olsen et al. 1998), *Oki100* (unpublished; provided by Canada's Department Fisheries and Oceans), *OMM1080* (Rexroad et al. 2001), *Ots201b, Ots208b, Ots211, Ots212, Ots213* (Greig et al. 2003), *Ots3M, Ots9* (Banks et al. 1999), *OtsG474* (Williamson et al. 2002), and *Ssa408* (Cairney et al. 2000). Lab-specific PCR conditions can be obtained from each participating laboratory. Fluorescently labeled forward primers will be used to visualize PCR products using an Applied Biosystems® model 3730xl genetic analyzer. GeneMapper software will be used to assign standardized GAPS allele calls to allele peaks. Individual fish's unique genotypic profiles will be tracked using a unique identifier, transferred from GeneMapper to Microsoft excel spreadsheets, and archived in a Microsoft Access or FileMaker Pro databases. Laboratories will be responsible for genotyping samples and submitted results within one month of receiving samples.

Genetic Stock Identification Analysis

Genetic stock estimates will be performed using GAPS baseline v2, which contains 166 Chinook salmon populations from mid-California north to Alaska. The GAPS baseline will be used with "reporting regions" for compositional analyses: reporting regions are groups of populations with similar genetic signatures, as previously identified by other genetic allozyme and microsatellite

studies, taking into account a combination of geographic features and management applications (Teel et al. 1999, Seeb et al. in press, Banks et al. in prep).

Genetic-based estimates of stock mixture proportions (mixed stock analysis, MSA) and individual assignment (IA) probabilities will be calculated using the computer program Genetic Mixture Analysis (GMA; Kalinowski 2003) and GSIsim (Anderson unpublished). These programs use Bayesian priors to calculate the probability that an individual fish came from a specific population in the baseline.

Data Analysis

The GAPS-derived stock identity results will provide distribution data on all the reporting groups in the GAPS database that are encountered in the fisheries, and when coupled with the scale ageing results will provide the basic stock-age-time-area-specific encounter data. The number of encounters will then be standardized (divided) by the associated sampling effort to yield CPUE (catch per unit of effort). Normalizing the area-specific CPUE estimates for each stock, age, and time period estimates the respective distributional coefficients (fraction of the coast-wide stock-age abundance at that time that was in that area). It is not necessary to know the stock-age (cohort) ocean-wide abundance to estimate these coefficients–it factors out with the normalization of the CPUEs since they refer to the same cohort in the same time period. Non-uniformity of the estimated distributional coefficients would reflect a non-uniform distribution of the stock over the area, as well as the associated sampling and/or measurement error contained in these data. Where possible, the estimated distributions will be compared with those derived from the CWT database.

Who will be responsible for carrying out the various activities

Fishing vessels owned by salmon-permit holding fishermen will be commissioned by the California Salmon Council (CASC) and the Oregon Salmon Commission (OSC). Participant fishermen will be recruited two ways. First, OSC and the CASC maintain lists of fishermen who have expressed interest in future GSI projects, and these fishermen will be contacted. In 2007, Project CROOS has 125 signed fishermen contracts, up from 72 the prior year. In California, 16 vessels were contracted for work for six weeks of employment during the 2007 fishing season. The CASC list of interested fishermen, prior to any outreach is ~30. Secondly, both councils will outreach to the various fishermen port organizations. The CASC will recruit interested fishermen by working through the local port presidents. In this way, the decision is made at the local level and it provides more direct participation for those involved in the process. The OSC may limit recruitment to fishermen that fish out of the port closest to the sample area-strata.

Three port-liaisons in Oregon and six in California will be hired by the OSC and CASC, respectively. Liaisons will be responsible for data-quality checks, downloading GPS data, and transferring samples to the respective laboratories. If possible, port-liaisons involved in previous or ongoing GSI or other Salmon Commission-related projects (in the case of Oregon) will be hired. The OSC employed six port-liaisons and one fleet manager in 2007 for Project CROOS.

The CASC employed three port-liaisons and one fleet manager during the 2007 GSI sampling period.

Lead scientists in California, Oregon and Washington will be responsible for analysis and drawing inferences from findings in a collaborative and timely manner, ensuring a mutually agreed upon distribution of work-load and publishing opportunity.

What are the major products and how will project results be disseminated

The major product of this study will be fine-scale mapping of Chinook distributions over time for one fishing season. A database with all data collected using funds from this project will be available to scientists and fishery managers, as permitted by privacy rules. All data released will be aggregated so that the fishing practices of individual fishermen is not revealed. A semi-annual project status report will be filed by the CASC within 30 days after the end of each 6-month period. The final report will be submitted 90 days after completion of this project.

Project results will be distributed several ways. At least one manuscript will be submitted to a scientific journal for peer-reviewed publication. Preliminary data will be reported back to the PFMC in September or November of 2008. Technical presentations will be given at scientific meetings. Regionally tailored presentations will be provided to local watershed councils, chambers of commerce, and other interested parties, on request. Reports to fishermen on their individual data will be sent to each participating fishermen. A formalized protocol describing the collaborative process between Industry / GSI / Scientists and Managers will be posted on the CASC (http://www.calkingsalmon.org) or Project CROOS (www.ProjectCROOS.com) website or available by request. These websites will also be used to communicate data to multiple audiences, including the general public, consumers, fishermen, managers and scientists. Genotypic data may eventually be archived in an online GAPS ocean-harvest centralized data repository.

Project milestones

Month	Activity	Individual(s) Responsible
1-2	Select and train Port Liaisons and Fishermen	David Goldenberg, CASC Nancy Fitzpatrick, OSC
3 - 6	Conduct at-sea sampling; refine sampling protocols as necessary	David Goldenberg, CASC Nancy Fitzpatrick, OSC
	Transfer data and samples to genetics laboratories; begin genotyping	David Goldenberg, CASC Nancy Fitzpatrick, OSC OSU / NWFSC / SWFSC
6.5	6 month status report filed	David Goldenberg, CASC
7	At-sea sampling completed	David Goldenberg, CASC Nancy Fitzpatrick, OSC
	More than 60% of samples genotyped	David Goldenberg, CASC Nancy Fitzpatrick, OSC OSU / NWFSC / SWFSC

	Samples with individual assignments ≥ 90% will be transferred to scale ageing facilities	Alan Grover, CDFG Lisa Borgerson, ODFW
7 or 9	Preliminary results for analyzed samples will be presented in a preliminary report to the PFMC	David Goldenberg, CASC
9	Genotyping completed and results posed in central database	OSU / SWFSC / NWFSC
	Samples with individual assignments ≥ 90% will be transferred to scale ageing facilities	OSU / SWFSC / NWFSC
11 - 15	Scales aged, CWTs read; results placed in central database	Alan Grover, CDFG Lisa Borgerson, ODFW
	Report individual results back to Fishermen	David Goldenberg, CASC Nancy Fitzpatrick, OSC
	Analyze data, write preliminary reports, file 12-month status report	David Goldenberg, CASC leads - all collaborators participate
15-17	Internal review of final report Write draft of peer-reviewed manuscript	David Goldenberg, CASC leads - all collaborators participate
18	Final report filed Submit manuscript to scientific journal for peer-review	David Goldenberg, CASC

PARTICIPATION BY PERSONS OR GROUPS OTHER THAN THE APPLICANT

The success of this project relies heavily on participation by members of the fishing community. The proposed project would fund the CASC and OSC to employ commercial salmon trollers for at-sea sampling. All port-liaisons are members of the fishing community, either married to a fishermen or directly involved in support-services. Fleet managers (one per state) are both members of the fishing fleet. The OSC will hire all port liaisons, a fleet manager, and fishermen in the proposed project for work conducted in Oregon, while the CASC will hire counterparts for work conducted in California. SeaGrant is involved by providing an extension agent who will facilitate collaboration among fishermen, managers and scientists. CDFG and ODFW are both involved in ageing analysis and CWT reading. OSU and NMFS Santa Cruz will provide facilities for genetic analysis. OSU and NMFS Santa Cruz laboratories will work closely with the OSC and CASC to manage data and coordinate reporting of results. NMFS Montlake Laboratory will provide supporting services for genotypic analysis.

PROJECT MANAGEMENT

David Goldenberg, CEO of the CASC, will act as the principal investigator for this project. He will keep the project on track administratively while working cooperatively with the science and technical teams. He will act as the main conduit with the S-K Administration to sign all contracts, provide regular reports, financial data and receive and disburse grant funds. Mr. Goldenberg will schedule all meetings, and supervise workflow so that the project goals are accomplished in a timely manner. He will communicate with all project partners and keep all

informed about the progress of the study. Mr. Goldenberg will be the key central person who will be responsible for meeting all goals and objectives of the study on behalf of the industry in California. He will coordinate with his Oregon counterpart, Nancy Fitzpatrick, Lead Administrator of the OSC. Personnel at Oregon State University will coordinate the collection of scientific data and amalgamation of the databases. Nancy Fitzpatrick, will be responsible for selecting a fleet manager, port-liaisons, and fishermen for work conducted in the state of Oregon, while the CASC responsible for selecting a fleet manager, port-liaisons, and fishermen for work conducted in the state of California.

The project does not anticipate using consultants but for financial purposes the Oregon State University and the Oregon Salmon Commission collaborators are considered subcontractors to the California Salmon Council. Therefore the Council will follow the procurement guidances as indicated in 15 CFR part 24, "Grants and Cooperative Agreements to State and Local Governments," and 15 CFR part 14, "Uniform Adminstrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, Other Non-Profit, and Commercial Organizations."

Gil Sylvia, OSU, providing overall leadership to all science components of the project, will ensure that industry and scientist are collaborating to achieve project goals and objectives. Nancy Fitzpatrick, lead administrator of the OSC, will hire all fishermen, liaisons, and fleet managers, and represents industry interests in Oregon. David Goldenberg will hire all fishermen, liaisons and fleet managers, and represent industry interest, in California. Jeff Feldner, SeaGrant extension agent and former fishermen, will provide consultation for at-sea sampling and industry-scientist relations. Michael Banks leads the Marine Fisheries Genetics Laboratory at Oregon State University and oversees all genetic analysis. Renee Bellinger works closely with the OSC to train fishermen and port-liaisons, amalgamate data, manage the database, perform data analysis, coordinate among scientists and industry, and to provide support material to the OSC and scientists for reporting to contracting agencies. Carlos Garza leads the University CA Santa Cruz genetics laboratory and works closely with the CASC to coordinate data collection, perform data analysis and report results. Allen Grover, CDFG, oversees scale aging analysis and CWT data. Lisa Borgerson oversees scale aging work performed by ODFW.

DAVID J. GOLDENBERG

3548 Amer Way, El Dorado Hills, California 95762-5658
(916) 933-5050 FAX (916) 933-7055 golden59@pacbell.net

INDUSTRY / SCIENCE COLLABORATION EXPERIENCE

2006 - present: Partnered with the University of California Santa Cruz / NMFS Santa Cruz Laboratory to employ fishermen to collect data on the marine distribution of Chinook salmon stocks. As Chief Executive Officer of the California Salmon Council he oversaw fleet managers, port-liaisons, hiring of vessels, and all other CASC administrative components to the California genetic stock identification pilot project

PROFESSIONAL EXPERIENCE

April 1994 / Present **PRESIDENT**
DG Management Consultants

- Manage – Calif. Salmon Council, Calif. Sheep Commission & the Calif. Pistachio Board.
- Consultant/Instructor-Western Institute for Food Safety & Security, December 2004 – present.
- Member of California Exotic Newcastle Disease Task Force-Commercial Industry Liaison 2002-04
- Facilitated the California Egg Quality Assurance Plan under contract with the California egg industry and the supervision of the California Department of Food & Agriculture, 1994-2005
- Managed the West Coast United Egg Producers from 1997-2002.
- Solicit, research and administer management consulting contracts.
- Report and analyze contract results in a timely manner to meet stated criteria.

December 1991 / April 1994 **EXECUTIVE DIRECTOR**
Pacific Egg & Poultry Association
PePa Scholarship & Research Foundation

- Supervised and administered programs relating to government affairs, media relations, convention and exhibits, educational workshops, membership recruitment, research and scholarship programs for an 11 Western States and Western Canadian regional trade association.
- Supervised two full-time and one part-time clerical employees.
- Responsible for a combined $360,000 budget.
- Directed office work flow and set policies.
- Liaison with federal, state and university officials and other agricultural commodity groups.
- Accountable to two sets of Board of Directors totaling 44 individuals.
- Authored monthly newsletter and all press releases.

December 1988 / December 1991 **EXECUTIVE VICE PRESIDENT**
Indiana State Poultry Association
Indiana State Egg Board
Indiana State Turkey Market Development Council
Tri-State Poultry Federation

- Administered programs relating to government affairs, generic promotion, media relations, membership recruitment, enforcement of state laws, workshops and convention planning.
- Supervised a staff of five professionals and three clerical employees.

- Responsible for a combined $400,000 budget.
- Liaison with federal, state, Purdue University officials and other agricultural commodity groups.
- Accountable to four sets of Board of Directors totaling 45 individuals.
- State administrator for the USDA National Poultry Improvement Plan.
- Wrote press releases and monthly newsletter.

February 1982 / December 1988 **DIRECTOR OF INDUSTRY RELATIONS**
National Turkey Federation

- Responsible for media relations and served as an industry spokesman.
- Liaison between industry and Congress, federal regulatory agencies and other agricultural trade associations.
- Supervised national generic promotion programs and public relations agency. Developed two award winning promotional booklets.
- Organized association's fund raising activities.
- Directed and organized all phases of planning for two yearly conventions and various smaller meetings.
- Developed press releases, newsletter articles, and congressional testimonies.

January 1980 / February 1982 **DISTRICT SALES MANAGER**
Diamond Shamrock Corporation

- Sold full line of proprietary products and provided technical support to approved customers.
- Assisted customers in the implementation of marketing programs.
- Sold product benefits to and solicited orders from approved customers.
- Assessed market potential and developed Annual District Sales Plan.

June 1978 / January 1980 **MARKETING COORDINATOR**
Diamond Shamrock Corporation

- Directed costing and pricing of custom products for domestic and international sales.
- Supervised one employee in computer terminal operations.
- Initiated and coordinated all phases of developing, updating and printing of product bags and labels to ensure compliance with federal and corporate regulations.
- Determined costs for proposed standard products.

EDUCATION AND ADVANCED TRAINING

- BS in Poultry Science, Minor in Business, The Ohio State University, 1978
- Courses in:
  Marketing Boot Camp, *American Marketing Association, 1996*
  Increasing Productivity Through Effective Time Management, *Franklin Quest*, 1994
  Managing Multiple Projects, Objectives and Deadlines, *Skillpath, 1993*
  How Congress Operates and the Legislative Process, *George Washington University, 1984*

Nancy Fitzpatrick, Administrator Oregon Salmon Commission

As Administrator of the Oregon Salmon Commission since 1992, Nancy Fitzpatrick has managed all aspects of the commission including financial, budgets, communication with the fleet, regulatory participation, grants, and contracts.

Ms Fitzpatrick has administered the 2006 & 2007 CROOS (Collaborative Research on Oregon Ocean Salmon) grant projects, as well as a Port Outreach Specialist grant project providing assistance to fishermen to access state resources.

Ms Fitzpatrick will be responsible for coordination of the Oregon parts of the grant. She will notify the industry of the fleet management, port liaison and fishermen opportunities, and provide contracts for these positions. Communication with the Oregon scientific community, and coordination with the California Salmon Council will be provided by Ms Fitzpatrick.

Biographical Sketch *Michael A. Banks January, 2007*

Professional Preparation

University of Cape Town	Zoology	BSc, 1981
University of Cape Town	Physics, Chemistry & Biology	HED, 1982
Louisiana Tech University	Zoology	MSc, 1988
University of California, Davis	Population Genetics	PhD, 1994

Appointments

Director of the Cooperative Institute for Marine Resources Studies		2006 –
Assistant Professor	Marine Fisheries Genetics	2001 –
Assistant Geneticist	Bodega Marine Laboratory	1996 – 2000
Postdoctoral Fellow	Bodega Marine Laboratory	1994 – 1996
Research Assistant	Univ. of California, Davis	1989 – 1993
Research Assistant	Univ. Of Texas at Austin, MSI	1987 – 1988
Head of Dept. Science & Biology	Ngangelizwe Secondary School	1984 – 1986
Assistant Teacher	Umtata High School	1983

Selected Publications

O'Malley, K. G., Camara, M.D. Banks, M. A. In Press. Candidate loci reveal genetic differentiation between temporally divergent migratory runs of Chinook salmon (*Oncorhynchus tshawytscha*). *Molecular Ecology.*

G. R. Moyer, M. S. Blouin, and M. A. Banks. In Press The influence of family-correlated survival on N_b/N for progeny from integrated multi- and single-generation hatchery stocks of coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Science.*

Seeb, L.W., A. Antonovich, M.A. Banks, T.D. Beacham, M.R. Bellinger, S.M. Blankenship, M. Campbell, N.A. Decovish, J.C. Garza, C.M. Guthrie III, T.A. Lundrigan, P. Moran, S.R. Narum, J.J. Stephenson, K.J. Supernault, D.J. Teel, W.D. Templin, J.K. Wenburg, S.F. Young and C.T. Smith. In Press Development of a standardized DNA database for Chinook salmon. *Fisheries*.

O'Malley, K. G., M. A. Banks. 2007. Duplicated Clock genes with unique polyglutamine domains provide evidence for nonhomologous recombination in Chinook salmon (Oncorhynchus tshawytscha). Genetica DOI 10.1007/s10709-007-9151-8 http://www.springerlink.com/content/085087w754135636/fulltext.pdf

Bucklin, K., M.A. Banks and Hedgecock D. 2007. Assessing genetic diversity of protected coho salmon populations in California. Canadian Journal of Fisheries and Aquatic Science. 63(1): 30-42

Gomez-Uchida, D. and M.A. Banks. 2006. Integrating Temporal and Spatial Scales in Rockfish Population Genetics: Shaping Conservation and Management Goals. In press for: Biology, Assessment and Management of Pacific Rockfishes. 2005 Wakefield symposium.

Gomez-Uchida, D. and M.A. Banks. 2006. Estimation of effective population size for the darkblotched rockfish *sebastes crameri.* In press for *Journal of Heredity*. 97: 603-606.

Wofford, J.E.B., R.E. Gresswell and M.A. Banks. 2005. Factors influencing within-watershed genetic variation of coastal cutthroat trout. Ecological Applications: 15(2):628-637.

Banks, M.A. 2005. Stock identification for the conservation of threatened or endangered species. In: Stock Identification Methods Eds: Cadrin, S.X., K.D. Friedland and J.R. Waldman. Elsevier Press. pp609-629.

Miller, J.A., M.A. Banks, D. Gomez-Uchida, and A.L. Shanks. 2005. Population structure in black rockfish (*Sebastes melanops*): a comparison between otolith microchemistry and DNA microsatellites. *Canadian Journal of Fisheries and Aquatic Science.* 62:2188-2198.

Gomez-Uchida, D. and M.A. Banks. 2005. Microsatellite analysis of special genetic structure in darkblotched rockfish (Sebastes crameri): is binning safe? In Press for Canadian Journal of Fisheries and Aquatic Sciences 62:1874-1886.

Banks, M.A., W. Eichert, J.B. Olsen. 2003. Which Genetic Loci have Greater Population Assignment Power? Bioinformatics 19(11):1436-1438.

Gomez-Uchida, D., E.A. Hoffman, W.R. Ardren and M.A. Banks. 2003. Microsatellite Markers for the heavily exploited canary (*Sebastes pinniger*) and other rockfish species. *Molecular Ecology Notes* 3:387-389.

Banks, M.A., V.K. Rashbrook, M.J. Calavetta, C.A. Dean, and D. Hedgecock. 2000. Analysis of microsatellite DNA resolves genetic structure and diversity of chinook salmon in California's Central Valley. *Candian Journal of Fisheries and Aquatic Sciences* 57:915-927.

GIL SYLVIA
Professor, Agricultural and Resource Economics
Superintendent, Coastal Oregon Marine Experiment Station
Oregon State University
Hatfield Marine Science Center
Newport, Oregon 97365

Education

B.S. 1973, University of Massachusetts, *Natural Resources*
M.S. 1981, Colorado State University, *Fisheries and Wildlife Biology*
Ph.D. 1989, University of Rhode Island, *Marine Resource Economics*

Appointments

2004 to present: *Professor,* Department of Agricultural and Resource Economics, Oregon State University.

1997 to present: *Superintendent*, Coastal Oregon Marine Experiment Station, Oregon State University.

1996 to 2004: *Associate Professor,* Department of Agricultural and Resource Economics, Oregon State University.

1989 to 1995: *Assistant Professor,* Department of Agricultural and Resource Economics, Oregon State University.

Recent Publications

Samailia, U.R., A. Charles, and G. Sylvia. In Press. Topical Problems in Fishery Economics: An Introduction. *Marine Resource Economics*

Larkin, S., Sylvia, G., Harte, M., and K. Quigley. In Press. Optimal Rebuilding of Fish Stocks in Different Nations: Bioeconomic Lessons for Regulators. *Marine Resource Economics*

Sylvia, G., H. Munroe, and C. Pugmire. In Press. The Pacific Whiting Cooperative: Rational Cooperation in a Sea of Irrational Competition. Fisheries Coops and Beyond: Realigning Fisheries Management, eds Townsend, R. and G. Knapp. Food and Agriculture Organization, United Nations, Rome.

Thompson, M., G. Sylvia, and M.T. Morrissey. 2005. Seafood Traceability in the United States: Current Trends, System Design, and Potential Applications. *Comprehensive Reviews in Food Science and Safety* 1:1-7.

Larkin, S. and G. Sylvia. 2004. Generating Enhanced Fishery Rents by Internalizing Product Quality Characteristics. *Environmental and Resource Economics*, 28 (1):101-122.

Gallagher, C., R. Hannah, and G. Sylvia. 2004. A Comparison of Yield per Recruit and Revenue per Recruit Models for the Oregon Ocean Shrimp, *Pandalus jordani*, Fishery. *Fishery Research,* 66 (1): 71-84

Tuininga*, C., G. Sylvia, and S. Larkin, 2003. Portfolio Analysis for Optimal Seafood Product Diversification and Resource Management. *Journal of Agriculture and Resource Economics*, 28 (2): 252-271.

Recent Grants

2007-2010 Oregon Innovation Plan Oregon Innovation Council $900,000	Community Seafood Initiative Co-Investigator with Michael Morrissey and Diane Moody
2006-2009 USDA CSREES $99,653	Enhancing global competitiveness of the U.S. seafood industry: educational case studies in international trade and marketing Principal Investigator
2006-2008 Oregon Sea Grant $194,212	Improving Participation In Fisheries Management: Stock Assessment Training for Stakeholders Principal Investigator
2006-2008 Oregon Sea Grant $164,241	Market Based Environmental Standards for Sustainable Fisheries Co-Investigator with Michael Harte
2006-2008 Oregon Watershed Enhancement Board $1,186,391	Using "Real Time" Genetic Information to Address the Klamath 'Weak' Stock Crisis for Oregon's Ocean Salmon Fishery Co-Investigator with Michael Morrissey and Michael Banks
2002-2006 Kellogg Foundation $691,875	Bridging the Divide: Integration of Research and Conservation-Based Development Co-Investigator with Michael Morrissey

Synergistic Activities

Dr.Sylvia is Co-PI on the Community Seafood Initiative, a program initially sponsored by the Kellogg Foundation and USDA which offers assistance to seafood entrepreneurs and small and mid-size businesses throughout the Pacific Northwest. He is co-chair of the W1004 CSREES Fisheries and Aquaculture Resource Marketing and Management Committee. Dr. Sylvia recently served on a National Research Council Committee on Cooperative Fisheries Research. He has been Associate Editor, Journal of Aquacultural Economics and Management, and Transactions of the America Fisheries Society. Dr Sylvia has lectured and participated on fisheries management and marketing conferences throughout the world and has participated in education and research projects in North and South America, Asia, New Zealand, and Australia.

JEFF FELDNER

Oregon Sea Grant Extension Agent
jeff.feldner@oregonstate.edu
29 SE 2nd St., Newport, Oregon 97365
(503) 574-6537 Ext. 33

CAREER BACKGROUND:

- **OSU Sea Grant Extension Fisheries and Seafood Specialist:** Nov. 2006 – present
  Duties: Promote sustainable West Coast fisheries and fishing communities by strengthening the integration of the community-based seafood industry with fishery management.

- **Self Employed Commercial Fisherman:** Newport, Oregon, 1972 - present
  Duties: Own and operate commercial fisheries business involving fishing for various species; currently owner of vessel Granville, 45 ft. combination boat.

- **Fisheries Research: Fleet Manager,** CROOS Project, Newport, Oregon, 2006 - present
  Duties: Coordinate fishery participation for pilot collaborative genetic research project administrated by Oregon Salmon Commission; develop experimental design and sampling protocols; train fishers; report results of pilot project and help develop follow-up programs; charter participant.

- **Seafood Marketing:** Granville Fisheries, Inc., Newport, Oregon, 2003 - present
  Duties: Own and operate wholesale and retail seafood marketing business specializing in locally caught and processed seafood; lease and operate full scale cooperative seafood processing plant in South Beach, Oregon.

- **Fish Collection Coordinator:** Oregon Coast Aquarium, Newport, OR, 1999 - 2000
  Duties: Coordinate fishers for collection project for Open Ocean Exhibit, charter vessel Granville for collection of various species for exhibit.

- **Manager:** Oregon Oyster Farms, Newport, Oregon, 1996 -1998
  Duties: Manage oyster production and sales; assist in long range planning and development of polyculture venture involving oysters and other marine species

- **Fisheries Research: Fleet Manager**, Natural Resources Consultants, Inc., Seattle, WA, 1995 - 96
  Duties: Administer and coordinate fishery activities for research projects performed by NRC, Inc. for NEAP Data Collection Projects; experimental design; charter participant.

- **Fisheries Research:** Oregon State University, Sea Grant, Newport, OR, 1994
  Duties: Charter vessel Granville for at-sea study of cooling strategies for Albacore tuna.

- **Fisheries Research:** Oregon Department of Fish and Wildlife Differential Selectivity Study of Salmon Gear Types, 1990
  Duties: Experimental concept and design, identify and secure funding, charter participant.

- **Development Engineer:** Film Division, Minnesota Mining and Manufacturing Co., St.Paul, Minnesota, 1969-71
  Duties: Research and development on thermoplastic films, flammability studies, thin-film barrier development.

MANAGEMENT EXPERIENCE:

- **Oregon Fish and Wildlife Commission;** Commissioner, 1995-2004
- **Pacific Fishery Management Council;** Salmon Advisory Subpanel, Chairman; Represented Oregon from 1987-1995, reappointed: 2006 - 2007
- **Oregon Salmon Commission;** Vice Chairman; Commissioner, 1983-1995
- **All Coast Fishermen's Marketing Association;** Board of Directors; 1979-1982

EDUCATION:

- University of North Dakota, Grand Forks, North Dakota
  B.S. Chemical Engineering, 1967; Minor: Mathematics
- University of Minnesota, St. Paul, Minnesota
  Graduate Study in Chemical Engineering, 1967-69

M. Renee Bellinger
Hatfield Marine Science Center, Oregon State University
2030 Marine Science Drive
Newport, OR 97365 USA
Phone: 541-867-0213, Fax: 541-867-0138
E-mail:renee.bellinger@oregonstate.edu

Education

M. S. Biology, University of Wisconsin, Milwaukee, 2001. Thesis title: Loss of genetic variation in Wisconsin Greater Prairie Chickens following a population bottleneck. Major advisor: Dr. Peter O. Dunn.

B. S. in Wildlife Management (1997). Humboldt State University, Arcata, California, Department of Wildlife Management. Major advisor: Dr. Mark Colwell.

Relevant Experience

2003 - present	Faculty Research Assistant. Supervises genetic technicians and oversees collection of genetic data in laboratory, manages Chinook salmon tissue collections, performs data analysis. Science coordinator for Project CROOS (Collaborative Research on Oregon Ocean Salmon). Participated in Genetic Analysis of Pacific Salmonids Consortium that developmed GAPS standardized microsatellite baseline.
2001 – 2003	Geneticist. U. S. Geological Survey - Biological Resources Division, Forest and Rangeland Ecosystem Science Center, Corvallis Research Group, Oregon. Conducted research on population genetics and systematics of red tree voles (*Phenacomys longicaudus*).
1999 – 2001	Student Teaching Assistant and Graduate Student. University of Wisconsin, Milwaukee, Wisconsin. Conducted a molecular comparison of a historic and contemporary population of threatened Greater Prairie Chickens in Wisconsin using microsatellites
1997 - 1999	Site Coordinator / Biological Technician. U. S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Colorado Plateau Field Station, Flagstaff, Arizona. Worked as a research technician / site coordinator on a demographic study of endangered SouthWestern Willow Flycatchers.
1996 (summer)	Field Technician. Willamette Industries, Dallas, Oregon. Conducted marbled murrelet and neotropical migrant surveys.

Publications

S.R. Narum, M. Banks, T. Beacham, M. R. Bellinger, M. Campbell, J. DeKoning, A. Elz, C. Guthrie, C. Kozfkay, K. Miller, P. Moran, R. Phillips, L. Seeb, C. Smith, K. Warheit, S. Young, J.C. Garza. Differentiating populations at broad and fine geographic scales with microsatellites and SNPs. In prep for submission to Molecular Ecology.

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Miller, M. P, M. R. Bellinger, S. M. Haig, and E. D. Forsman. 2006. Effects of historical climate change, habitat connectivity, and vicariance on genetic structure and diversity across the range of the red tree vole (*Phenacomys longicaudus*) in the Pacific Northwestern United States. Molecular Ecology 15:145-159.

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Kvitrud, M. A., S. D. Riemer, R. F. Brown, M. R. Bellinger, and M. A. Banks. 2005. Pacific harbor seal (*Phoca vitulina*) and salmon prey: Genetics presents hard numbers for elucidating predator-prey dynamics. Marine Biology 147:1459-1466.

Johnson, J. A., M. R. Bellinger, J. E. Toepfer, and P. Dunn. 2004. Temporal changes in allele frequencies and low effective population size in greater prairie-chickens. Molecular Ecology 13:2617-2630.

Bellinger, M. R., J. A. Johnson, J. Toepfer, and P. Dunn. 2003. Loss of genetic variation in Greater Prairie Chickens following a population bottleneck in Wisconsin, U. S. A. Conservation Biology 17:717-724.

Allen Grover

8/1/99 to present
California Department of Fish and Game
Senior Biologist Specialist Marine/Fisheries
475 Aviation Blvd. Santa Rosa CA 95403

Lead the CDFG's Ocean Salmon Project. Represent the CDFG on the Salmon Technical Team of the Pacific Fishery Management Council and assist the technical team of the Klamath Advisory Council. Represent ocean salmon fisheries on the Department's winter run technical team. Coordinate with NMFS on the evaluation of ocean salmon fisheries impacts on ESA listed salmonids. Assist in the development of improved escapement estimation methodologies and coordination in the Central Valley. Published results of hook and release studies (see below). Principal investigator in a research project to age Central Valley Chinook using scales.

2/1/89 to 7/31/99 CDFG Associate Biologist Marine/Fisheries
1528 Healdsburg Ave. Healdsburg CA 95448
Produce estimates of catch, composition of catch including CWT's, and angler effort for the ocean salmon sport and commercial fisheries in California. Act as lead person for one A\B biologist and up to 20 scientific aids. Design and implement sampling program and manage associated data bases. Designed on conducted hook and release mortality study in marine sport fisheries which resulted in the implementation of circle hook regulations.

12/1/85 to 1/31/89 CDFG Biologist Marine/Fisheries Range B
411 Burgess Dr. Menlo Park CA
Produce estimates of catch, composition of catch, and angler effort for the ocean salmon sport and commercial fisheries. Act as lead person for one A\B biologist and up to 20 scientific aids. Design and implement sampling program and manage associated data bases.

7/1/83 to 11/31/85 CDFG Biologist Marine/Fisheries Range B
350 Golden Shore, Long Beach CA
Participate in the monitoring of coastal pelagic commercial fisheries in Southern California. Including: data analysis, laboratory dissections, otolith reading. Act as the lead person for one Seasonal Aid and one Fish and Wildlife Assistant.

10/19/81 to 9/31/83 CDFG Biologist Marine Fisheries Range A/B
350 Golden Shore, Long Beach CA
Design and conduct ecological studies of the subtidal environment in Southern California.
Relevant publication:

Grover, A. M., M. S. Mohr, and M. L. Palmer-Zwahlen. 2002 Hook-and-release mortality of Chinook salmon from drift mooching with circle hooks: management implications for California's sport fishery. American Fisheries Society Symposium 30:39-56.

Lisa Borgerson
Oregon Department of Fish and Wildlife
28655 Hwy 34
Corvallis, Oregon 97333
(541)757-4263 x232
Lisa.Borgerson@oregonstate.edu

Education
B.S. Fisheries Science, Oregon State University, 1980

Experience

1992-present	Project Leader, Scale Analysis Project. Oregon Department of Fish and Wildlife, Corvallis, OR.
1990-1991	Basin Planner, Yaquina Basin. Oregon Department of Fish and Wildlife, Corvallis, OR.
1985-1990	Assistant Project Leader, Coastal Fall Chinook Project. Oregon Department of Fish and Wildlife, Corvallis, OR.
1981-1985	Assistant Project Leader, Private Hatchery Impacts Project. Oregon Department of Fish and Wildlife, Corvallis, OR.
1979-1981	Scale analyst, Coho Hatchery/Wild Stock Identification. Oregon Department of fish and Wildlife, Corvallis, OR.
1977-1979	Seasonal Project Assistant, Oregon Department of Fish and Wildlife, Maupin, Astoria, and Newport, OR.

All following Curriculum vitae are for NMFS researchers proposed to act as collaborators that will not receive any financial support from this project.

PETER W. LAWSON
National Marine Fisheries Service
Northwest Fisheries Science Center
Conservation Biology Division
2030 S. Marine Science Drive
Newport, Oregon 97365
peter.w.lawson@noaa.gov
(503) 867-0430

EDUCATION:

9/80-12/86	Idaho State University, Pocatello, Idaho. M.S. 3/84, Ph.D. 12/86.
9/71-6/73	The Evergreen State College, Olympia, Washington. B.A., 9/73.
9/66-12/69	Grinnell College, Grinnell, Iowa.

RECENT EXPERIENCE:

7/97-present	National Marine Fisheries Service, Northwest Fisheries Science Center. Research Fishery Biologist
4/87-7/97	Oregon Department of Fish and Wildlife, Newport, Oregon. Fishery Biologist/Modeler

RESEARCH INTERESTS:

Climate and ocean environment effects on nearshore ecosystems and coastal landscapes.
Risk assessment using life-cycle simulation models.
Effects of man on ecosystem structure and function.

PUBLICATIONS:

Marasco, R.J., D Goodman, C.B. Grimes, P.W. Lawson, A.E. Punt, and T.J Quinn. 2007. Ecosystem-based fisheries management: some practical suggestions. Canadian Journal of Fisheries and Aquatic Sciences 64: 928-939.

Burnett, K.M., J.L. Ebersole, R.E. Gresswell, D.P. Larsen, P.W. Lawson, D.J. Miller, J.D. Rodgers, E.A. Steel, D.L. Stevens, and C.E. Torgersen. in review. Data and modeling tools for assessing landscape-level influences on salmonid populations: Examples from Western Oregon. for Arctic Yukon Kuskokwim Sustainable Salmon Initiative.

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Lawson, P.W., E.A. Logerwell, N.J. Mantua, R.C. Francis, and V.N. Agostini. 2004. Environmental factors influencing freshwater survival and smolt production in two Pacific Northwest coho salmon (*Oncorhynchus kisutch*) populations. Can. J. Fish. Aquat. Sci. 61:360-373.

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Lawson, Peter W. 1993. Cycles in ocean productivity, trends in habitat quality, and the restoration of salmon runs in Oregon. Fisheries (Bethesda) 18(8):6-10.

Lawson, Peter W. and Richard M. Comstock. 1995. Potential effects of selective fishing on stock composition estimates from the mixed-stock model: application of a high-dimension selective fisheries model. ODFW Information Report 95-2.

John Carlos Garza

Southwest Fisheries Science Center; carlos.garza@noaa.gov
PRESENT POSITION: Molecular Ecology Team Leader

EDUCATION: Ph.D. in Integrative Biology, 1998, University of California, Berkeley; M.S. in Biology, 1991, B.A. (magna cum laude) in biology, 1990, University of California, San Diego.

Positions:	2003-present	Supervisory Research Geneticist, NOAA/NMFS/SWFSC Santa Cruz, CA
	2001-present	Assistant Adjunct Professor, Department of Ocean Sciences University of California, Santa Cruz
	1999-2003	Research Geneticist, NOAA/NMFS/SWFSC Santa Cruz, CA
	1998-1999	Postdoctoral Fellow, Museum of Vertebrate Zoology Berkeley, CA

RESEARCH INTERESTS: Population genetics, evolutionary ecology, molecular ecology of marine/anadromous fishes and marine mammals, inheritance of ecologically important traits.

HONORS AND AWARDS: NSF Postdoctoral Fellowship, 1998; UC San Diego Alumni Association-Scholar of the Year (Twice), 1990, 1989; Phi Beta Kappa, 1989.

SELECTED SERVICE ON SCIENTIFIC COMMITTEES: North-Central California Salmonid ESA Technical Recovery Team (2001-2004); Editorial Board, *Molecular Ecology*.

SELECTED PUBLICATIONS:

Pastor T, Garza JC, Allen P, Amos W, Aguilar A (2004). Low genetic variability in the highly endangered Mediterranean monk seal. *Journal of Heredity* 5: 291-300.

Wlasiuk G, Garza JC, Lessa EP (2003) Genetic and geographic differentiation in the Río Negro tuco-tuco (*Ctenomys rionegrensis*): inferring the roles of migration and drift from multiple genetic markers. *Evolution* 57: 913-926.

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Garza JC, Freimer NB (1996) Homoplasy for size at microsatellite loci in humans and chimpanzees. *Genome Research* 6: 211-217.

Garza JC, Slatkin M, Freimer NB (1995) Microsatellite allele frequencies in humans and chimps with implications for constraints on allele size. *Molecular Biology and Evolution* 12: 594-603.

Di Rienzo A, Peterson AC, Garza JC, Valdes AM, Slatkin M, Freimer NB (1994) Mutational processes of simple-sequence repeat loci in human populations. *Proceedings of the National Academy of Sciences, USA* 91: 3166-3170.

Garza JC, Woodruff DS (1992) A phylogenetic study of the gibbons (*Hylobates*) using DNA obtained non-invasively from hair. *Molecular Phylogenetics and Evolution* 1: 202-210.

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Beacham, T. D., I. Winther, K. L. Jonsen, M. Wetklo, L. Deng, and J. R. Candy. In review. The application of rapid microsatellite-based stock identification to management of a Chinook salmon troll fishery off the Queen Charlotte Islands, British Columbia. North American Journal of Fisheries Management.

Cairney M., J. B. Taggart, and B. Hoyheim. 2000. Atlantic salmon (Salmo salar L.) and cross-species amplification in other salmonids. Molecular Ecology 9: 2175- 2178.

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Rexroad, C. E., III, R. L. Coleman, A. M. Martin, W. K. Hershberger, and J. Killefer. 2001. Thirty-five polymorphic microsatellite markers for rainbow trout (Oncorhynchus mykiss). Animal Genetics 32: 317-319.

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Teel, D. J., P. A. Crane, C. M. Guthrie III, A. R. Marshall, D. M. VanDoornik, W. D. Templin, N. V. Varnavskaya, and L. W. Seeb. 1999. Comprehensive allozyme database discriminates chinook salmon around the Pacific Rim. (NPAFC document 440) 25p. Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, Alaska USA 99518.

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DRAFT COUNCIL OPERATING PROCEDURE 15
Salmon Estimation Methodology Updates and Review

Approved by Council: 07/10/85
Revised: 11/19/87, 03/09/89, 04/06/95, 06/23/97, 03/11/05

PURPOSE

To establish procedures for the review and approval of Council estimation methodologies, utilizing the Scientific and Statistical Committee (SSC), ~~and~~ the Salmon Technical Team (STT), and the Model Evaluation Workgroup (MEW). This oversight review of current and proposed methodologies for abundance and harvest projection, experimental fishing permits (EFPs), and conservation objectives is intended to help clarify the technical basis for the Council's management actions. It should function to provide peer review of the technical estimation and modeling procedures, to ensure the best and most objective technical analyses possible, to minimize confusion during the preseason option development process, and to resolve disputes over methodology.

OBJECTIVES AND DUTIES

During the March and April meetings or at other appropriate times, the SSC, in conjunction with the STT and ~~Model Evaluation Workgroup (~~MEW~~)~~, will identify methodology issues which need documentation and/or merit a full review. The SSC is responsible for reviewing new or changed methodology as opposed to specific applications of the methodology. Examples of issues that merit a full review include new model algorithms, methods for incorporating base data into models, forecasting methods for major PFMC stocks, experimental design of proposed experimental fisheries, and technical changes to stock complexes or conservation objectives. Examples of issues that do not merit full review include updating base periods in models, changing coded-wire-tag representation for modeled stocks, adding new stocks to models, and changing data ranges used to estimate parameters in models. Issues in this latter category will be reviewed within the MEW or STT, and can be implemented without formal review by the SSC and approval of the Council; provided both the Council and SSC receive updates on such changes; however, if warranted, the Council may require additional review by the SSC.

At the September meeting t~~T~~he SSC will inform the Council of the methodologies selected for review and recommend a review schedule. The SSC also will notify the Council of assistance needed from management entities and the MEW to accomplish the review.

The appropriate management entities, with assistance from the MEW, are expected to provide background information on procedures and data bases for methodologies undergoing full review, as well as early notification and documentation of anticipated changes in procedures for methodologies not under full review in a particular year. Management entities, with assistance from the MEW, are responsible for ensuring that materials they submit to the SSC and Council are technically sound, clearly documented, and identified by author. Documents should receive internal entity review before being sent to the Council. To provide adequate review time for the

SSC, materials must be received in the Council office at least three weeks before scheduled review meetings.

The SSC and STT will report to the Council at the November meeting on the results of these reviews and provide recommendations for all proposed methodology changes. During the November meeting, the Council will adopt all proposed changes to be implemented in the coming season or will provide directions for handling any unresolved methodology problems.

During each March meeting, the STT will report on the status of all current estimation procedures and models used in analyzing the management options and identify any problems or potential changes to model inputs or parameters that could occur prior to completion of the annual preseason management process in April.

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON SALMON METHODOLOGY REVIEW

The Scientific and Statistical Committee (SSC) Salmon Subcommittee and the Salmon Technical Team (STT) met at the Sheraton Portland Airport on October 24-25, 2007, to review four salmon methodology issues:

- Revisions to Council Operating Procedure 15.
- Genetic Stock Identification Study Proposal and EFP.
- Coho Fishery Regulation Assessment Model (FRAM) Base Period Revisions.
- Review of recovery exploitation rate for Lower Columbia River natural tules.
-

The Model Evaluation Workgroup (MEW) was also present. Comments on these four items follow.

Council Operating Procedure (COP) 15

The SSC reviewed proposed changes to the Salmon Estimation Methodology Updates and Review COP (COP 15) presented by Mr. Chuck Tracy. The changes were suggested primarily in order to:

1. Acknowledge the role of MEW.
2. Define what, in general, merits SSC review.
3. Make it clear that data modifications (including changes in the range of data to which an accepted methodology is applied) do not generally require SSC review. This includes such changes that occur subsequent to adoption of the final methodology review in November and prior to preseason forecast calculations early in the following year.

The SSC approves of the proposed changes and makes the following suggestions for clarification purposes:

1. In the second proposed new sentence below "Objectives and Duties", add the word "could" before "merit a full review…"
2. In the second paragraph below "Objectives and Duties", replace "selected" with "ready".
3. Towards the end of the third paragraph below "Objectives and Duties", replace "three weeks" with "two weeks".

Genetic Stock Identification Study Proposal and EFP

Dr. Peter Lawson presented a project proposal for "Strategies to Minimize Catch of Klamath River Chinook Salmon in West Coast Mixed Salmon Fisheries". The goals of this project are to use genetic stock identification methods to determine the distribution of Klamath River and other PFMC-managed Chinook stocks in areas off the northern California and Oregon Coasts. The goals and objectives of the project are well defined and, if achieved, will provide information that will be valuable to fishery managers.

The proposed project would be similar to the Collaborative Research on Ocean Salmon (CROOS) Project conducted primarily in the waters off of central Oregon during 2006. Sampling methodologies and protocols developed by the CROOS project would be used in the proposed project which would extend sampling into the waters off of southern Oregon and northern California. The sample design, data collection methods, and proposed methods of analysis will meet project goals and objectives. The sampling design defines 144 weekly time/area strata for sampling. In recent years, a large number of the proposed strata have been closed to commercial fishing (51 in 2007). Therefore, an experimental fishing permit will be needed in order for samples to be collected from those areas which may be closed in 2008. If the project cannot collect samples from closed areas in 2008, the project goals and objectives will be compromised as the distribution and stock composition of fish in closed time/area strata will remain unknown. Therefore, the Scientific and Statistical Committee (SSC) supports the EFP application.

Sample size objectives of 240 fish per time/area strata are proposed. The analyses presented support these sample size goals. However, these analyses were based on the assumption of a random distribution of fish from a stock within a sampled time/area stratum. The SSC suggests that an analysis of the CROOS data be conducted to examine the assumption of a random distribution of fish from a stock or whether there is "clustering" of fish from a stock. If it appears clustering (due to schooling behavior) exists, the possible effect of this on the sample size objectives should be evaluated and appropriate sample allocation should be addressed. Additional details will need to be provided on the spatial distribution of sampling effort in closed areas under Plan A (such as transects versus random locations). Similar information should be provided with regard to Plan B (no EFP).

Finally, the stock impact analysis for the project (number of fishery-induced mortalities due to fishing in closed areas) is based on a maximum sample size of 12,240 fish (240 samples collected from each of 51 closed time/areas). However, sampling efforts in closed areas may continue after the sample size goal is obtained in order to distribute samples across the entire weekly time period, if possible. The SSC recommends that an additional impact analysis be conducted that accounts for the possibility of sampling more than 240 fish per time/area strata.

Coho FRAM Base Period Revisions

Mr. Jim Packer reviewed the status of base period updates to the coho FRAM. Over the past several months he has held a series of regional meetings from Canada to the Oregon Coast to explain recent developments in the model and to solicit suggestions and updates to the base period input data. As a result, there is an increased familiarity with the model, an increased acceptance of the model, and a substantially improved and updated input data set.

A considerable effort has gone into conducting new cohort analyses for the years from 1992 to 1997 with the intention of updating the FRAM base period. Except for 1992, fishing has been restricted in these years to the point that it is difficult to incorporate them into the base period. As a result, Mr. Packer recommended a new base period that included the updated data set and added only the year 1992 to the current 1986-1991 base period. Data from the Upper Fraser River in 1986 would be omitted because of poor data quality and anomalous estimates for the

Thompson River stock in that year. An alternative is to use the current 1986-1991 base period years (without Upper Fraser 1986) but with updated data.

The SSC agrees that, because of the regional meeting process that was used, the updated data set should constitute an improvement over the earlier version and should be used for modeling. We had no objective way to evaluate the addition of the 1992 year to the base period. However, based on Mr. Packer's information that 1992 was similar in data scope and quality to the earlier years it seems that the addition of a seventh year would likely lead to a more robust base period.

The SSC had difficulty evaluating the new data set or proposed base periods because we have no objective measure of stock distributions or model performance for comparison. Now that there are five additional years of reconstructed fisheries that may not be used in the base period fisheries could be simulated using different base periods to reproduce 1993-1997 fisheries. Output could then be compared with the reconstructed fisheries and escapements to see how well they match. This would help resolve three important questions: (1) how well does a base period that uses years of coast-wide fishing and average exploitation rates represent catch patterns in years with restricted fishing or differing ocean conditions, (2) how sensitive is the model to the selection of base period, and (3) does the addition of 1992 to the base period improve the simulation of current fisheries? A set of metrics needs to be developed to facilitate this comparison among model runs.

In the future the SSC recommends that the MEW use the new cohort reconstruction tools to focus on post-season analysis. We now have a tool that could be used for estimating total abundance of coho salmon. This could lead to an agreed-to coast-wide coho data set for preseason forecasting in terms of the FRAM base period and for postseason evaluation of exploitation rates and escapements. It would also be useful to have the MEW use the current tools to analyze the 1979-1985 catch years. In addition to providing more data for potential base years this would fulfill the original intent of the MEW to have more people trained in the use and development of FRAM base period data.

Review of recovery exploitation rate for Lower Columbia River natural tules

Due to an apparent oversight, the document describing this analysis was not provided to the SSC or the Council prior to the November meeting. While the SSC salmon subcommittee (SSCSS) was able to conduct a review at the October Salmon Methodology Review Meeting, and the SSC recognizes their expertise, the SSC as a whole was not able to provide a complete review of this topic at this meeting and would be interested in revisiting this topic in March, 2008.

Dr. Michael Ford (NWFSC, Conservation Biology Division) gave a presentation on analyses to support a review of an Endangered Species Act jeopardy consultation on fisheries impacting Lower Columbia River (LCR) tule (early fall run) Chinook salmon. The work, conducted by a joint NMFS/WDFW working group, provides a comprehensive review of the data available to assess the status of the LCR tule populations and presents two analyses useful for evaluating rebuilding exploitation rates (RERs). There is an apparent lack of data on tule Chinook populations for the Oregon side of the Lower Columbia River. Beginning in 2007, harvest actions on these stocks are evaluated on the basis of a RER limit of 42% based on results from the analysis of three natural-origin tule populations. This was a reduction from the 49% limit

that was used during the previous five years based on an analysis of the Coweeman River population. Estimates for the Coweeman River population indicate that recent brood-years have experienced adult equivalent exploitation rates in excess of both the 42% and 49% exploitation rate limits.

The working group developed two possible approaches for evaluating run status, one based on a viability curve analysis and the other based on rebuilding exploitation rates (RER). A viability curve shows how extinction risk varies with population abundance and productivity. Curves were presented for three harvest rates (0, 25%, 50%). Probability contours for estimates of current population abundance and productivity are superimposed on the viability curves to evaluate the current status of the population relative to extinction risk at three harvest levels. The RER approach uses a stochastic Viability-Risk Assessment Procedure (VRAP) to project population abundance into the future based on current productivity and capacity conditions. For their analyses the working group applied both approaches to the same fundamental run reconstruction data to develop relationships between recruitment and parental spawning stock for the three LCR tule populations with the best available data sets (Coweeman, Grays, and Lewis). The working group considered the data available from the other LCR tule populations to be too poor or too tainted by hatchery strays to use in the analyses. Plots of the curves fitted to the recruits versus spawner data for the three populations indicated that the data are extremely noisy and not well characterized by any of the spawner-recruit curves considered by the working group.

The results from both methods of analysis are sensitive to model parameters used to assess stock status when projecting a population's abundances into the future (e.g., the quasi-extinction threshold [QET] for the viability curve analysis and the lower and upper escapement thresholds [LET and UET] for the VRAP analysis). The choice of these values embodies the level of risk inherent in the chosen RER and, therefore, is partly (but not wholly) a policy decision

The SSCSS is concerned by the very poor quality of the data underlying the working group's analyses. The analyses are complicated and it is unclear how measurement errors propagate through the calculations and influence the results. The SSCSS suggests that the working group conduct an evaluation of the two methods using simulated data with known levels of measurement error, including a perfect data set with no measurement error. Comparing the results from such an evaluation would provide a basis for selecting between the viability curve approach versus the RER approach. Analyses with simulated data could also measure the relative sensitivity of the two approaches to different forms of measurement error, the choice of values for assessing a population's projected future abundance (QET, etc.), and indicate possible sources of bias.

For the viability analyses, the probability distributions for the population's current status were generated using random time-series with 20% uniform error, which has a coefficient of variation of 11%. This seems a low level of uncertainty. The SSCSS suggests using normally distributed random errors with coefficients of variation of at least 20%.

Both methods are based on the assumption that the most important factors governing viability of these populations are the recently realized stock-recruit relationships rather than changes in ocean or freshwater environmental conditions or in hatchery supplementation practices. The

data supporting this assumption are weak, so the degree of confidence that can be placed in either of these methods is low. The SSCSS recommends that sensitivity analyses to these other relevant factors should be conducted.

The SSCSS concurs with the working group's suggestion of exploring other analytical techniques. A mixed-model approach that simultaneously analyses data from multiple populations might provide better parameter estimates and allow for use of data from more of the populations.

PFMC
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Agenda F.2.c
Supplemental Tribal Comments
November 2007

Salmon Methodology Review

The Tribes are still very concerned about mark-selective fisheries for chinook and the ability of the chinook FRAM to project the impacts of any mark-selective fisheries. It has not been demonstrated that chinook FRAM can adequately deal with multi-year selective fisheries which are of extended duration and have the potential to significantly impact Puget Sound chinook stocks.

Also, the Tribes are concerned that our ability to make post-season estimates of stock-specific impacts to wild Chinook stocks will be jeopardized by any expansion of mark-selective fisheries for Chinook. There is currently no agreed upon methodology for estimating those impacts by selective fisheries, which impact multiple ages of a brood year over multiple years.

In addition the Tribes encourage the FRAM "modelers" to use the new base period expansion to include years 1986-1992 in the coho FRAM and the inclusion of additional stocks in the Chinook FRAM. The Tribes are also in agreement of use of additional CWT groups to represent Lower Columbia River Natural Tule Chinook stocks in the Chinook model.

The Tribes are committed to participating in the technical process required to develop and evaluate the tools needed for these analyses.

MODEL EVALUATION WORKGROUP
REPORT ON SALMON METHODOLOGY REVIEW

The Model Evaluation Workgroup (MEW) met, in October, with the Salmon Subcommittee of the Scientific and Statistical Committee (SSC) and the Salmon Technical Team (STT) for review of:

- Coho Fishery Regulation Assessment Model (FRAM) Base Period Methods and Results, and
- Proposed Changes to Council Operating Procedure 15 (COP 15) – Salmon Methodology Review.

The work on revising the Coho Fishery Regulation Assessment Model (FRAM) Base Period is being done by a workgroup of the Pacific Salmon Commission (PSC) Coho Technical Committee as part of their efforts towards developing Coho FRAM for PSC fishery assessment. The 1986 through 1991 base years were re-created, while the 1992-1997 years were added to the set of available base years. The review of this work has two components. First are changes to the methodologies and associated data updates. The second component was the focus of the October presentation: the evaluation of the base years recommended for averaging into a FRAM Base Period, which potentially could include all years 1986-1997. Several general methods for selecting years for the base period were discussed. An important factor in the development of this base data is the number of coded wire tags (CWT) recovered. Reduced levels of ocean fisheries in 1993-1997 produced correspondingly low numbers of CWT recoveries. Inclusion of the 1993-1997 years in the Coho FRAM Base Period could degrade the quality of information contained in the earlier 1986-1992 years. The PSC workgroup has recommended that the present Coho FRAM Base Period be expanded from 1986-1991 to 1986-1992. The MEW concurs and supports the use of common data sets in Coho FRAM for Council and PSC fishery assessments.

Although the coho base development methodologies were not discussed this past October, the draft documentation has been provided and methodology has been discussed in previous review sessions. Again this October another revision of the draft was provided. The MEW recognizes that this documentation remains a work in progress until the PSC work is completed. At that time, the MEW intends to review the Coho FRAM Base Period Development document for incorporation into the Council's set of FRAM documentation.

The draft Council Operating Procedure 15 was revised to include the MEW and to clarify salmon methodology review responsibilities of the SSC, STT, and MEW. The MEW supports the revised COP 15, but has suggested some minor edits to allow management entities appropriate flexibility for their interaction with the MEW during developmental stages of products.

At the October meeting MEW also provided information updates on:

- Stock Additions to Chinook FRAM Base Period,
- Lower Columbia River Natural Tule Chinook CWT Representation, and
- Lower Columbia River Natural Coho CWT Representation.

Five more stocks were added to the Chinook FRAM Base Period. These included the addition of three new stocks (California's Central Valley, Washington's Willapa Bay and North Coast stocks). These stocks were added to capture the annual abundance variability of these three stocks and their influence on fishery impacts on Council managed Chinook stocks. The MEW believes this effort has improved the estimates of stock specific impacts in Council area fisheries, primarily north of Cape Falcon.

The other two stocks added to the base period were for specific management purposes: Hoko and Lower Columbia River Natural Tule. Hoko Chinook were separated from the Strait of Juan De Fuca Chinook stock in FRAM because they are not part of the Puget Sound Chinook evolutionary significant units (ESU) and, hence, impacts on this stock should not be considered in Endangered Species Act (ESA) impact assessment. Lower Columbia River Natural Tule stock was added to FRAM as a potential representative for ESA fishery impact assessment on the Lower Columbia Chinook ESU. This FRAM stock was developed using CWT release groups from four Lower Columbia salmon hatcheries covering a broader geographical area (and tributaries) than the Washington Tule FRAM stock which is currently used for ESA assessment and is based on CWT releases from one hatchery (Cowlitz Salmon Hatchery).

This new Chinook FRAM Base Period will be ready for use in 2008, although some refinements and error checking tasks remain to be completed. In fact, as part of the review process some errors were discovered in the analysis. Most of the errors were not the result of adding stocks to the model but were instead problems with existing FRAM data and FRAM program coding. Correcting these errors does not negate the impact assessment benefits in adding the five stocks to Chinook FRAM. A corrected version of the analysis will be posted on the Council website following a MEW review. Evaluation continues but the focus is upon report development.

There has been little progress on selection of CWTs for representation of Lower Columbia River Natural Coho. This task is dependent upon the determination of the geographical range of this stock and of the life history components (early verses late coho adult run timing). Columbia River technical staff are reviewing available information. If representative CWT groups are selected soon and subsequent base data development work is completed, then a Lower Columbia River Natural coho stock could be incorporated into Coho FRAM for use in 2008.

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SALMON ADVISORY SUBPANEL
REPORT ON SALMON METHODOLOGY REVIEW

The Salmon Advisory Subpanel (SAS) continues to support the genetic stock identification study and recommends any experimental fisheries permit necessary to carry out the proposed study design be given the highest priority for National Marine Fisheries Service (NMFS) approval to allow for implementation in 2008.

The SAS supports the proposed use of multiple hatchery stocks to represent Lower Columbia River natural tules in the Chinook Fishery Regulation Assessment Model (FRAM). Including more stocks in the FRAM representation should provide better estimates of exploitation rates because of larger sample sizes and wider distribution patterns. However, the SAS does not think the Grays River population is representative of natural spawning populations in the Lower Columbia River due to past hatchery practices and past and current habitat conditions. It is not reasonable to expect recovery of a Grays River natural population given these conditions, and it has been repeatedly demonstrated that cutting back harvest is not the way to rebuilding depressed salmon runs. The Grays River population should not be used to determine a recovery exploitation rate for Lower Columbia River natural tules.

PFMC
11/05/07

SALMON TECHNICAL TEAM
REPORT ON SALMON METHODOLOGY REVIEW

Coho Fishery Regulation Assessment Model (FRAM)

The Salmon Technical Team (STT) heard a presentation from the Model Evaluation Workgroup (MEW) regarding: (1) cleanup of the coho base period data, and (2) extending the Coho FRAM base period by an additional year. The proposal is to extend the base period range of years from the current 1986-1991 (excluding 1986 Upper Fraser) to 1986-1992 (excluding 1986 Upper Fraser). Results presented by the MEW indicate that including 1992 in the model's base period yields similar results to that of the current base period. However, including the 1992 data increases the overall sample size and information content of the model's data base. The STT thus concurs with the revision of the base period data and the proposed data base extension as long as these changes do not conflict with any Pacific Salmon Commission (PSC) action taken on this matter.

Chinook FRAM

The STT was given an informational update by the MEW regarding two issues with the Chinook FRAM. The first issue regards the inclusion of additional stocks in the model. The STT is in agreement with these stock additions and believes it will improve the model's overall robustness. The second issue regards the use of additional coded-wire-tag (CWT) groups to represent Lower Columbia River Natural Tule Chinook stocks in the model. The STT believes this addition is a step in the right direction as it should allow for a more representative modeling of this stock complex. It is important to note however that this aggregate of stocks is different than that currently used for the National Marine Fisheries Service Endangered Species Act consultation standard and that this issue will need to be addressed.

Exempted Fishing Permit

The STT heard a presentation on the proposed genetic sampling of Chinook salmon in coastal waters off California and Oregon in 2008 with the intent of refining knowledge of ocean distributions of Chinook stocks, especially that of Klamath River fall Chinook. Two options were presented: one involved sampling only in areas open to commercial fishing, and the other involved contracting commercial fishing vessels to sample using catch and release fishing in closed areas. The latter option is the preferred option and would require an exempted fishing permit, and the allocation by the Council of harvest impacts to the study. The proposed study is well designed, and the investigators have demonstrated their ability to carry out this work through ocean sampling of 2006 and 2007 ocean salmon fisheries. The STT supports the preferred study design.

Recovery Exploitation Rate (RER) for Lower Columbia River Tule Fall Chinook

Scientists from the Northwest Fishery Science Center presented analyses supporting the ESA exploitation rate guidance for lower Columbia River natural tule fall Chinook. Previous analyses focused on the Coweeman River tule stock exclusively. The analyses presented expanded the scope to include most lower Columbia River tule stocks, but focused on the Coweeman, Grays River, and East Fork Lewis River stocks. The methods presented included both viability analyses and calculation of RERs. Inconsistencies between the exploitation rates used to model and monitor fisheries, and those used in the calculation of RERs were noted. These inconsistencies need to be reconciled.

In computing RERs, an upper escapement threshold for each stock was chosen as the larger of S_{MSY} or average escapement over the time series. In nearly all cases, this turned out to be average escapement. This implies that the spawning escapements of these stocks have, on average, been above S_{MSY}. The relationship between RERs and stock rebuilding is not at all clear, and the response in future assessments of the RER to different rebuilding scenarios (e.g., increases in productivity or capacity, or decreases in harvest) has not been explored.

PFMC
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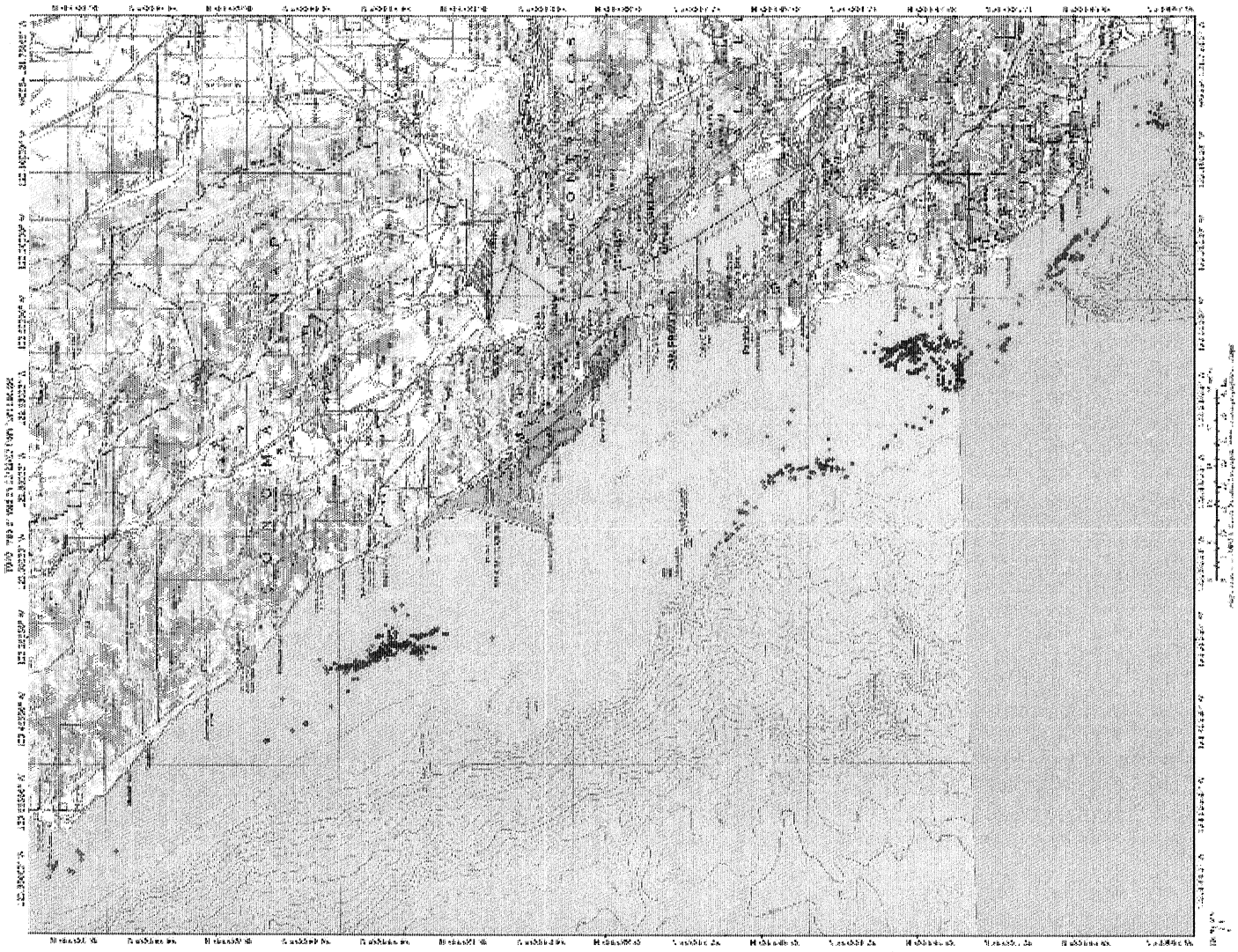
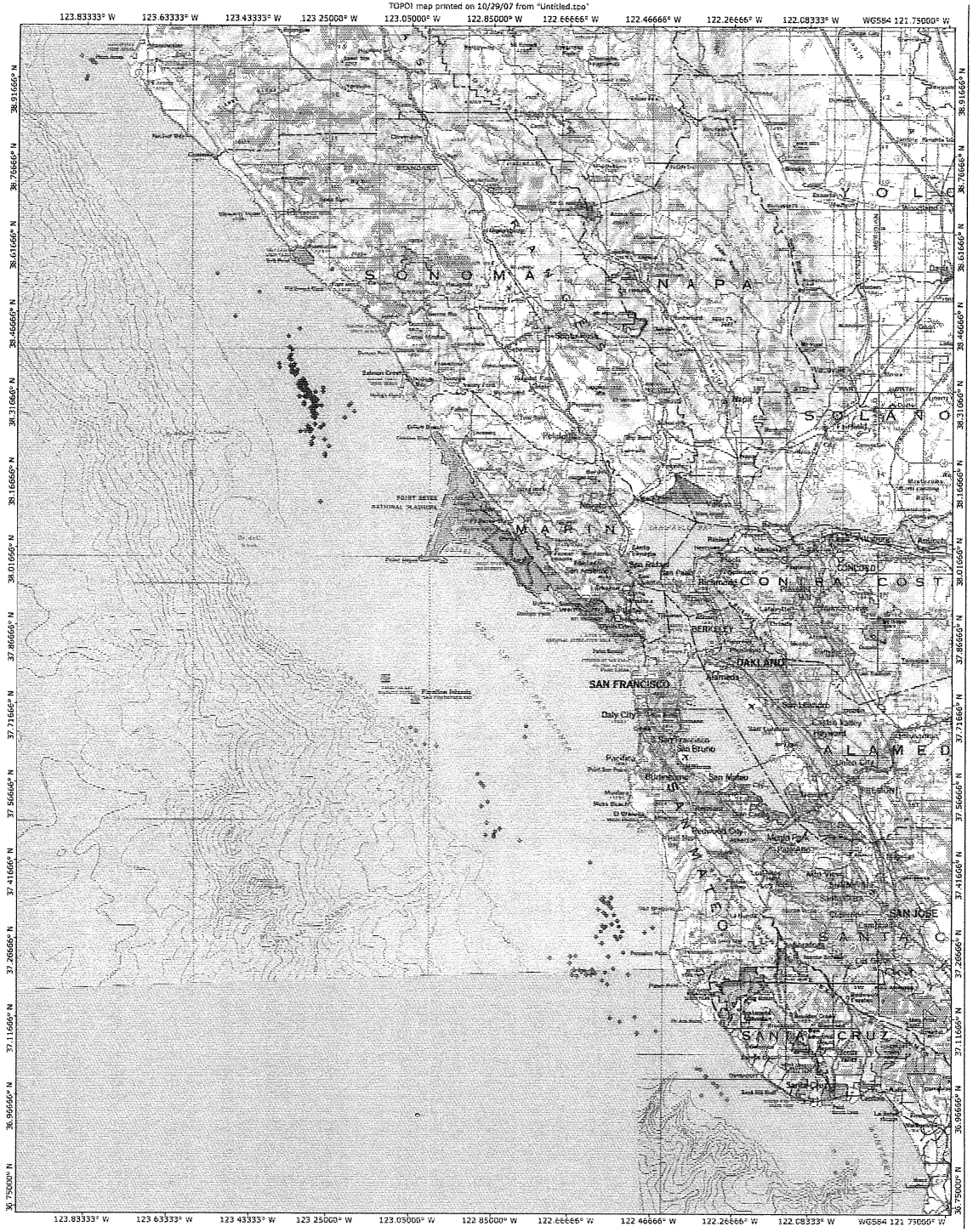
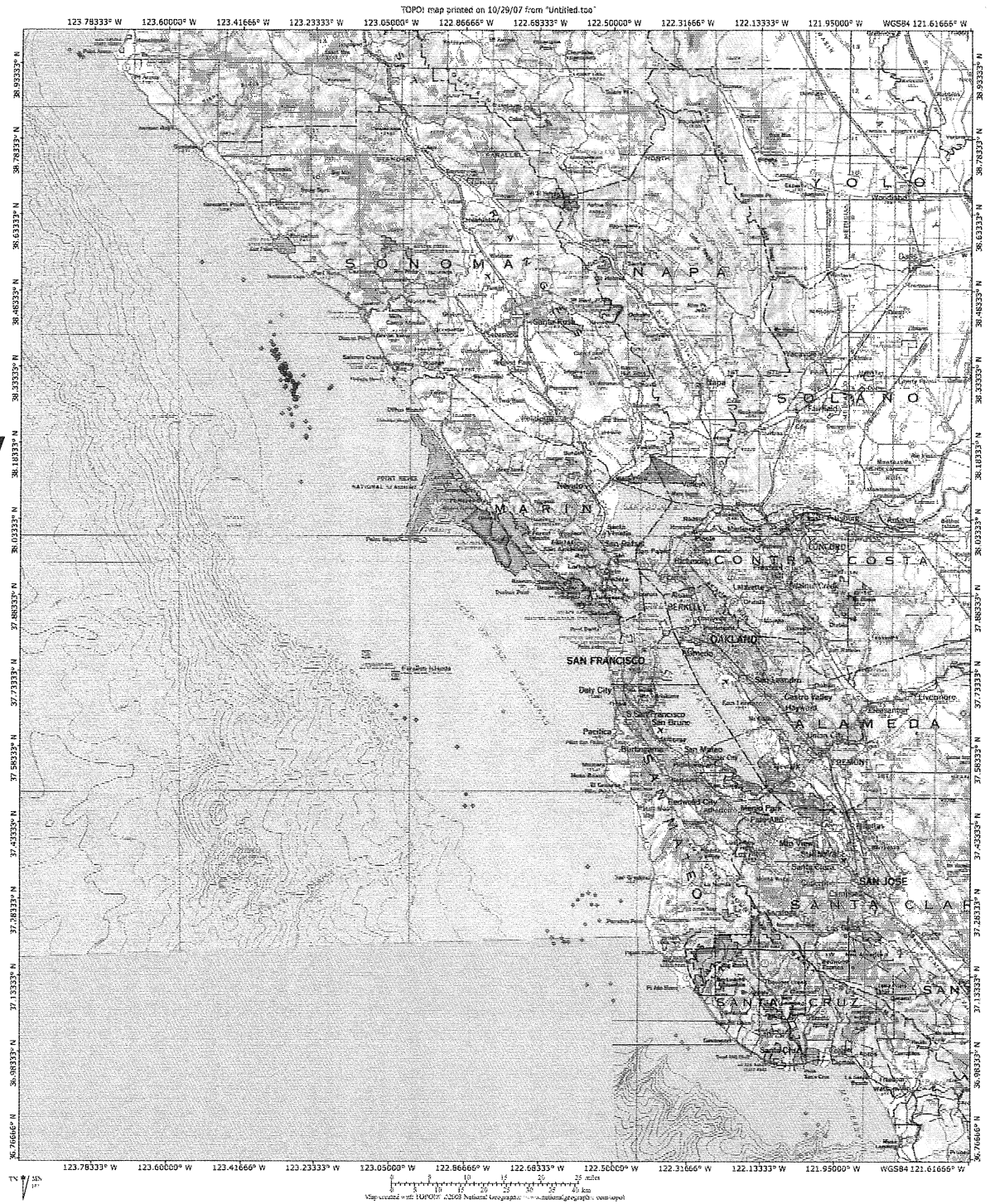


Catch locations-CA GSI Project May 2007

Klamath/ Coastal Chinook only -May 07



Coastal Chinook only -May 07



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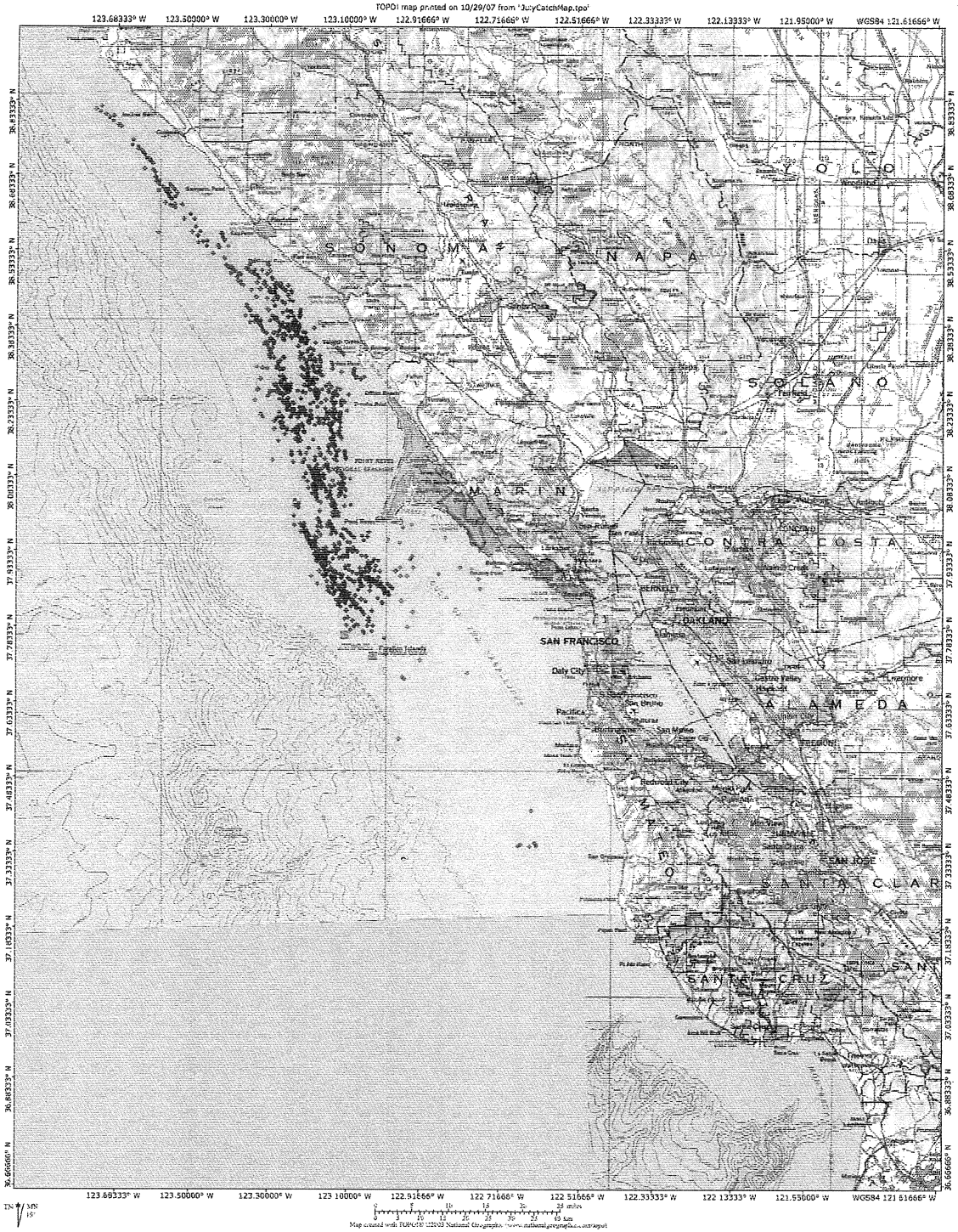
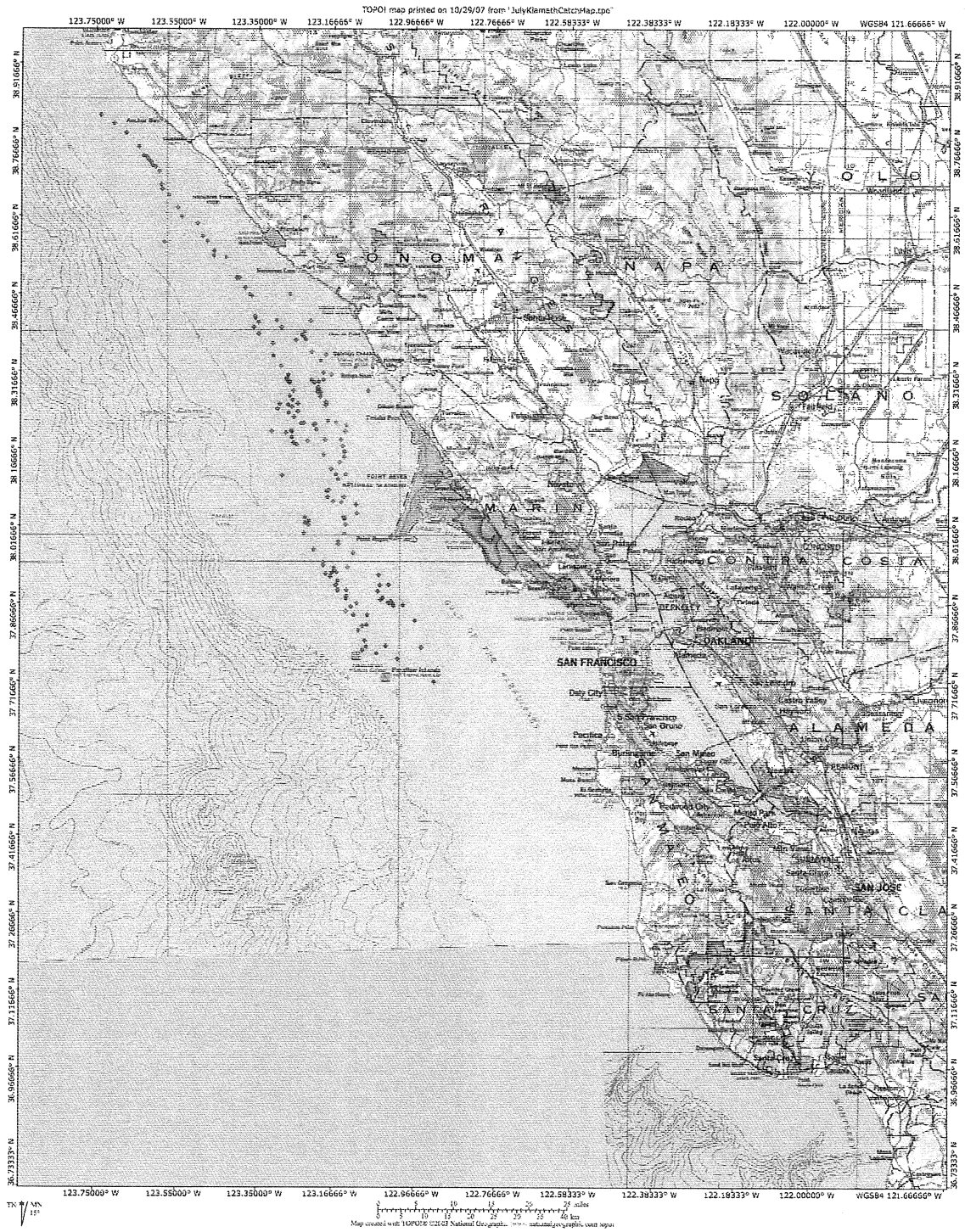


Catch locations- Klamath only July 2007



Catch locations- Coastal only July 2007

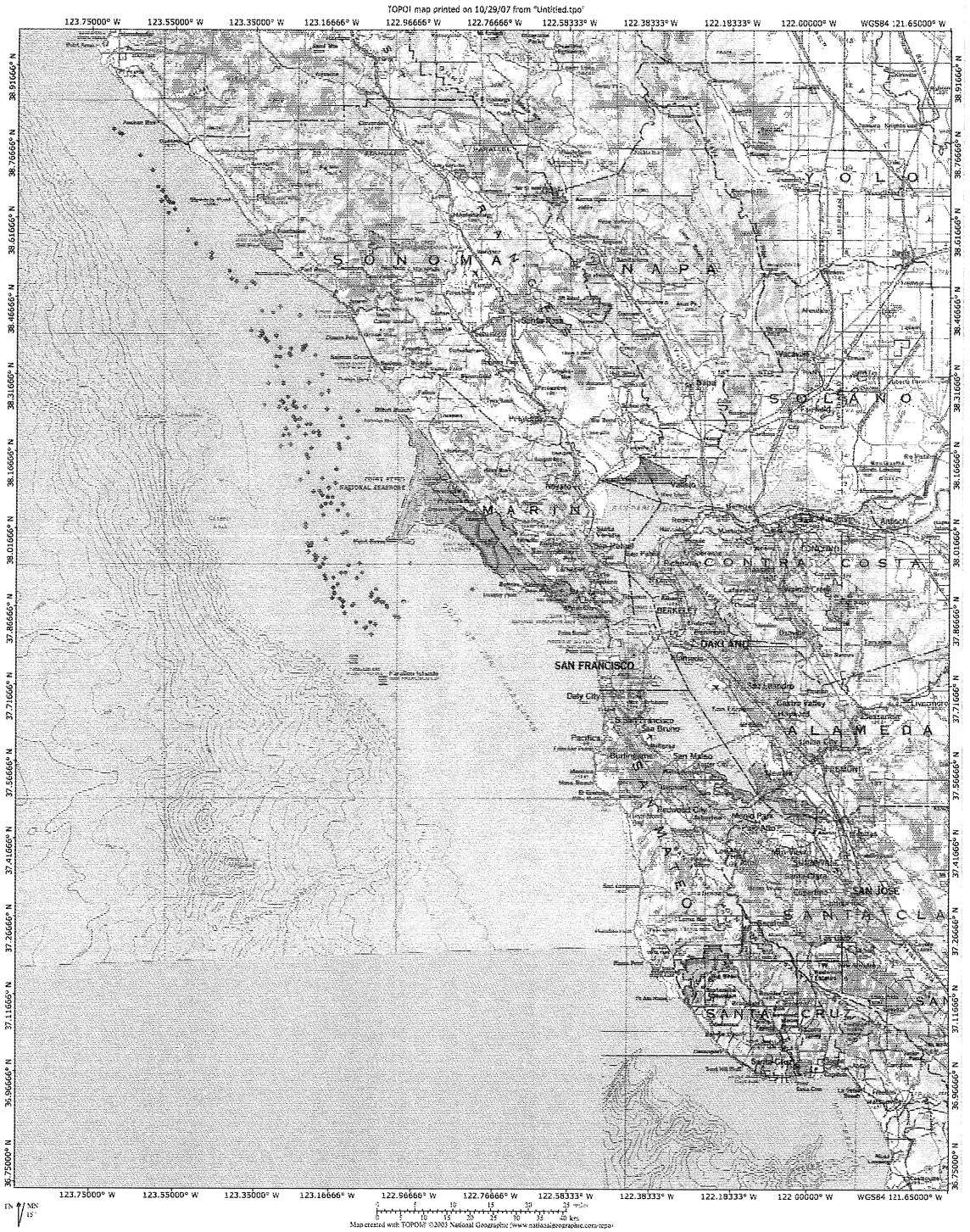
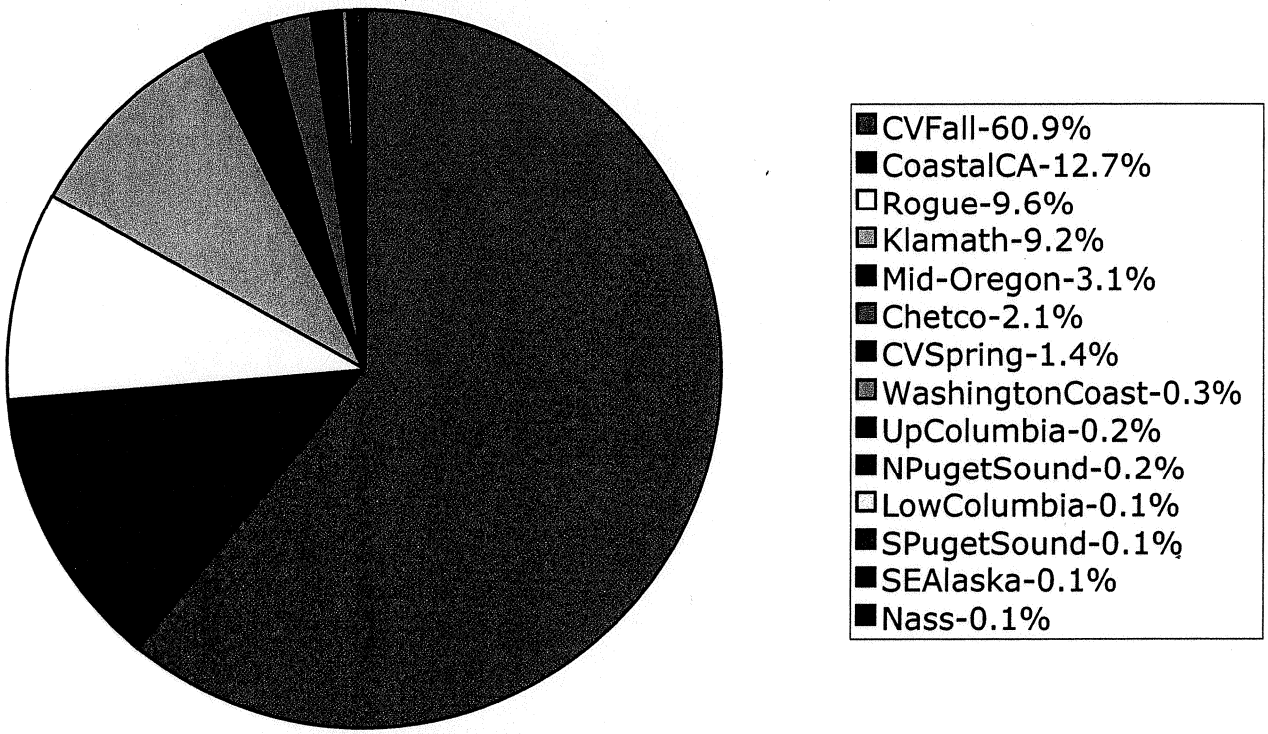


Figure 3

GSI Results for May 2007-
Stock proportion estimates from 1075 fish



GSI Results for July 2007-
Stock proportion estimates from 1539 fish