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

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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

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Newport, OR 97365 USA
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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.

Banks, M. A., E. Anderson, A. Antonovich, T. D. Beacham, M. R. Bellinger, S. M. Blankenship, M. Campbell, J. Candy, N. A. Decovich, J. C. Garza, C. M. Guthrie III, T. A. Lundrigen, P. Moran, S. R. Narum, Seeb, L. W., J. J. Stephenson, K. J. Supernault, D. J. Teel, W. D. Templin, K, Warheit, J. K. Wenburg, S. F. Young, and C. T. Smith. Power analysis of the GAPS baseline. In preparation for submission to Canadian Journal of Fisheries and Aquatic Science.

Seeb, L. W., A. Antonovcich, M. A. Banks, T. D. Beacham, M. R. Bellinger, S. M. Blankenship, M. Campbell, N. A. Decovich, 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. Development of a standardized DNA database for chinook salmon. In press, Fisheries.

Chapman, J. W., J. T. Carlton, M. R. Bellinger, and A. M. H. Blakeslee. 2007. Premature refutation of a human-mediated marine species introduction. Biological Invasions 9:737-750.

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.

Bellinger, M. R., S. M. Haig, E. D. Forsman , and T. D. Mullins. 2005. Taxonomic relationships among *Phenacomys* voles inferred by cytochrome-*b*. Journal of Mammalogy 86:301-210.

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
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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.

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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.

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Ford, M.J., Teel, D., VanDoornik, D.M. Kuligowski, D., and Lawson, P.W. 2004. Genetic population structure of central Oregon Coast coho salmon (*Oncorhynchus kisutch*). Conservation Genetics 5: 797-812.

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.

Logerwell, E.A., N. Mantua, P. Lawson, R.C. Francis, and V.Agostini. 2003. Tracking environmental processes in the coastal zone for understanding and predicting Oregon coho (*Oncorhynchus kisutch*) marine survival. Fisheries Oceanography 12:6 554-568

Lawson, Peter W., and R.M. Comstock. (1999). The proportional migration (PM) selective fishery model. In E.E. Knudsen, C.R. Steward, D. MacDonald, J.E. Williams, and D.W. Reiser (*eds.*), Sustainable Fisheries Management: Pacific Salmon. CRC Press, New York.

Nickelson, T. E. and P. W. Lawson. 1998. Population viability of coho salmon, *Oncorhynchus kisutch,* in Oregon coastal basins: application of a habitat-based life-history model. Canadian Journal of Fisheries and Aquatic Sciences 55:2383-2392.

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Lawson, Peter W. and David B. Sampson. 1996. Gear related mortality in selective fisheries for ocean salmon. North American Journal of Fisheries Management 16:512-520.

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

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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, 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.

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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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Hankin, D. G., J. H. Clark, R. B. Deriso, J. C. Garza, G. S. Morishima, B. E. Riddell, C. Schwarz, and J. B. Scott. 2005. Report of the Expert Panel on the future of the coded wire tag recovery program for Pacific salmon. Pacific Salmon Comm. Tech. Rep. No. 18: 230 p. Available at: http://www.psc.org/pubs/CWT/EPfinalreport.pdf

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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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