PACIFIC SALMON COMMISSION

ESTABLISHED BY TREATY BETWEEN CANADA
AND THE UNITED STATES OF AMERICA
MARCH 18, 1985

600 – 1155 ROBSON STREET
VANCOUVER, B.C. V6E 1B5
TELEPHONE: (604) 684-8081
FAX: (604) 666-8707

Our File: 11202

Your File:

Pacific Salmon Commission Invited Workshops:

Current and Future Applications of Genetic Stock Identification (GSI) to Ocean Salmon Management

Focus and Content:

Workshops will be tightly focused on the current and future capabilities, limitations, and uses of GSI methods in ocean salmon management. Alternative technologies will be considered to the extent that they may be used as a direct complement to GSI data collections or analyses.

Overall Objective:

To develop recommendations for integration of GSI information into a coordinated coast-wide management system to improve the ability of ocean fisheries to access abundant stocks within impact constraints established for other specific stocks and, to the extent possible, to identify and quantify the costs, implementation steps and timeframes to incorporate these recommendations.

Workshop Structure and Format:

We propose a two workshop format, with each workshop lasting three days. A notice announcing the proposed workshops would be posted on the PSC website. Formal invitations would be sent to management agencies, proposed members of workgroups, and workgroup coordinators. The first day of workshop 1 would be open to individuals from management agencies and the general public, but attendance would be limited (150-200) and a modest pre-registration fee ($25) would be charged (no fee would be charged to presenters, or members of workgroups, the Steering Committee or the CSC). Attendance on days 2 and 3 of workshop 1 and on all days of workshop 2 would be limited to workgroup members, Steering Committee members, and members of the CSC. A detailed outline of the proposed schedule for Workshop 1 is included as Attachment A.

At the first workshop, a first day's session would consist of essential background presentations on "What manager's want" (AM) and "GSI: State of the Science" (PM). Several case studies will illustrate use of GSI in ocean salmon management. Although the primary audience is intended to be the members of invited workgroups, a limited opportunity will be available for the public to listen to the presentations by pre-registering and paying a nominal fee to defray costs. On the second and third days of the first workshop, invited participants would break into four pre-assigned workgroups (Genetics, Logistics, Management, and Modeling/Sampling), each charged with addressing a set of issues and questions and, working with a coordinator, begin to develop a set of proposed actions or recommendations designed to contribute to achievement of the overall objective specified above. Members of all four workgroups would reconvene at the end of the second day to exchange preliminary findings and recommended products. Workgroup deliberations would continue on the third day. Workgroup *Coordinators* (see below) would meet with members of the *Steering Committee* (see below) at the end of the third day to agree upon direction for preparation of workgroup reports.

Following Workshop 1, Workgroup *Coordinators* (compensated) would be responsible for interacting with workgroup members to develop written reports/proposals which would be formally presented at a second workshop. Participants from all workgroups would be expected to participate at the second workshop. Deliberations would be focused on the contributions of workgroup recommendations to the overall objective, identification and resolution of incompatibilities, and development of specific implementation plans. Workgroup Coordinators would meet with workgroup members on days 2 and 3 of the second workshop, revising the draft report and addressing newly identified issues, and would thereafter be responsible for delivering a final revised workgroup report to the GSI Workshop Steering Committee. The Steering Committee would discuss the merits of the four final reports, resolve, if possible, any incompatibilities across reports, compile them, submit the reports to a group of three peer reviewers, and subsequently provide the reports to the PSC

Compensated peer reviews would be solicited from each of three fishery scientists, selected by the CSC, who are qualified to assess the merits of the combined reports but did not participate in the GSI Workshops. Peer reviews would be provided to members of the Steering Committee who would then attach the peer reviews, along with Steering Committee response, to the PSC.

We anticipate that the product delivered through this process would consist of (a) explicit recommendations for field protocols and sample sizes regarding collection of GSI data, (b) explicit recommendations for how GSI data might best be incorporated into ocean salmon management models and regimes, and (c) explicit proposals for further research that is needed to ensure effective incorporation of GSI data in management of ocean salmon fisheries.

Steering Committee:

Although the original idea for the workshops originated as a proposal from the bilateral Committee for Scientific Cooperation (CSC) to the Northern and Southern Restoration and Enhancement Funds, detailed development of workshop format and objectives has been tasked to a Steering Committee. Steering Committee members are as follows:

Craig Busack, WDFW
Al Cass, DFO
John Clark, ADFG
David Hankin, CSC (Chair)
Robert Kope, NMFS
Paul MacGillivray, PSC Commissioner, Canada
Gary Morishima, QIN
Dave Peacock, DFO
Larry Rutter, PSC Commissioner, US

Workshop Dates and Schedule for Deliverables:

Workshop #1: Portland, OR   15-17 May 2007
Workshop #2: Vancouver, BC   11-13 September 2007
Final Workgroup Reports to Steering Committee: 15 October 2007
Reports sent out for Peer Review: 15 November 2007
Workshop Reports & Peer Reviews Submitted to PSC: 15 January 2008

Workgroups:

The Steering Committee has recommended the formation of four workgroups: Genetics, Logistics, Management, and Modeling/Sampling. Although these workgroups are structured around traditional disciplinary areas in Fisheries, proposed workgroup membership is designed to ensure cross-fertilization so that managers, geneticists and modelers communicate with one another. Each workgroup will be expected to contribute to the overall objective: to develop recommendations for integration of GSI

information into a coordinated coast-wide management system. Steering Committee members would be assigned to specific workgroups to provide clarification, guidance and direction during deliberations.

The Steering Committee has developed a list of recommended participants for each of the four proposed workgroups and has identified candidate individuals who might serve as coordinators of the workgroups. Workgroup members would be expected to be present and working at both workshops (3 days duration each) and would be expected to make themselves available on a limited basis between workshops, as requested by workgroup coordinators. Workgroup coordinators, serving as compensated consultants, would be expected to prepare written workgroup products and to orally present the draft workgroup product on the first day of the second workshop. Initial lists of workgroup participants range in size from 11-14 per group plus 2 or 3 additional members from the Steering Committee. We anticipate that final workgroup sizes will be approximately 10 individuals, including Steering Committee members and workgroup Coordinators. A list of proposed workgroup participants is included as Appendix B.

For the Genetics, Management, and Modeling/Sampling workgroups, the expected content of the final deliverable product to be produced by individual workgroups is not explicitly stated. Instead, workgroup products are intended to be guided by their response to a series of sample questions that have been posed by the Steering Committee to each workgroup. If workgroups address these questions, we expect that their reports will contribute to the overall thematic objective of the workshops. Note that some workgroups may wish to address questions that have been posed for other workgroups and that workgroups are expected to pose additional questions of their own construction.

For the Logistics work group, however, members of the Steering Committee have crafted a very explicit deliverable product:

> To develop a proposal for development and implementation of a GSI infrastructure for coast-wide application of GSI for Chinook (and coho?) salmon for management of ocean fisheries which operates within a multi-jurisdictional environment and is capable of supporting (a) the level of resolution of stock identification required by harvest managers, and (b) an adequate turnaround time for sample analysis. (Included in this proposal would be a recommended GSI baseline, standardized protocols for data collection, analysis and reporting, database design and access, including costs and timelines for implementation).

Sample Questions to Focus and Guide Workgroup Discussions and Analyses

Genetics:

- What level of stock resolution can be reasonably expected from genetic methods? What are the *intrinsic* possibilities and how do these possibilities depend on the number of loci examined. For example, without full parental genotyping (FPG) it appears impossible to use GSI to identify hatchery release groups and the "standard" microsatellite loci may not allow separation of closely related wild and hatchery stocks, closely related races, or fish that have the same genetic heritage but different rearing strategies (e.g., yearling vs fingerling releases). What is the level of classification (e.g., population?, "reporting groups"?) that can be expected from the current GAPS baseline. Will this level be sufficient for harvest management needs? If not, could level of classification be improved by modest augmentation of the GAPS baseline?

- What types of genetic markers are best suited to advance the overall workshop objective, and what are the states of development of techniques used for each marker type?

- What are the species-specific states of GSI baseline development and how standardized are collection and analysis protocols? What are the collection dates for data used for the baselines? What further effort is required to develop baselines that can be expected to support coastwide

ocean salmon management at the level of resolution desired by managers? Do protocols provide for assessment of temporal stability of population markers, particularly for small populations?

- What are the significant differences between the use of mixture and individual fish assignment models to assign fish to their correct parent populations? How are assignment errors influenced by sample sizes, true stock proportions, # of loci examined? What are the magnitudes of errors assignment using the current 13 microsatellite standardized baseline for Chinook salmon? What methods can be employed to correct for assignment error?

- How might the potential performance, management value, and cost of the FPG concept best be explored?

- What are the advantages and disadvantages of SNPs versus microsatellites? Is it true that SNP analysis may reveal genes important for traits subject to natural selection? Do those have any value for management of ocean fisheries?

Logistics

- What standardized protocols should be developed for collection of field samples? What are the logistics and costs of making field GSI collections?

- What are the sample processing issues that would be raised by widespread application of GSI methods to ocean salmon management? What turnaround times would be feasible (collection to reporting of GSI results)? What lab facilities are available or would be needed? What kind of throughput is feasible now and what are current lab costs? How might throughput and lab costs change over the next ten years? Should agencies plan on expanding the sizes of their own labs, or would it be more cost-effective to send samples to commercial labs for processing?

- What kind of data management system would be needed to maintain a coast wide GSI database of fishery management? What procedures would need to be established for data reporting, for access to archived samples, "voucher" samples, and setting up a standardized database system (as has been developed for the CWT system)?

Management

- What are the basic management data that must be collected/estimated to support current management regimes? What more do we need than estimates of age- and fishery-specific impacts on specific stocks ?

- What are acceptable levels of error for management? What would be needed to develop standards for bilateral acceptance of GSI data?

- What additional information could be collected by GSI methods that is not currently available but could improve fishery management? For example, how could GSI-based information on sublegal stock composition in size-selective fisheries and stock composition in non-retention fisheries (e.g., Chinook retention only with coho release) be incorporated into management planning processes?

- What other potential uses might GSI-based information have? For example, parentage analysis could be used to assess reproductive performance of wild as compared to hatchery fish spawning in natural spawning streams; hatchery breeding programs might benefit from an ability to separate hatchery from wild fish, or spring from fall races; estimates of stock composition might be combined with estimates of exploitation rates derived from CWT experiments to estimate spawning escapements.

- What are the specific stocks that constrain ocean salmon management today, and what specific stocks are likely to do so in the future? What are the perceived sizes of these stocks? Are there closely-related hatchery stocks mixed with wild stocks that are constraints to ocean fisheries? On what basis will the new Canadian Conservation Units be managed?

- Are in-season GSI-based adjustments to fisheries compatible with pre-season agreements and with achieving overall management objectives? How could GSI-based in-season adjustments to fisheries be designed to generate desired fishery impacts under the Pacific Salmon Treaty?

Modeling/Sampling

- How might GSI data best be integrated with CWT data? For example, could the Methot (groundfish) stock synthesis model/mindset/approach somehow be applied to salmon management?

- Is it realistic to expect that GSI methods would be capable of generating the data required for cohort analysis (analogous to data that have been provided by the CWT system)? If so, what would be the required scale and design of a coast-wide sampling program (as for CWTs) that might be needed for implementation of GSI;

- What are the likely sample size requirements to generate estimates of acceptable reliability for populations of interest assuming (a) perfect classification (no classification errors) or (b) imperfect classification (with stock-specific "mis-assignment probabilities" to be provided by genetics workgroup)

- How could GSI data improve our current CWT-based understanding of ocean distribution patterns of individual stocks? Based on CWT data, how much do these distributions change across years? How could new GSI ocean distribution data be easily incorporated into existing management models?

PROJECTED COSTS

The Steering Committee anticipates that the direct cost of the two workshops will range between $87,000 and $102,000. Uncertainty in total cost in large part reflects uncertainty in projecting travel costs which will, in part, depend on the identity of individuals who agree to serve on workgroups. Agency (US, CA, tribal) participants will be expected to cover their travel costs, but travel costs will need to be reimbursed for non-agency (academic, retired) participants and possibly for a few agency participants unable to secure funding for attendance.

Appendix A. Tentative Agenda for Workshop 1: 15-17 May, Portland, OR

Workshop 1:

DAY 1:

Introduction to Two Workshop Structure, Approach (Pennoyer): CSC involvement in GSI workshop proposal. First day overviews of management regimes, genetic methods. Why four workgroups? Tasks on Days 2 and 3; breaks, meals (20)

Charge to Workshop Participants: What managers need to know (TBA). Issues that prompted the workshop and what we hope to achieve from it. Expert Panel Findings and Recommendations wrt GSI and ocean salmon management. Overall objective of workshops: To develop recommendations for integration of GSI information into a coordinated coast-wide management system. Clear and immediate desire for approaches whereby GSI data might be used to complement CWT data, but also expecting/hoping for thinking "outside the box", e.g. hypothetical management systems that might rely almost exclusively on GSI and landings data, without CWT data. End product: a realistic, objective appraisal of how GSI can be used, now, and in the future, to improve ocean salmon management. (30 min)

Overview of Current Fishery Management Regimes and Management Models (Morishima): ABM vs ISBM fisheries; Ocean vs terminal area fisheries management needs; CWT system; existing ocean Chinook salmon management models. Reliance on exploitation rates and connection with CWT program. Questions that cannot be answered with CWTs (e.g., stock composition of sublegal contacts/mortalities), but which might be answered with GSI techniques. Recognized GSI Issues (previously identified by EP report): accuracy of GSI for racial separation (e.g., Klamath fall vs spring); sample sizes required to estimate contributions from small natural stocks; GSI separation of hatchery & wild when derived from same source; (1 hr)

Break – 20 min

Review of ocean Chinook fisheries management. (Riddell) Expectations for potential use of GSI; review of applications thus far. Constraints: ESU/individual populations vs Canadian CUs. "Weak natural stocks". (1 hr)

Use of GSI in Near-Terminal Fisheries: Northern Boundary and Transboundary Mgt under the PS Treaty (Sandy Johnston, Dave Peacock, Scott Kelly) Need for and use of genetic methods and GSI for management of Chinook and sockeye stocks. Importance of stock composition estimates. (30 min)

Lunch – 1 hr

PM session:

Genetics - State of the Science (Moran). Survey of genetic tools and approaches. What genetic markers are available and what are their relative merits? What kinds of information and analyses are managers getting from GSI now and what can they realistically expect in the future? Review of GAPs process, including current projects and baseline development. Discussion of GSI issues identified in Expert Panel report. (1 hr)

Case Studies

WCVI Fisheries: (Beacham/Candy). Lessons Learned. (30 min)

CROOS: (Banks). Study design, estimated costs, concerns, what will be delivered, preliminary results. (30 min)

Break – 15 min

Puget Sound and Columbia River Chinook Stocks: (Warheit) - Desired level of resolution for GSI. What is the power of the GAPS baseline to identify fish from populations of interest? What would be required for adequate discrimination among stocks? (30 min)

SEAK Chinook GSI (Seeb) (30 min)

GSI applications for Fraser Sockeye: (Lapointe) (30 min)
****

Note: All listed durations for talks include 10 minutes for questions.

DAY 2:

8 AM - Noon: Workgroup Breakouts
1 PM – 3 PM: Workgroup Breakouts
3 PM – 5 PM: Joint Workgroup Sessions – Coordinators make Preliminary Presentations & Lead
             Discussion of Issues

DAY 3:

8 AM – Noon: Workgroup Breakouts
1 PM – 3 PM: Workgroup Breakouts
3 PM – 5 PM: Workgroup Coordinators Meet with Steering Committee Members

Appendix B. Proposed List of Workshop Participants and Steering Committee Workgroup Assignments

Genetics (13 maximum + Coordinator) – Brad Thompson (WDFW)*, Rick McNicol (DFO)*, Lisa Seeb (ADFG), Michael Banks (OSU), Ken Warheit (WDFW), Eric Anderson (NMFS, Santa Cruz), Kristi Miller (DFO), Shawn Narum (CRITFC), Christian Smith (USFWS, Abernathy), Steve Kalinowski (Montana State), Steve Latham (PSC); Steering Committee Members (Clark, Busack).

Logistics (14 maximum + Coordinator) – Eric Volk (ADFG), Terry Beacham (DFO), Carlos Garza (NMFS, Santa Cruz), Linda Park (NMFS, Seattle), John Candy (DFO), Richard Kang (NMFS/GAPS), Bruce White (PSC), Denise Hawkins (WDFW), Bill Ardren (USFWS), George Nandor (PSMFC), , Bill Johnson (ADFG), Chris Habitch (ADFG); Steering Committee Members (Rutter, MacGillivray).

Management (16 maximum + Coordinator) – Pat Patillo (WDFW), Ken Currens (NWIFC)**, Paul Moran (NMFS)**, Sandy Johnston (DFO), Alex Wertheimer (NMFS, Juneau), Gayle Brown (DFO), Peter Dygert (NMFS), Mike LaPointe (PSC), Arlene Tompkins (DFO), Scott Kelley (ADFG), Wilf Luedke (DFO), Kit Rawson (Tulalip), Heather Bartlett (WDFW), Gary Graves (NWIFC), Steering Committee Members (Dave Peacock, Gary Morishima).

Modeling/Sampling (16 maximum + Coordinator) – Marianna Alexandersdottir (NWIFC), Bill Templin (ADFG, genetics lab)**, Pete Lawson (NMFS), Chuck Parken (DFO), Dave Bernard (ADFG), Jerome Pella (NMFS, retired), John Carlile (ADFG), Michael Mohr (NMFS, Santa Cruz), Annette Hoffmann (WDFW), Carl Schwarz (Simon Fraser), Rishi Sharma (CRITFC), Terry Quinn (UA, Juneau), Robert Conrad (NWIFC), Steering Committee Members (Kope, Hankin, Cass).

- *   Management expertise assigned to Genetics workgroup;
- ** Genetics expertise assigned to Management and Modeling/Sampling workgroups