Utility of the CWT System for Management of Chinook and Coho Salmon

By
Gayle Brown
Pacific Biological Station
Department of Fisheries and Oceans

Overview of the Role Played by CWT Data in Fishery Management

- Pre-Season Fishery Planning
  - Domestic and Canada/U.S. bilateral processes (i.e., directed by the PST)
- In-Season Decision Making Concerning Openings and Closings of Fisheries
  - Primarily domestic process
- Post-Season Assessment of Fishery Impacts and Achievement of Management Objectives
  - Domestic and bilateral processes
- Other Important Uses
  - Results supply data for each of the above uses

Pre-Season Fishery Planning

- Huge annual effort involving many agencies and individuals in Canada and the U.S. devoted to fishery planning at the domestic and international level
- Data required include coastwide estimates of the previous season's and historical time series of catches and spawning escapements
- Analyses of CWT recoveries from fisheries and escapements provide the basic building blocks used to forecast most stock-specific abundances of chinook and coho salmon

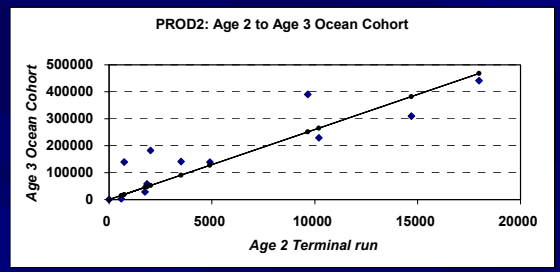
Chinook and Coho Salmon Forecasts

- Coho forecasts often apply a SR forecast from previous time series to stock-specific CWT releases also using CWT-based data on ocean distribution and fishery ERs
- Chinook forecasts often apply age-specific ERs and MRs to estimated terminal runs to generate various types of sibling regressions (e.g., terminal run to terminal run, terminal run to total production, total to total production) – forecasts at age are expanded for all unmarked releases and estimates of associated natural spawners
- Forecasts are crucial to modeling processes although they may differ in precision and bias
- Example: Robertson Creek Hatchery + Natural spawners (Stamp River, WCVI, B.C.)

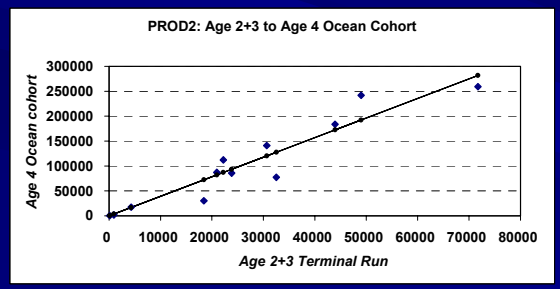
Sibling Regressions for Stamp River Fall Chinook

Terminal Run to Total Production 'Prod2' Models

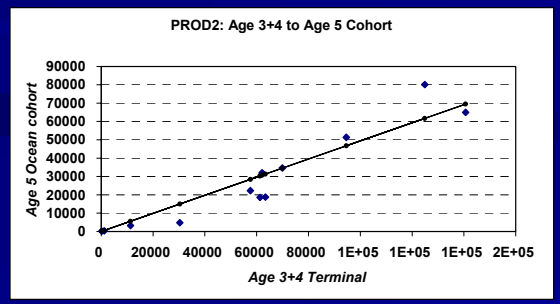
Appendix Figure 2. Prod2 Sibling regressions.



SSE = .70



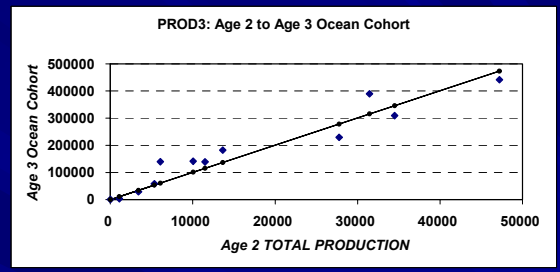
SSE = .41



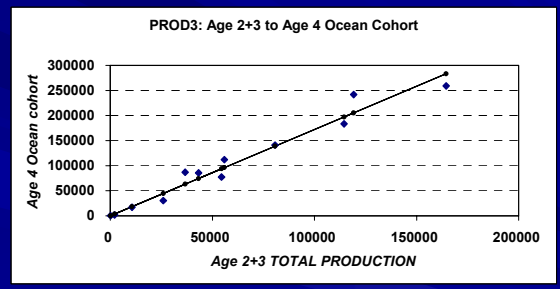
SSE = .59

Total to Total Production 'Prod3' Models

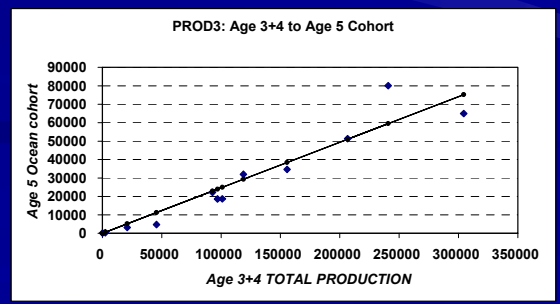
Appendix Figure 1. Prod3 Sibling regressions.



SSE = .42

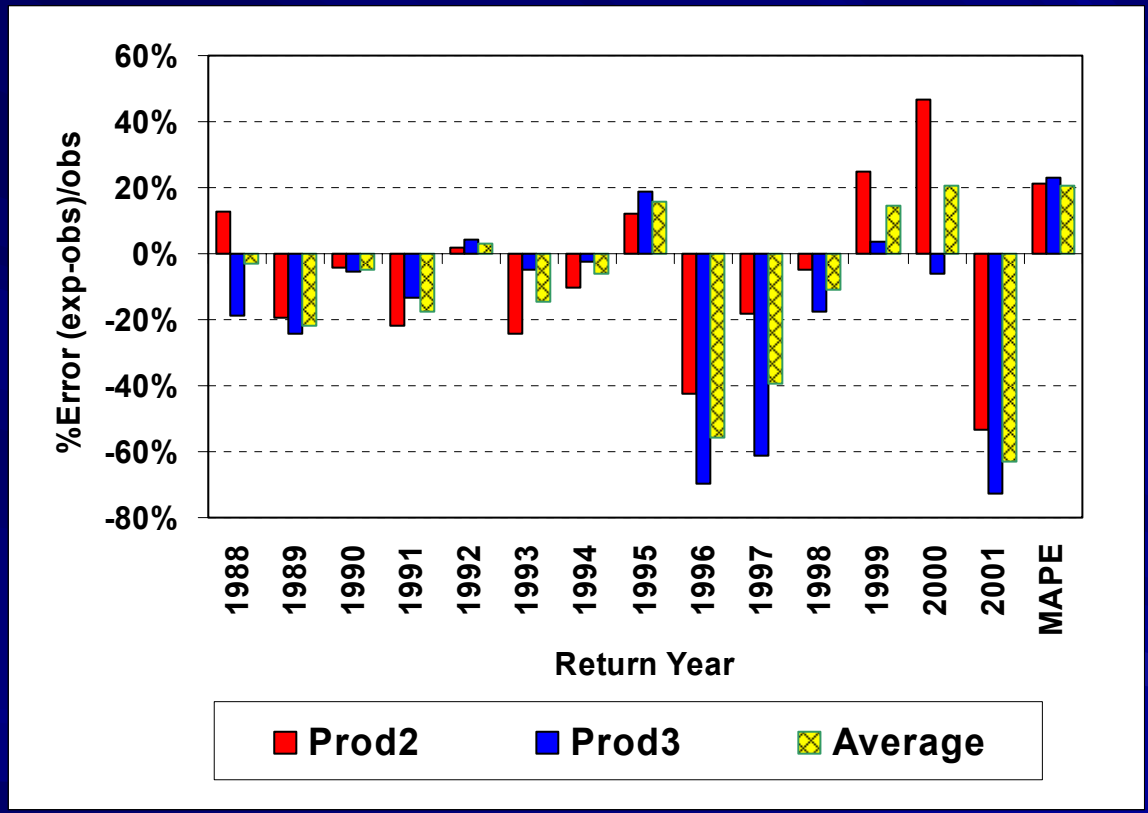


SSE = .24



SSE = .39

Annual Error in the Terminal Run Size Forecast for Stamp River Fall Chinook

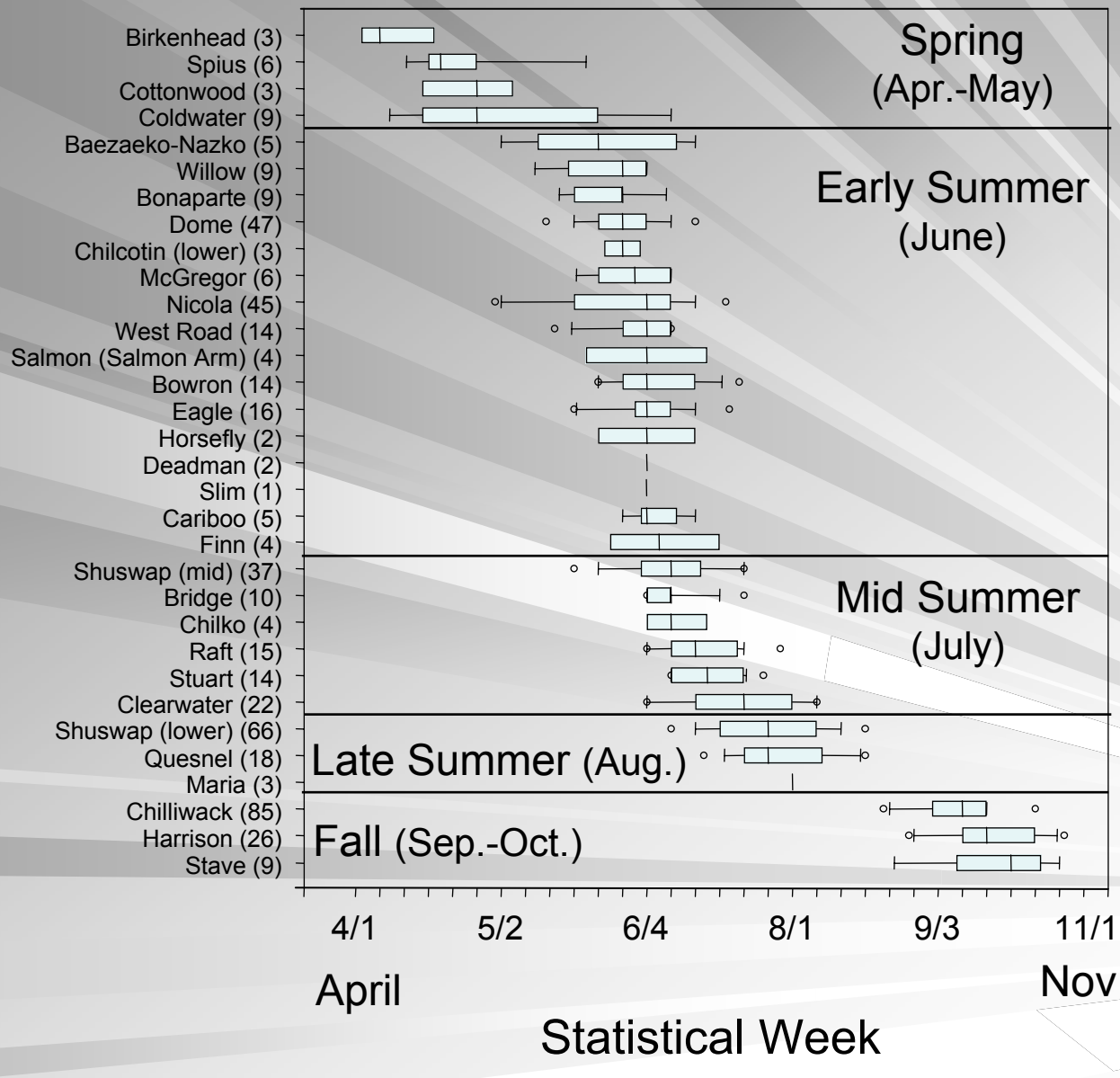


MAPE = mean absolute % error ~ 20%

Run Timing Data from CWT Recoveries Can Help Fisheries Management Schedule Fisheries

- No commercial chinook fisheries in the Fraser since 1980 due to conservation concerns for many chinook stocks
- Abundance of most chinook stocks has increased considerably since then and a comm. gillnet fishery was proposed for 2004
- CWT-based run timing data was useful for selecting the fishing period most likely to target more abundant chinook stocks, least likely to impact less abundant chinook stocks and highly depressed Cultus Lake and other late run sockeye while meeting First Nations FSC needs
- Likely a short fishing period in late July
- Until the recent emergence of still developing DNA technologies, such ‘micro-management’ wouldn’t have been possible without CWT data

CWT-based Migration Times of Fraser River Chinook Stocks at Albion (12 years)



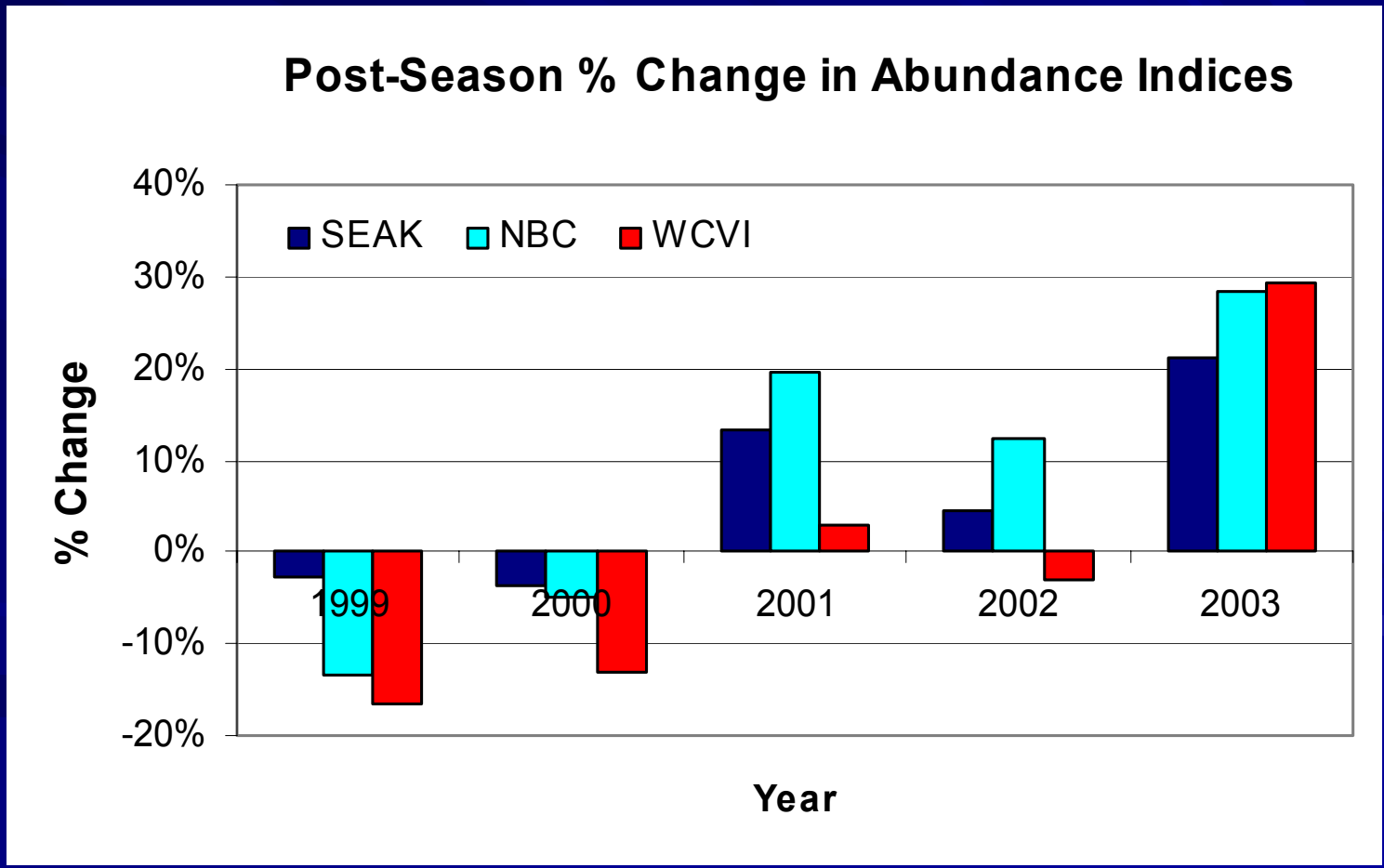
In-Season Decisioneering

- Fisheries sometimes occur in a north-south spatial and temporal pattern
- Analyses of incoming CWT recoveries in fisheries can be compared with pre-season forecasts and used to adjust decisions about when, where and how long to open specific fisheries
- Turn-around for CWT data must be on a weekly, or sometimes shorter time scale
- Examples include:
  - Existing management of the spring commercial chinook troll fishery in southeast Alaska (SEAK) – previous week's CWTs needed
  - Future management plan for coho salmon of north coast B.C. – previous -6 week's CWTs from SEAK troll needed
  - Early to mid-90's management of fisheries for spring chinook salmon in the lower Columbia River – previous day's CWTs needed

Post-Season Assessment

- Carried out at the domestic and international levels
- Follows completion of fishing year and completion of spawning runs (some escapement programs end in December)
- Based on updated data since the pre-season fishery plans were finalized
- Preferably based on data from the most recent fishing year but CWT and other data not always available for up to a year later
- PST directs that a post-season assessment of both the AABM and ISBM fishery indices applied to coastwide chinook fisheries will be carried out
- Bilateral coho post-season assessment framework in development

Post-Season Assessment of the AIs Forecast by the Coastwide Chinook Model



A Problem

- Complete CWT recovery data are not available in the major database, RMIS, for up to 1 or more years following completion of a fishing year
- Chinook post-season assessment via the ISBM indices are 2 years out of date

Other Important Uses

- Estimation of production and productivity parameters in natural spawning populations
- Development of biologically-based escapement goals that use information on population productivity

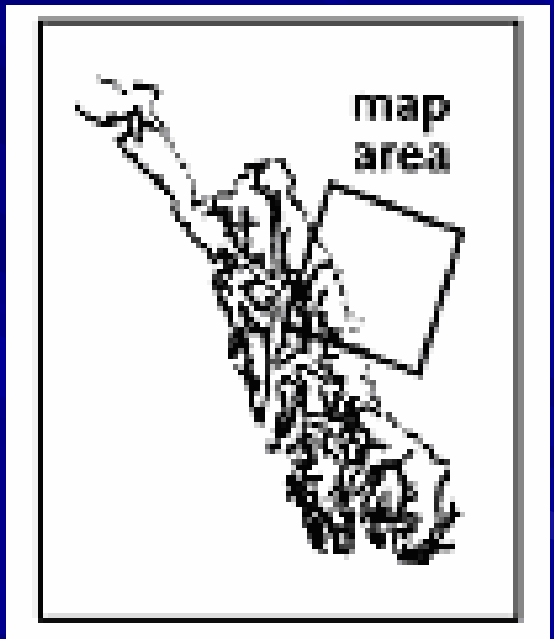
Development of Biologically-based Escapement Goals for Chinook Salmon

- Required under the 1999 PST Agreement
- PST provides incentive for development of escapement goals
- Absence of an escapement goal means that a Party is bound to the 'general agreement' of a 65% and 60% reduction in U.S. and CA ISBM fisheries, respectively
- PST directs certain reductions in ERs if 2 or more stocks within a stock group are not meeting escapement goals
- Biological escapement goals for natural stocks can be very difficult to derive!
- Coded wire tagging can provide means for estimating production of natural populations and developing escapement goals
- Two examples: Taku River spring chinook and Harrison River fall chinook

Estimation of Production of Natural Taku River Chinook

- Large, pristine river system
- Juveniles live 1 year in freshwater (relatively large)
- Juveniles caught & CW tagged during migration
- Escapements estimated by visual surveys & MR experiments
- CWT data provides marine distribution, ERs, SRs and assists in smolt abundance estimates

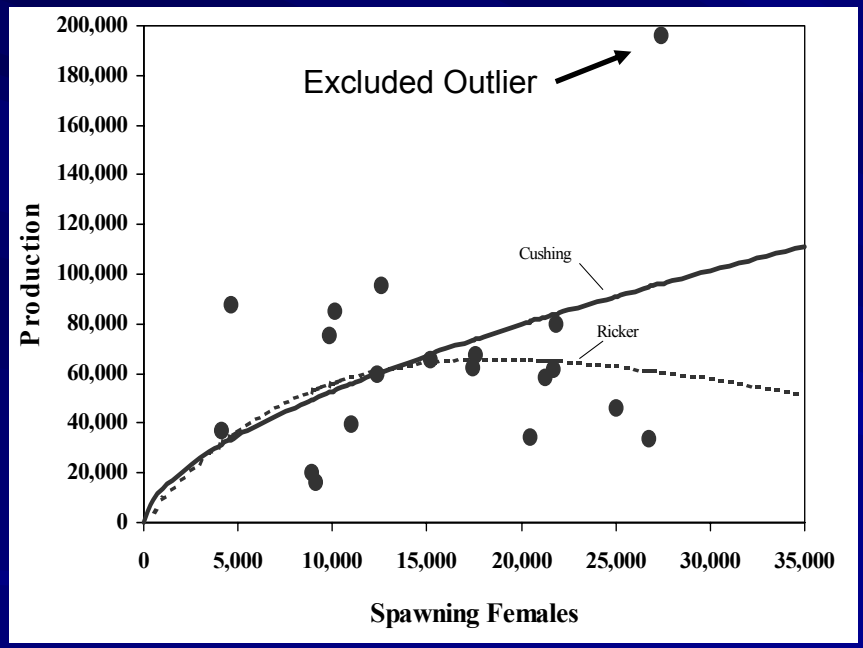
Southeast Alaska and Canada



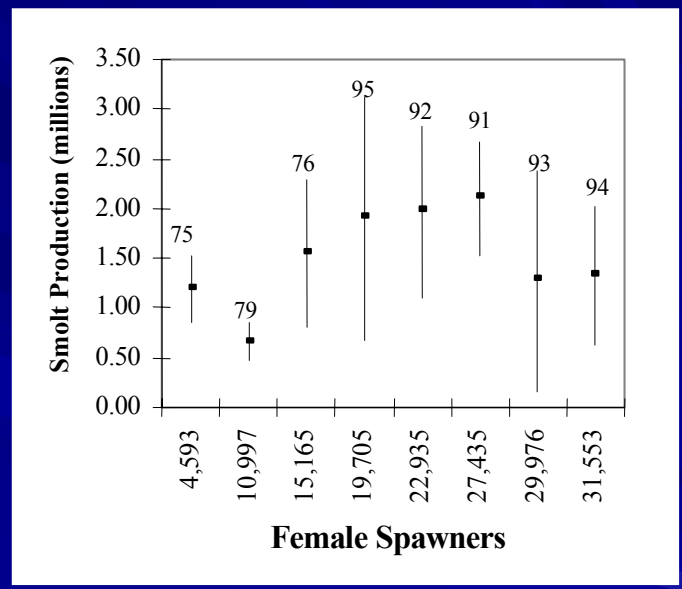
Joint U.S. and Canada program

Estimation of Production of Natural Taku River Chinook

Recruits/Female



Smolts/Female

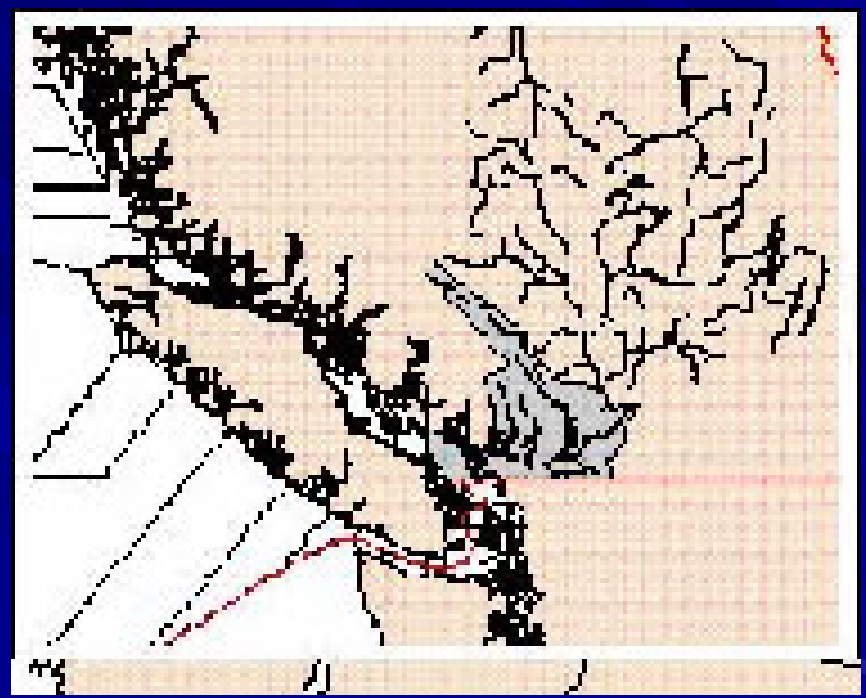


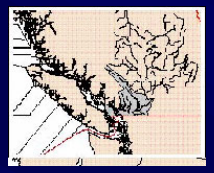
Result is Escapement Goal Range: 30,000 -55,000 age 3+ chinook

Estimation of Production of Natural Harrison River Fall Chinook

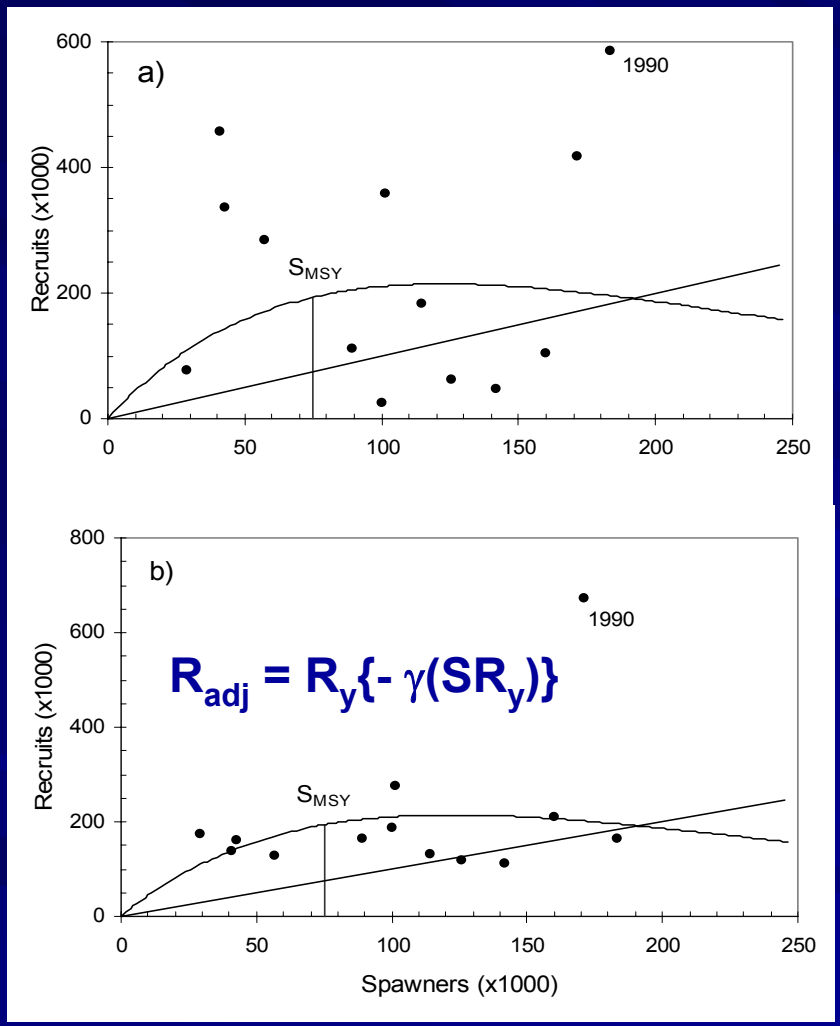
- One of largest chinook spawning populations
- All ages found year-round throughout southern B.C.
- Major contributor to all fisheries in southern half of B.C. and in WA
- Immediate migrant fry (small)
- Chilliwack Hatchery stock used as CWT indicator (founded from HR spawners)
- ERs, MRs and AEQs from cohort analysis of CHI recoveries used to estimate total production from HR terminal run

Southwestern B.C.





Estimation of Production of Natural Harrison River Fall Chinook



- CWT indicator enabled development of stock and recruitment function
- Development of an escapement goal
- S_{MSY} = 75,100
- Escapement goal range: 75,100 – 98,500
- Only chinook stock in B.C. which has a biologically, scientifically based, bilaterally accepted goal
- Not possible without data from CWT indicator
- Methodology also enables age-specific forecast

In Conclusion

- Acts like a circulatory system – supplies needed data to all levels and scales of fishery planning
- Requires long-term support for CWT indicator stock programs
- Requires annual statistically reliable sampling programs in all fisheries and all components of spawning escapements