ABSTRACTS

Northwest/Central Valley Adult Salmon Escapement Monitoring Workshop

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EDD Auditorium
722 Capitol Mall
Sacramento, California

Sponsored by:
California Bay-Delta Authority, CALFED Bay-Delta Science Program

Session 1: Use of Escapement Data in Ocean Harvest Management and Recovery Planning

[1] Use of Inland Escapement Data in Management of Pacific Coast Ocean Salmon Fisheries

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Ocean fisheries for Pacific salmon are regulated through a complex hierarchy of management organizations with different legal authorities and mandates. These range from international commissions focusing on issues of interception in international waters of the high seas to state and tribal resource agencies with direct management authority for enforcement and monitoring of fisheries at the port level, and monitoring spawning escapement. Effective management of ocean salmon fisheries is very data intensive and ultimately relies on accurate and timely estimates of spawning escapement. Escapement data feed into the management process in a number of ways. Spawning escapement estimates are used to generate preseason forecasts of stock abundance, which form the basis of the preseason planning process. Escapement estimates are the foundation for reconstruction of the history of past abundance, which is used to assess fishery impacts and to calibrate individual stock forecasts. Where spawning runs can be monitored in real time, this information is often used for in-season management of terminal fisheries. Finally, because management objectives for most salmon stocks are stated in terms of escapement goals, the corresponding escapement estimates are used to evaluate the performance of fishery management.

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[2] The Management of Ocean Salmon Fisheries to Meet the Pacific Fishery Management Council's (PFMC) escapement goal for the Sacramento River Fall Chinook

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California ocean fisheries are managed each year to meet the PFMC's fishery management plan (FMP) objective of 122 to 180 thousand adult spawners of both hatchery and natural fall Chinook into the Sacramento River and its tributaries. This FMP goal is evaluated through the use of the Central Valley Index (CVI). The CVI is the ocean harvest south of Point Arena plus the adult spawners into the Central Valley. A regression relationship is calculated using the grill return in one year regressed on the CVI of the subsequent year. The regression relationship is used to make a preseason projection of the CVI using the current years grill returns to the Central Valley. The Central Valley ocean harvest rate index is the proportion of the CVI that was made up by ocean harvest. The harvest rate index is predicted using the preseason predicted landing south of Point Arena and the predicted CVI. The preseason estimated escapement to the Sacramento River is then based on the predicted harvest rate index, a five year average proportion of Central Valley escapement to the Sacramento River, and the preseason projection of the CVI. These methods are used because there are no age specific spawning escapement estimates, known fractional marking from hatcheries, or a comprehensive monitoring and CWT recovery program in the Central Valley.

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[3] Use of Escapement Data in Recovery Planning for Listed Stocks

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NOAA Fisheries is undertaking coastwide recovery planning for listed stocks of Pacific salmon and steelhead. High quality escapement data will be crucial to the success of the salmon recovery process. In this presentation, I'll describe the recovery planning process, highlighting the role of escapement data and other types of monitoring, with emphasis on the Central Valley recovery domain.

Session 2: Chinook Salmon Escapement Monitoring in California's Central Valley

[1] Escapement Monitoring in the Upper Sacramento River Basin: Fall, Winter, and Spring-run Chinook

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The Department of Fish and Game's Upper Sacramento River Salmon and Steelhead Resource Assessment Project is responsible for salmon and steelhead escapement estimates in the Sacramento River basin in Shasta and Tehama counties. The project's initial purpose was to provide data for ocean harvest management needs. But as the needs of fisheries managers' increase, data is increasingly being used for recovery planning, evaluating the contribution of hatchery stocks, and monitoring restoration programs.

All four runs of Chinook salmon: winter-, spring-, fall-, and late-fall runs occur in the upper Sacramento basin. Inventories for spring-run began in the 1940's with the construction of Shasta Dam. Surveys for fall-run salmon have been routinely conducted since 1953 on most major streams. Counts for the remaining runs began in 1967 after the completion of trapping and counting facilities at RBDD. Due to inconsistent methodologies and varying intensities of sampling efforts used over the past 50 years, historical population sizes and population trend data has been difficult to reconstruct. Currently, a combination of inter-dependent methods are used to determine annual run size for each run including ladder counts, carcass surveys, diving surveys and foot and aerial redd surveys. The sampling method employed for each run in each basin, is determined by the unique conditions and sampling limitations within that basin. The long-term goal is to maintain consistency in sampling each river while obtaining biologically meaningful salmon and steelhead escapement data. Concurrent with escapement data, biological information on age composition, pre-spawning mortality, length, hook scarring, six ratios and genetic tissue sampling and otolith recovery is also collected.

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[2] Escapement Monitoring in the Lower Sacramento River Basin and Delta Tributaries

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This presentation will provide an overview of the spawner escapement monitoring activities for Chinook salmon stocks in the Department of Fish and Game's Sacramento Valley Central Sierra Region. The watersheds in the Region include the tributaries of the Lower Sacramento River Basin and Sacramento – San Joaquin Delta. I will include a brief description of the methods used for the Chinook stocks present, by watershed, as well as a characterization of each of the watersheds surveyed. Also, there will be a short discussion of the Central Valley Salmon and Steelhead Harvest Monitoring Project.

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[3] Escapement Monitoring of Fall-run Chinook in the San Joaquin River Basin

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Documenting the abundance of San Joaquin Valley Chinook salmon has occurred on an annual basis since the early 1950's although information exists, particularly in commercial fishing records, even further back in time. With the exception of short effort at weir counts, the first counting processes were carcasses surveys that attempted to count all the fish in each of the three main tributaries once every two weeks. Little information was retained beyond the numbers of fish, except for the general location, the sex and the length of the fish in some cases. This technique was modified in the 1970's to accommodate a recently developed population estimation technique involving mark-recapture of the carcasses. Flagging was applied to each carcass that was in fresh condition and the carcass was returned to flowing water so that it would redistribute (hopefully randomly) into the pool of carcasses. Different flagging was applied each week so that marked carcasses that were recovered could be identified to week of release.

These techniques were further modified in the late 1980's by replacing the flagging with a numbered tag so that each marked fish can be individually tracked allowing a variety of population estimation methods. The carcasses surveys were also further enhanced by the collection of scales and otoliths, which are only now being analyzed. In the mid 1990's tissues sample collections were begun to allow for an evaluation of the genetic makeup of the San Joaquin River Chinook salmon. These analyses are being performed at present.

Analysis of the salmon population estimates has occurred repeatedly for the past two decades. Stock-recruit curves have been developed which imply an internal mechanism controls the abundance such that stocks of greater than 20,000 to 30,000 adults actually produce fewer young than when the stocks are in that range. Concurrently, regressive relationships have been developed between the population estimates and external factors such as streamflow during the spring outmigration. These relationships indicate that somehow streamflow is affecting the abundance of the juveniles and therefore spawning escapement abundance several years later.

Session 3: Salmon Escapement Monitoring in the Pacific Northwest: Survey Methodologies and Data Use

[1] Run Reconstruction and Forecasting Methods for Spring and Fall Chinook Returning to the Columbia River and its Washington Tributaries

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Run reconstruction and forecasting of spring and fall Chinook salmon in the Columbia River basin is a collaborative effort involving state, federal, and tribal biologists. Biodata, scale samples, and coded-wire tags (CWT) are collected from sport or commercial fisheries and fish returning to escapement areas (hatcheries or streams). Scale samples are used to age the fish while CWTs are used to develop age correction factors and stock composition estimates. Visual Stock Identification (VSI) utilizes differences in external characteristics between stocks of fish and is used for in-season stock composition estimation where separation of stocks such as upper and lower river spring Chinook or bright and tule fall Chinook is needed. A database for each stock of fish is constructed and maintained by age. Each database includes data tables for each harvest or escapement area involved. When feasible, stray fish are removed from each database prior to the run forecasting process. Forecasts are made for each stock by age. Several methods can be used with linear regression being the primary method. Cohort ratios and averages may be utilized if no linear relationship can be found. Once completed, the forecasts are put through a validation process with either the US vs. Oregon Technical Advisory Committee (TAC) or the Joint Staff (representatives from ODFW Columbia River Management and WDFW Region 5 Fish Management) prior to each forecast's release to management entities such as NMFS or PFMC and the public.

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[2] Development and Implementation of a Program to Monitor Spawner Escapement of Anadromous Salmonids in Oregon Tributaries of the Lower Columbia River

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A regional-scale monitoring program for populations of coho salmon (*Onchorynchus kisutch*) and winter steelhead (*Onchorynchus mykiss*) spawners is currently being implemented in Oregon

tributaries of the Lower Columbia River. The design of this monitoring program is based on a similar program that has been implemented on Oregon coastal streams over the past 13 years. These monitoring programs use a random probability design to select stream reaches as sites to conduct spawning surveys. Survey sites are repeatedly visited over the course of the spawning season to obtain estimates of spawner density. Results obtained through this monitoring effort have proved to be extremely useful in providing statistically rigorous estimates of abundance status and trends, spatial and temporal distribution and the occurrence of hatchery fish in natural spawning areas. In the Lower Columbia River we have completed our first year of coho spawner monitoring and are presently in the process of preparing for monitoring coho and winter steelhead that will return this fall and winter.

In this talk I will discuss the overall design of the monitoring programs and provide examples of the products that have been obtained form our sampling on the Oregon Coast. I will also discuss our initial findings from the Lower Columbia River. Finally, I will discuss implications of this monitoring to recovery programs.

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[3] Monitoring Abundance, Productivity, and Life History of Spring Chinook Salmon in the Imnaha River Basin, Oregon

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The Imnaha River originates in the Wallowa Mountains in the Northeast corner of Oregon. The Imnaha River enters the Snake River 830 kilometers from the ocean and eight dams and reservoirs exist between the mouth and the ocean. The Imnaha River once supported a large and robust population of spring Chinook salmon, however the population declined precipitously from the mid-1970's through the late 1990's. As a component of the Snake River Spring/Summer ESU, Imnaha Chinook were listed as threatened in 1992 under the Federal ESA. Population declines are principally attributed to reduced productivity resulting from juvenile and adult mortalities that occur during migration through the Snake and Columbia River dams and reservoirs. A hatchery program was initiated in 1982 to compensate for the losses resulting from the Snake River hydrosystem operations. The goals of the hatchery program are to supplement natural production and restore traditional tribal and recreational fisheries. Monitoring and evaluation studies are conducted to assess the success of achieving management objectives and to monitor the health of the natural population. We focus our natural population health monitoring on four major attributes including: abundance; productivity; diversity; and, spatial distribution. In addition, we monitor the hatchery population to provide comparisons of productivity, life history, and spawning distribution with the natural population. Methods used to determine escapement at the mouth of the Imnaha River are complex and require estimates of in-river harvest, spawning escapement above a weir, spawning below the weir, broodstock collected for the hatchery program, and fish released above the weir to spawn naturally. A combination of actual counts at the weir, redd counts, carcass recoveries, and mark-recapture estimates are used to collect data for monitoring population health. In addition, estimates of age structure, mainstem harvest, and adult mortality during migration through the mainstem are needed to determine broodyear specific progeny-to-parent ratios. Escapement has been highly variable from year to year with recent peaks in 2001 and 2002. Progeny-to-parent ratios of naturally spawning fish have been below 1.0 in most brood years since 1983. We have observed differences in age-at-return and spawning distribution between natural and hatchery fish. We have found that redd counts are highly correlated with escapement estimates and that carcass recoveries do not accurately reflect age structure because age 3 males are recovered at a rate well below their actual proportion.

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[4] Calibrating Fall Chinook Spawning Ground Surveys to Mark-Recapture Estimates of Abundance in Coastal Oregon Streams

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The Pacific Salmon Commission adopted an abundance-based management scheme for Chinook salmon in 1999. Successful implementation will require Oregon to report escapement and catch estimates with increased precision and accuracy. Historic Chinook spawning ground surveys are inadequate for this purpose. Through funding from the U.S. Section of the Pacific Salmon Commission's Chinook Technical Committee, the Oregon Department of Fish and Wildlife is estimating the abundance of fall Chinook salmon using mark-recapture methods in four coastal river basins. Developing a reliable means to track abundance of Oregon's fall Chinook is important to meet Treaty commitments and to ensure the sustainability of these populations. Mark-recapture estimates of abundance can be statistically precise, yet they are considered cost prohibitive for sustained monitoring. ODFW is working to identify survey indices that will reliably reflect the abundance of fall Chinook within coastal Oregon watersheds as a basis for cost-effective long-term monitoring.

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[5] Evolution of the Puyallup River Fall Chinook Escapement Estimate and Use of Personal Digital Assistants (PDA) as Data Loggers for Salmonid Stock Assessment

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Evolution of the Puyallup River Fall Chinook Escapement Estimate
The Puyallup River system is tributary to central Puget Sound, Washington. This system is predominantly glacier-fed, which poses significant challenges in assessing annual fall Chinook escapement levels. Historically, harvest management objectives associated with Puyallup River natural fall Chinook have not required precise escapement estimation. "Threatened" listing of this stock under the Federal Endangered Species Act and the demands of the resulting Comprehensive Chinook harvest management plan led to an examination of the history of fall Chinook escapement estimation in the Puyallup River basin and an analysis of the then-current methodology. That method was determined to be deficient. Atypically good survey conditions in 1999 provided an opportunity to development a superior method for that year. The new method estimated an escapement of 1,988, compared to 4,000 Chinook estimated by the replaced method. Typical conditions in recent years have required continued modifications of this method. Additional modifications are anticipated as survey data in atypical years accumulate and totally new estimation bases will be considered as technologies and/or additional resources become available.

Personal Digital Assistants (PDA) as Data Loggers for Salmonid Stock Assessment
Salmonid stock assessment survey data have become more complex in recent years. Improved data management techniques are necessary to efficiently record and summarize field data. Historical methods have proven to be deficient for WDFW's evolving needs. Data processing and error checking historically took several weeks to complete and had a high potential for transcription errors as well as potential loss of survey records. In the spring of 2002, an electronic field data recording system utilizing Personal Digital Assistants (PDAs) was implemented. A specialized electronic sampling form was developed using commercially available software and was deployed using inexpensive PDAs. Field crews were provided with verbal and written instruction regarding data entry into the electronic form system. Crews entered stock assessment survey data daily and PDAs were synchronized (downloaded to a PC) regularly. Although some field staff were apprehensive, they adapted quickly to the system. Improvements were realized in data quality (reduced transcription errors), adaptability, standardization, and real-time data availability.