

FISH LIFE HISTORY ANALYSIS PROJECT



PROJECT DESCRIPTION

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PURPOSE

The purpose of this manual is to provide a background and context for other projects that work with the Fish Life History Analysis Project (FLHAP). Further information on scale analysis can be found in Clemens et al. 2013a and 2013b.

The project maintains high standards of quality in estimation of life history parameters, including accuracy, precision and efficiency from sample and data handling through age estimations and other life history analyses and data dissemination.

PROJECT BACKGROUND

History

Fish scales were collected and analyzed in various capacities in various locations and parts of ODFW from ca. 1950s/1960s – 1988. In about 1989, the Fish Life History Analysis Project began as the “Scale Analysis Project”, reading coho and Chinook salmon scales. In 1990 the project discerned between hatchery and wild spring Chinook via discriminant function analysis as part of the Lower Snake River Compensation Plan, which led to work with NOAA Fisheries on barged spring Chinook. The project stopped reading coho scales from spawning ground surveys in 2002 when fin clipping was well established in hatcheries. The current focus is primarily from 2 sources, coastal Chinook surveys and Willamette Chinook research. The remainder of the work comes from needs of various projects and district biologists. In 2012, the Scale Analysis Project was re-named the “Fish Life History Analysis Project”, which is a more appropriate name, given our expanding scope into other areas of fish life histories beyond scale analysis alone (e.g., otoliths).

Scope

The FLHAP is part of the Western Oregon Research and Monitoring Program within the Northwest Region. The FLHAP provides technical support within this program and to other programs, research projects and management districts within the Oregon Department of Fish and Wildlife. We work primarily on scales from salmonids, although occasionally we work on scales from warm water fishes.

The FLHAP analyzes fish scales to provide estimations of age composition, hatchery or wild origin, growth information and other life history data as needed. Samples come from spawning ground and creel surveys; mark-recapture, broodstock, juvenile fish outmigration, and adult trapping for return migrants. These data provide the foundation of estimates used to generate run size forecasts, status assessment, identification of hatchery strays, and growth analyses. Whenever possible, the project seeks to obtain reference samples from fish implanted with CWTs to inform and validate age estimations.

If measurements are required for purposes of back-calculating lengths or discriminant function analysis, we use an image analysis system to measure meristics and morphology. Depending on the needs of the project that collected the scales, the FLHAP will return basic scale analysis results, statistical analyses or a short report.

When the requested work is completed on a scale collection, it is placed in the scale archive which is administered by the FLHAP. The scale archive is the historical repository of scale collections from around the state of Oregon.

The FLHAP processes between 10,000 and 20,000 scales per year. Samples from 2011 are from the largest number of fish to date, at an estimated 22,000 fish. The project has typically been staffed by 2 full time employees: one project leader and one EBA. In the past, the project has swelled to a third, part time employee, hired on an as-needed basis.

Associated Projects

The Fish Life History Analysis Project supports several different projects within the Oregon Department of Fish and Wildlife. Below is a listing of these projects with a brief description of the recent kinds of life history analyses needed.

Northwest Region ODFW

Coastal Chinook Research and Monitoring Project (CCRMP)—Shelly Miller. Age estimations and occasional discernment of origin (“hatchery” vs. “wild”) from ~20 different basins of coastal Chinook. For the coastal Chinook scale samples collected from coastal Chinook spawning ground surveys, mark and recapture, hatchery broodstock, and creel. The 2011 sample year garnered scale samples from ~13,800 adult Chinook. Annual samples have typically been much less than this in previous years. The Fish Life History Analysis Project analyzed scales from all of these samples from 2011, and had to use assistance from other ODFW project staff to mount these scales in order to meet timelines.

Oregon Adult Salmonid Inventory and Sampling (OASIS)—Mark Lewis, Briana Sounhein, Eric Brown, and Matt Weeber. OASIS obtained a few hundred samples of Chinook scales on their spawning ground surveys during 2011, and these samples were used for age estimations to supplement samples obtained by CCRMP staff. The data was used for CCRMP purposes as well as for OSCRP run forecasting.

The Fish Life History Project aided OASIS in data integrity through the identification/verification of species via scale morphology (e.g., coho vs. Chinook). In this way, dozens of samples were identified to species. We also estimated the age and origin of two dozen adult coho sampled during spawning ground surveys in the Sandy River and Columbia River gorge and a few hundred chum salmon from coastal rivers.

Ocean Salmon and Columbia River Program (OSCRP)—Ethan Clemons; Tim Dalton. See above; this data was used for run forecasts by OSCRP staff.

Willamette Spring Chinook—Kirk Schroeder.

Willamette Hatchery Research and Monitoring—Cam Sharpe.

During 2011, we estimated ages from 2,372 Chinook from spawning ground surveys, plus another 294 Chinook for the McKenzie pedigree study. These data were for the 2 projects listed immediately above. In addition, we are working on these data to improve the methods for delineating life history diversity, and for describing this diversity.

Willamette Reservoirs Project—Fred Monzyk. During 2012, the Fish Life History Analysis Project is coordinating with Fred to obtain known reservoir-rearing fish to aid in identification of life history types of Chinook in the Willamette. The scale patterns will be correlated with the body size and possibly other characteristics of the reservoir-rearing Chinook. We will also be estimating age for these fish, as Fred is interested in the age composition of those fish that have a body size intermediate to sub-yearling and yearling Chinook.

Life Cycle Monitoring Project (LCMP)—Erik Suring. This project was initially trained for estimating age by the Fish Life History Analysis Project. The LCMP is now self-sufficient, estimating steelhead ages via outmigrating smolts and adults. We do estimate the ages of chum salmon for this project. The Columbia Chum Reintroduction Project may become self-sufficient in aging its own fish in the near future.

ODFW

Various districts and research projects

Rainbow/steelhead, Chinook age estimates and origin for juveniles and adults, from various basins. These samples amount to scale samples from between 3,000 and 5,000 fish.

Conservation and Recovery

Aquatic Inventories (AQI)—Kim Jones. The FLHAP is assessing life history characteristics of several dozen juvenile coho.

Native Fish Investigations (NFI)—Shaun Clements, redband trout scales.

Non-ODFW

Project CROOS (Collaborative Research on Oregon Ocean Salmon)—Nancy Fitzpatrick (Oregon Salmon Commission); Jonathan Minch (OSU) et al. The Fish Life History Analysis Project estimates the age from scales of ~2,000 fish, per year, for Project CROOS (range ~1,000-3,000 fish). Project CROOS is a multiagency collaboration whose focus is to obtain vast amounts of information relative to the fish and the fisheries on ocean Chinook off the coast of Oregon, to enable adaptive management (avoid overexploited stocks). The age estimates that we generate are then tied into other data in this project, including basin of origin, identified through DNA.

Annual Flow of Data Needs

The demands on the Fish Life History Analysis Project (FLHAP), in terms of numbers of different projects needing services and the samples sizes needing to be analyzed, have evolved over time (see above). We expect that demands for the FLHAP will continue to change and evolve, as will priorities. This section will describe the most recent demands with the idea that these demands may be anticipated next year. It is clear that Winter is the busiest time for sample deadlines!

Fall: CCRMP, OSCRP ramps up.

Winter: CCRMP, OSCRP deadlines, some other ODFW (various) deadlines. OASIS supplementation and species ID verification.

Spring: Willamette Chinook, various projects deadlines, some other ODFW (various) deadlines. Hood River RM & E, OASIS, and AQI deadlines.

Summer: Willamette Chinook, various projects deadlines.

Other “down” times of the year may be taken advantage of by preparing, organizing, and improving the project in other ways besides just life history analyses, as described below.

Expanding Scope

The FLHAP is in the process of conducting the following tasks:

- Update and improve electronic data organization
 - Creation and use of standardized Access databases
 - Improve electronic file organization and accessibility
- Update and improve organization and access to “reference” scale samples for various projects.
- Update and improve sample storage in the scale archive
 - Physical scale samples
 - Electronic data
- Improve and disseminate protocols/procedures
- Encourage more collaboration with age validation via CWT and PIT tags, *whenever possible*
- Conduct power analyses to estimate the minimum number of scale samples needed for statistically-meaningful data
- Prepare otoliths for microstructure analyses, including identification of thermal marks on hatchery-reared fish
- Improve visualization and analytical capabilities of scale and otolith morphologies and meristics.

Other ODFW projects/personnel conducting life history analyses

Conservation and Recovery—Matt Falcy et al. Assess the abundance, productivity, spatial structure, and diversity of various fishes to help set harvest and hatchery guidelines in conservation plans. This group relies on life history information for estimating survival and escapement, age composition and origin of salmonids, and stock structure.

Native Fish Investigations (NFI)—Shaun Clements. The NFI are currently working with others from OSU on aging various non-salmonids via bony structures other than scales.

Ocean Salmon and Columbia River Program (OSCRP)—Kevleen Melcher et al. Do their own scale analyses on CWT Chinook and non-CWT Chinook.

Ocean Salmon and Columbia River Program (OSCRP)—Tucker Jones et al. Conduct their own life history analyses on white sturgeon, and various piscivores (northern pikeminnow, smallmouth bass, and walleye). These analyses include sectioning of fin rays or management based on fish length and growth rates (sturgeon); age estimates for piscivores via scales (all) and/or opercles (pikeminnow); and age validation via CWTs and PIT tags and use of oxytetracycline injections.

Northeast Region Fish Research—Rich Carmichael's group. Deb Eddie and others do some ageing on spring Chinook and summer steelhead.

Marine Resources Program—Bob Hannah and Lisa Kautzi—process and estimate ages for otoliths from groundfish (long-lived species). They conduct mostly break-and-burn processing to read, but occasionally use thin-sectioning to process and estimate ages.

REFERENCES

- Clemens, B., K. Bowden, and L. Borgerson. 2013a. Fish life history analysis project: Standard operating procedures for collection and preparation of fish scales and data management. Oregon Department of Fish and Wildlife.
- Clemens, B., K. Bowden, and L. Borgerson. 2013b. Fish life history analysis project: Methods for scale analysis. Oregon Department of Fish and Wildlife.