

Scale Terminology

List of common terminology from a meeting of Chinook salmon scale age specialists from the Pacific Northwest held in Juneau, AK 2-3 April 2014. This was designed to be a living document and be discussed and revised at future meetings. A list of common Chinook salmon life history terms follow.

Acetate	Acetate or vivak plastic® card with salmon scale impressions used to read fish age using a microfiche reader. Scale impressions are made on the acetate by applying heat and pressure to scales stored on a gummed card.
Age	Used to express passage of time, measured in years, months, days, or other units.
Age accuracy	Proximity of an age to the actual value.
Age estimation	Prediction of fish age using biological data such as length or weight as explanatory variables. Age estimation is not a direct measurement of fish age.
Age reading	Technique for establishing fish age by interpreting growth patterns on fish structures such as scales or otoliths.
Anterior field	Part of the scale that shows circuli and annuli. In live fish, this part is covered by other scales.
Annulus	(<i>Annuli</i> , plural) Growth zone representing one year of life. An annulus is commonly identified at the end of “winter” growth.
Axis	Plane of view or measurement from the posterior field of the scale to the scales anterior edge.
Base	Nexus of the posterior and anterior fields of the salmon scale.
Bias	The difference between an estimator's expectation and the true value of the parameter being estimated.
Birth date	Used to determine total age; important to consider when looking at final annulus. January 1 st is commonly accepted birthday for Chinook salmon in the northern hemisphere.
Check	Relatively closely-spaced circuli within a growth zone, circuli may not contain breakage or braiding, formed during a period of reduced growth, circuli may not continue all the way around the scale, and may be mistaken for an annulus. Commonly appear in marine environment during the first or second year of marine growth.
Circulus	(<i>Circuli</i> , plural) Growth increment radiating out from the focus of the scales that form over the course of weeks. Individual ring or ridge on a scale.

European age notation

Method of age notation for salmonid scales: the number of winters spent in freshwater before going to sea, 1 winter = age-1.X, followed by the number of winters spent at sea, three winters = age-X.3 or four winters = age-X.4. This notation is commonly used in North America.

Focus Point of origin of the scale. Used as a reference point for measurement or count of circuli. Area contained within first circulus.

Freshwater circuli Circuli that are more closely-spaced and thinner than circuli formed after ocean entry. Generally, the ends of the circuli (“tails”) point towards the focus

Freshwater plus Area on the scale between the last freshwater annulus and entry into the marine environment.

Freshwater zone Surround the focus, contains freshwater circuli that are relatively closely spaced and small. Counting winter zones provides fish’s age in fresh water.

Gilbert-Rich age notation

Method of age notation (Gilbert and Rich 1927) for salmonid scales: N_n , wherein N = the year of life of the fish; n subscript = age at smoltification including the year in gravel.

Gummed card Card with a gummed and numbered side where salmon scales are collected and stored and a labelled side where sample information is written. Gummed cards are pressed against acetates to create an impression of salmon scales.

Hatchery fish Hatchery origin fish, as identified by even and significant growth during the freshwater rearing phase. Contrast with wild fish, which have uneven and usually less growth during the freshwater rearing phase, but then undergo rapid growth upon entering the ocean.

Inverted scale Scale placed on gummed card with ridges down; impression on plastic card is unreadable.

Lateral line scales Scales collected from the lateral line. Pores apparent on scale.

Marine circuli Circuli that are less closely-spaced and thicker than circuli formed before ocean entry. Generally, the ends of the circuli (tails) of marine circuli point away (outwards) from the focus.

Non-preferred scales Scales sampled outside of the preferred sampling area on the fish.

Ocean entrance The portion of the scale following the freshwater zone. After ocean entrance, an increase in circuli spacing and size is apparent.

Plus growth Growth following an annulus on the edge of a scale. Depending on the situation (life history, stock, sample day), this observation can be used to justify counting the annulus preceding this growth in age estimation, and

in some cases, in adding another not visible annulus into age estimation (resorbed adults, spring growth in juveniles).

Posterior field	Portion of the scale exposed to water on a live fish; does not show circuli.
Precision	Repeatability of a given measure or age reading.
Preferred area	Area on the fish three scale rows above the lateral line between the posterior insertion of the dorsal fin and anterior insertion of the anal fin.
Preferred scales	Scales sampled within the preferred sampling area for a species of fish.
Reference sample	Scale taken from a known geographical location and time, sometimes with age estimates or age validation by coded-wire tag information or other method of determining known ages. Used by scale readers to “calibrate” subsequent reads.
Regenerated	Area of a scale with missing circuli caused by reforming a lost scale. Sometimes the fresh water age cannot be determined for regenerated scales.
Reabsorption/Absorbed/Eroded scale	Some or all of the scale edge on salmon scales is lost during migration and the maturation process that occurs when salmon are near spawning.
Reticulation	Apparent “bumps” or “nodules” on at the base of a scale. Reticulated scales can appear globular or ladder-like. Presence and appearance can be used as part of discerning species by scales.
Radius	Distance from focus to a specific point on the scale.
Saltwater plus	Growth that occurs after the final saltwater annulus in mature salmon.
Validation	Method for determining accuracy of an age reading, for example CWT, Parentage Based Tagging (PBT), or PIT tagged fish.
Zone	Region of similar structure or definition. Annual Growth Zone is one summer zone and one winter zone. Most Chinook salmon scales have zero to two freshwater zones and one to six marine zones.

Life History

The following Chinook salmon life history terms are not specific to reading Chinook salmon scales for age reading, however, knowledge of life history type may help inform readings of the variety of scale patterns.

Fall Chinook	Chinook salmon that return to fresh water during the fall to spawn.
Jack	Male that returns to spawn one year earlier than the bulk of the run. x.1 Columbia Basin: Male Chinook salmon that return to spawn after their first year in the ocean (one-ocean fish); total age 3. Alaska (Yukon): Male Chinook salmon returning after spending two years in the ocean (two-ocean fish); total age 4.

- Jill** Female that returns to spawn one year earlier than the bulk of the run.
- x.1 Columbia Basin: Female Chinook salmon that return to spawn after their first year in the ocean (one-ocean fish); total age 3.
- Alaska (Yukon): Female Chinook salmon that return to spawn after their second year in the ocean (two-ocean fish); total age 4.
- Minijack** A male Chinook salmon that smolts and matures in the same year. Return to freshwater occurs before forming an ocean annulus. Minijacks are defined for the Columbia River as an upstream migrating Chinook salmon with a fork length between 15-30 cm. Scale patterns, mean number of circuli in freshwater and saltwater, and circuli spacing are described for scales from minijack Chinook salmon in Idaho and Bonneville Dam by Johnson et al. (2012).
- Ocean type (sub-yearling)** Life history strategy of rearing less than a year in fresh water before emigrating to the ocean; most scales do not show a freshwater winter annulus.
- Reservoir-type** Life history strategy of rearing in a reservoir before emigrating to the ocean.
- Resident** Fish that are not anadromous, although their cohorts may be. Examples include kokanee (sockeye salmon); rainbow trout (steelhead); Chinook salmon, and coho salmon. Resident fish are identified by the lack of saltwater annuli, generally small scale size, and large fresh water zone on the scales.
- Spring Chinook** Chinook salmon that return to fresh water during the spring to spawn.
- Stream type (yearling Chinook)** Life history strategy of rearing a year or more in fresh water before emigrating to the ocean; most scales show at least one freshwater annulus.
- Summer Chinook** Chinook salmon that return to fresh water during the summer to spawn.

Based on terminology lists and glossaries by Tobias et al. (1994), Ruggerone et al. (2002), Summerfelt, (1987) and Campana et al. (1995), Martinson et al. (2009), ADF&G (2010) and ODFW draft scale aging manual.

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