A Basic Guide to Aging & Identification of Pacific Salmon Scales

Presented by the

Alaska Department of Fish & Game

Information provided in this presentation is for general usage and is not intended as a professional reference guide.

Outline of Presentation:

- Overview of salmon scale
- Anatomy of the salmon scale
- Scale collection methods
- Migration patterns affect scale growth
- Key scale features for identifying salmon species
  - Chum
  - Sockeye
  - Coho
  - Chinook
  - Pink

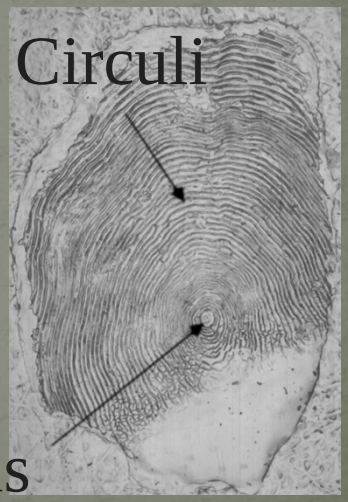
Overview of Salmon Scales

All salmon have nearly circular scales with a smooth posterior margin; this type of smoothed-rimmed scale is termed *cycloid*. This type of scale develops marks on it throughout the life of the salmon like the rings of a tree. A trained professional can use scale size, shape, and marks to determine the type and age of the salmon.

The marks on the scales are developed throughout the life of the salmon and vary depending on genetic variation of populations, life history patterns, or environmental variation among habitats.

Overview of Salmon Scales

Growth on the scale starts at the *focus*, which is a flat thin plate of keratinized protein (like a fingernail). As the scale grows, additional plates are added to the ventral surface of the scale with each subsequent plate being slightly larger than its predecessor. It is like a stack of pancakes, except the one on the top is the smallest, with the rest of the pancakes getting consecutively larger as you move down thru the stack. The difference from one stack to the next is what forms the ridges referred to as *circuli*. Circuli (singular circulus) are located on the outer surface of the scale and are similar to the rings in a tree. There is also accretion of material along the outermost edge of the scale. This is a greatly simplified explanation and is somewhat theoretical since the process is not completely understood and may vary among species.



Anatomy of the Salmon Scale

- Circuli: Growth ridges in a scale.
- Focus: Where growth begins.

Anatomy of the Salmon Scales

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- Circuli: Growth ridges in a scale.
- Focus: Where growth begins.
- Anterior Portion: Part of scale that faces towards the fishes head.
- Posterior Portion: Part of scale the faces towards the fish's tail.

Anatomy of the Salmon Scales

Circuli

Focus

Anterior portion
-towards head

Posterior portion
-toward tail

Anatomy of the Salmon Scale

- Circuli: Growth ridges in a scale.
- Focus: Where growth begins.
- Anterior Portion: Part of scale that faces towards the fishes head.
- Posterior Portion: Part of scale the faces towards the fish's tail.
- Reticulation: Network of ridges between the anterior and posterior portions of the scale.
- Reabsorption: Fish absorbs the nutrients in the scale causing deformity in the scale.
- Radial Striations and scalloping: Curved lines in the posterior portion of the scale.

Anatomy of the Salmon Scales

Reabsorption

Circuli

Focus

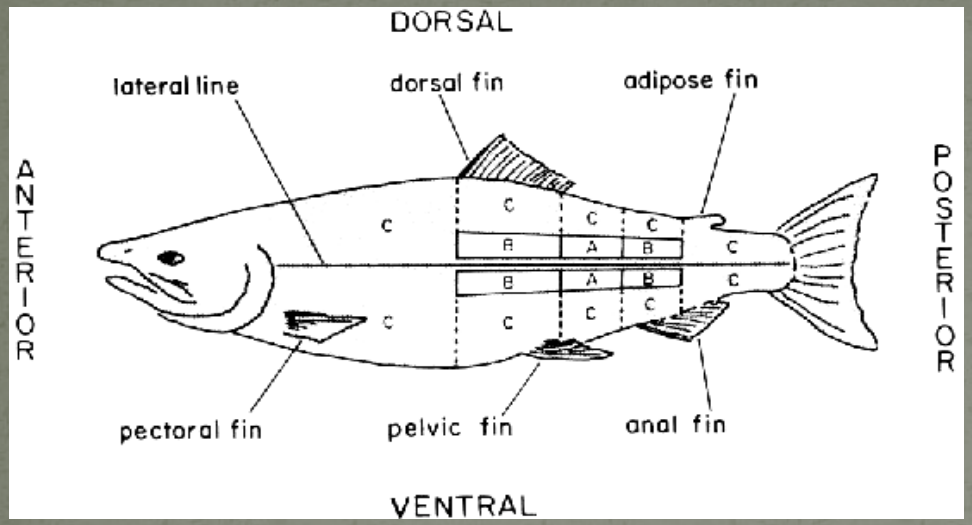
Reticulation

Radial Striations/
Scalloping

Anterior portion
-towards head

Posterior portion
-toward tail

Scale Collection Methods

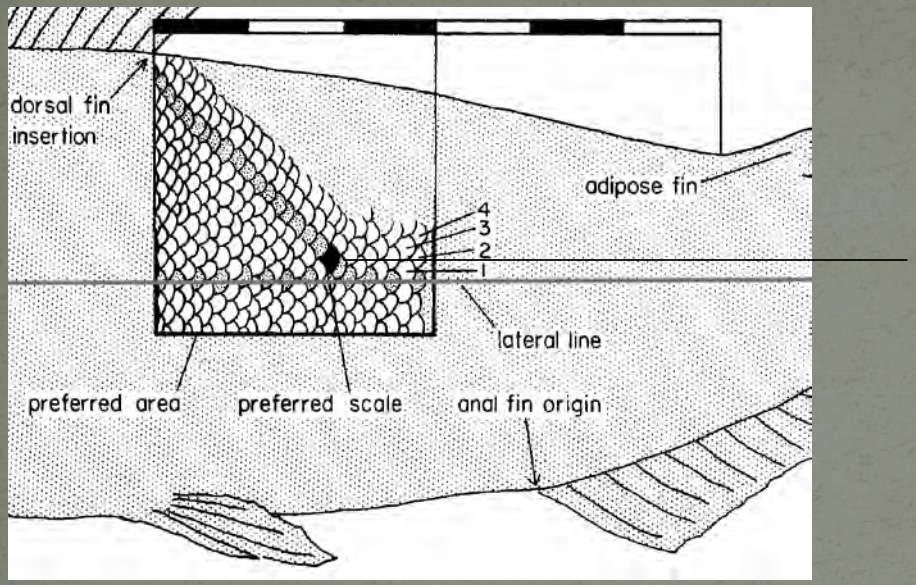


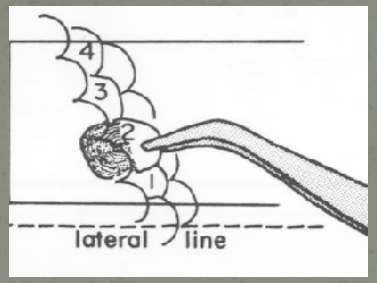
Valuable information can be gained about salmon life history from a properly collected and stored salmon scale.

The preferred scale collection area is from the left lateral side of the fish from area A (see above diagram). If scales from the left side of the fish are damaged, *regenerated* (regrow losing all previous information) or not available the next option would be the right lateral side of the fish. Area C designates non-preferred areas.

Scale with regenerated section

Scale Collection Methods





Preferred scale, in solid black in above diagram is located 2 rows up from the lateral line, on a diagonal from the insertion (posterior) of the dorsal fin "back" toward the origin of the of the anal fin.

Do not turn scale over. The circuli (ridges) should be up and facing away from the labeled scale (gum) card.

Factors affecting scale growth: Seasonal

- Scale development varies depending on the growth rate of the salmon.
- The growth rate varies depending on the amount of food available.
- During the summer when more food is available the salmon grows faster than in the winter when food is less abundant.
- Increased growth rate creates circuli that are formed faster and more widely spaced.
- Slow growth rate creates circuli that are formed slower and are spaced closer.
- Each type of salmon has a one or more life histories and this life history will be shown on the scale.

Factors affecting scale growth: Seasonal

Summer

Increased Food

Increased Growth

One summer's growth plus one winter's growth is counted as one year.

Decreased Growth

Winter

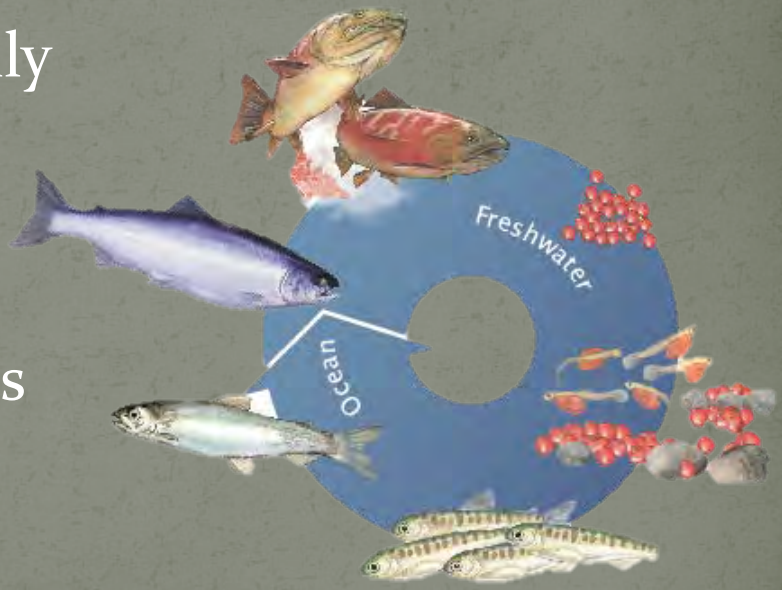
Decreased Food

Circuli more widely spaced

circuli more closely spaced

Factors affecting scale growth: Life History

- Pacific salmon spawn in the summer and fall.
- Salmon fry hatch in the gravel during the winter or spring.
- Young pink or chum salmon migrate to the sea shortly after emerging from the gravel and usually before fresh water circuli have begun to form.
- The young of other species usually remain in fresh water from 1-4 years before migrating in the spring to the sea.
- Since growth at sea is greater, it is possible to define the boundary between the fresh and salt water portions of the lifecycle.

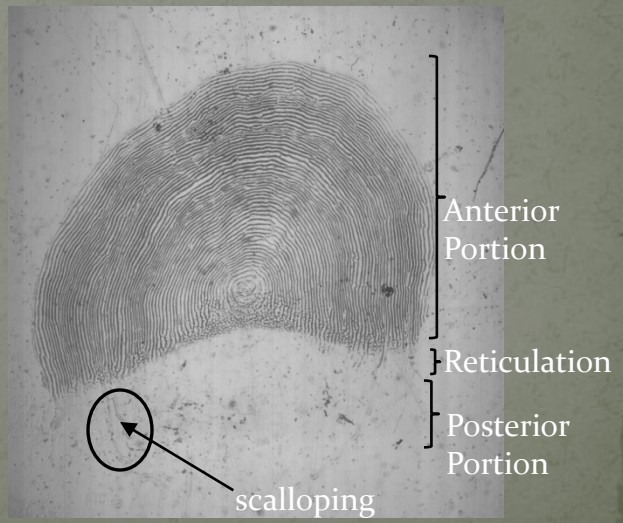


Factors affecting scale growth: Life History

- After a period at sea which ranges from a few months to as much as 5 years, the salmon return to their home stream to spawn and die.
- During this time the fish cease feeding and rely on protein and fat stored in the body. This results in *reabsorption* of the scales which progresses from the outside edge towards the focus. By the time spawning is completed only a small central section of the scale may remain.

Key scale features for identifying salmon species

- The number of circuli which are complete below the focus on the anterior half of the scale.
- The presence of broken circuli or fragments of circuli in the anterior field.
- Whether the circuli continue into the anterior field from the posterior.
- The appear of radial striations or *scalloping* which is curved lines in the posterior portion of the scale.
- The presence and nature of reticulations. *Reticulation* is a network of ridges between the anterior and posterior portions of the scale.

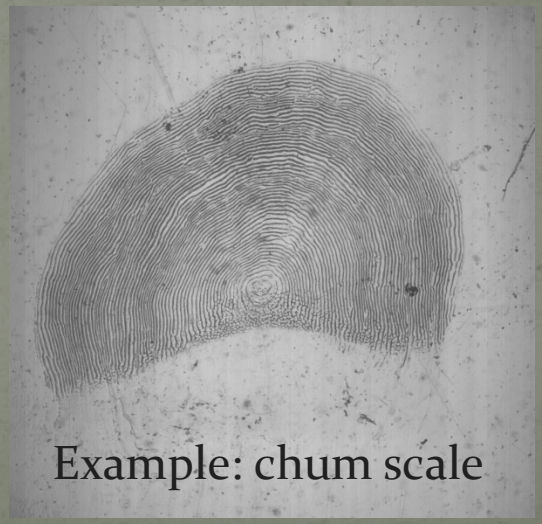


Key scale features for identifying salmon species

- How to identify and age five species of salmon
  - Chum – Dog Salmon
  - Sockeye – Red Salmon
  - Coho – Silver Salmon
  - Chinook – King Salmon
  - Humpy – Pink Salmon

Key scale features for identifying salmon species

- Features of: Chum – Dog Salmon Scale
  - Absence of freshwater growth zone
  - Usually less that 7 unbroken circuli between anterior and posterior portions.
  - Radial striations and scalloping the posterior field.
  - Heavy globular reticulation (net of ridges).
  - Overall scale shape is more circular than other species.



Example: chum scale

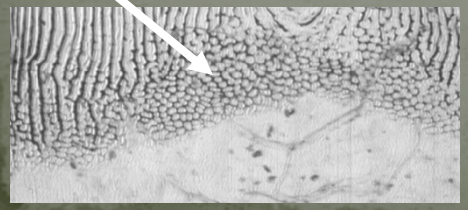
Scales are not actual size.

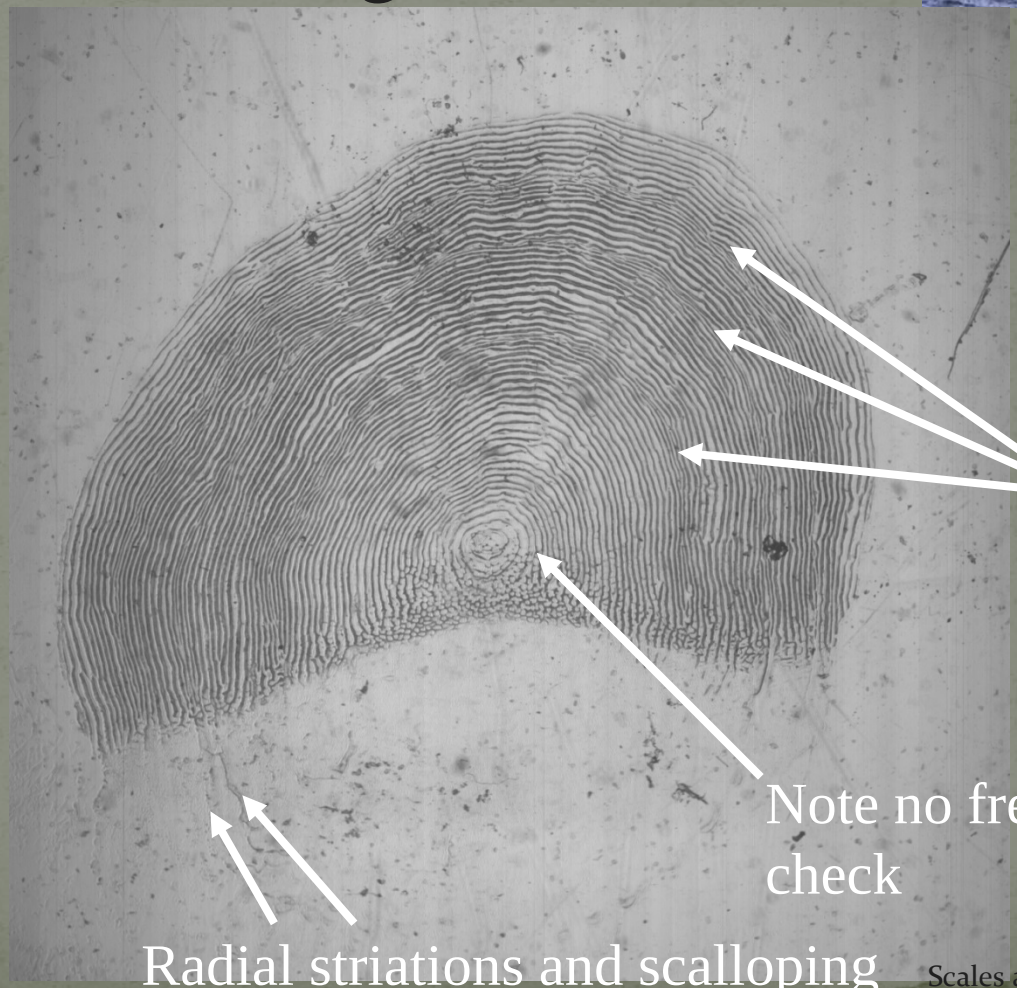
Key scale features for identifying salmon species

- Features of: Chum – Dog Salmon Scale

Focus

Globular reticulation





Saltwater winter checks

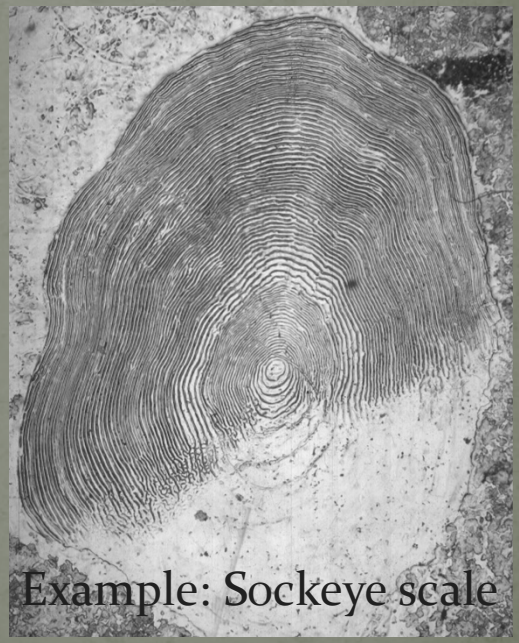
Note no freshwater check

Radial striations and scalloping

Scales are not actual size.

Key scale features for identifying salmon species

- Features of: Red – Sockeye Salmon Scale
  - Pronounced fresh water growth zone with one or more winter checks.
  - Saltwater portion has 2-3 winter check.
  - No more than 6 circuli are complete below the focus.
  - Reticulation is ladder-like.
  - Posterior field is without prominent markings.



Example: Sockeye scale

Scales are not actual size.

Key scale features for identifying salmon species

- Features of: Red – Sockeye Salmon Scale

Less than 6 circuli below focus

Focus

Ladder –like reticulation

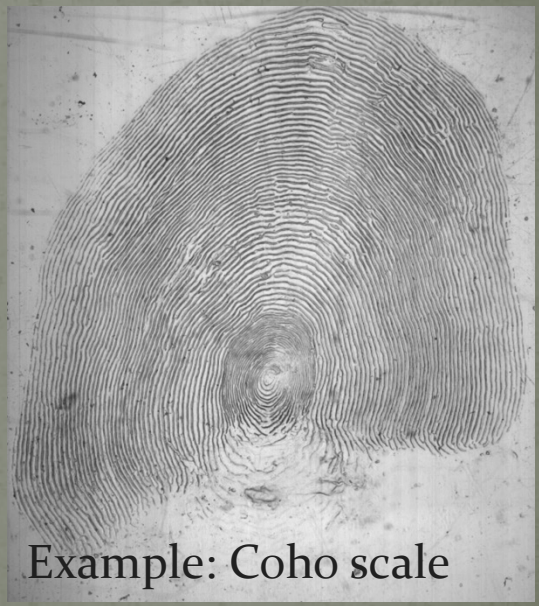
Saltwater winter checks

Freshwater check

Radial striations and scalloping

Key scale features for identifying salmon species

- Features of: Coho – Silver Salmon Scale
  - Scales are generally large for the size of the fish and circuli are distinct.
  - Freshwater zone has 1-3 winter checks.
  - Saltwater zone has 1-2 winter checks.
  - Often pinched where anterior meets posterior portion.
  - Generally have more than 6 complete circuli below the focus with prominent circuli segments in the posterior zones.



Example: Coho scale

Scales are not actual size.

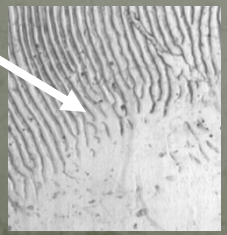
Key scale features for identifying salmon species

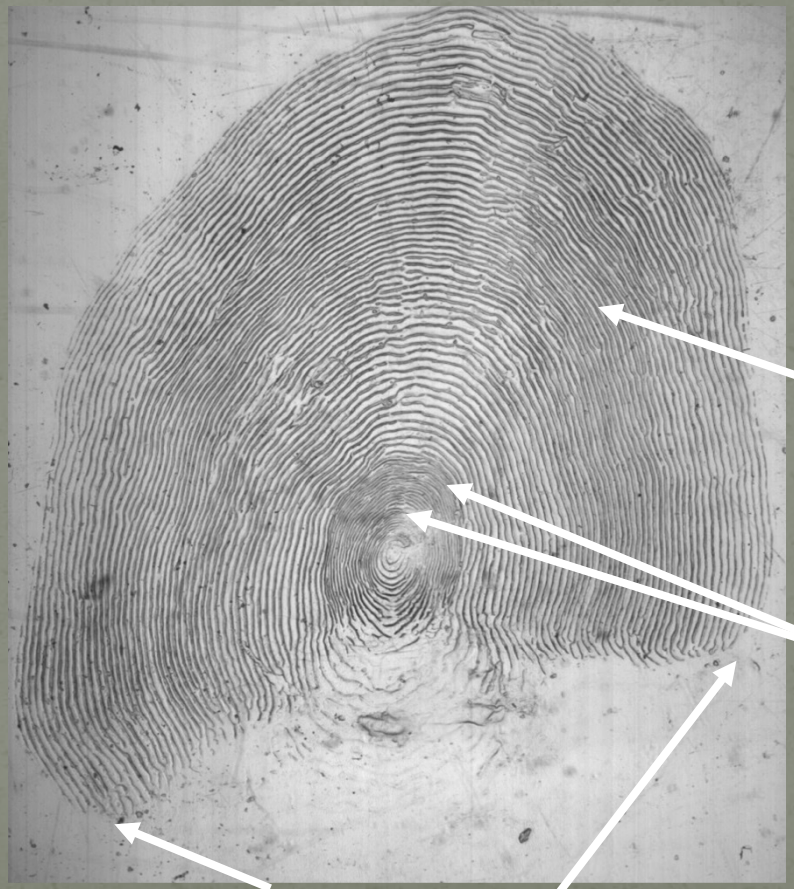
- Features of: Coho – Silver Salmon Scale

Focus

Prominent
circuli segments

No reticulation





Saltwater
winter
check

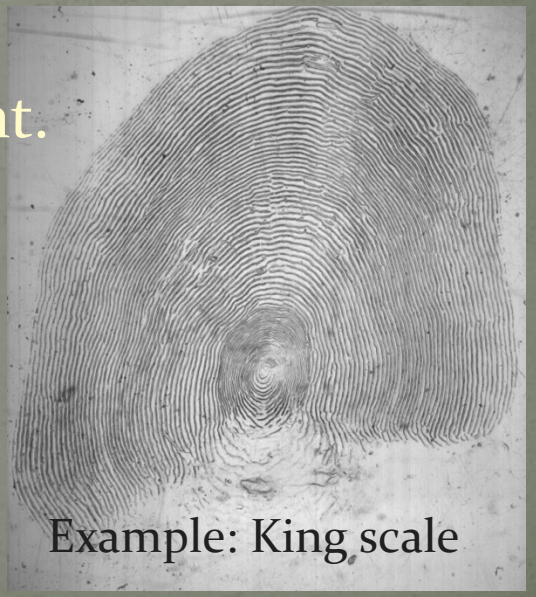
Freshwater
winter
checks

Pinch between anterior and posterior

Scales are not actual size.

Key scale features for identifying salmon species

- Features of: Chinook – King Salmon Scale
  - Usually have more than 6 complete and as many as 18 broken circuli in the posterior portion.
  - Often have 3-4 winter checks in the ocean zone.
  - Reticulation is uncommon.
  - Strong radial striations are often present.
  - Relatively large in overall size.
  - First ocean zone is usually large.



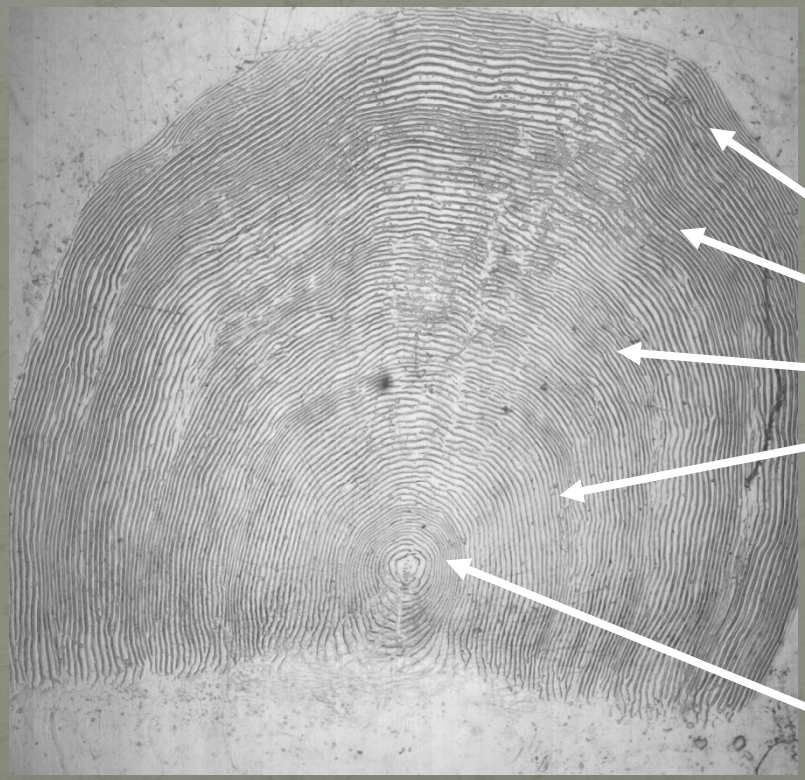
Example: King scale

Key scale features for identifying salmon species

- Features of: Chinook – King Salmon Scale

Focus

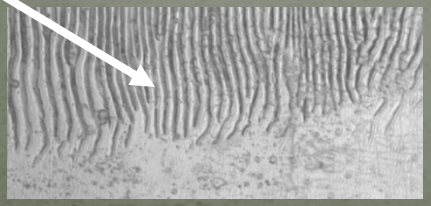
Broken Circuli



Saltwater winter checks

Freshwater winter check

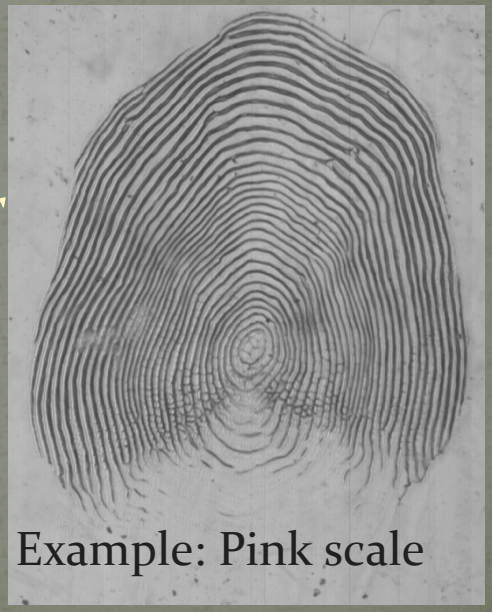
No reticulation



Scales are not actual size.

Key scale features for identifying salmon species

- Features of: Humpy – Pink Salmon Scale
  - Relatively small in size.
  - Absence of freshwater growth zone.
  - Single saltwater winter check.
  - Reticulation when present are ladder-like.
  - Less than 5 unbroken circuli in posterior portion.
  - Size of posterior portion of scale is more variable than in other species.


Example: Pink scale

Scales are not actual size.

Key scale features for identifying salmon species

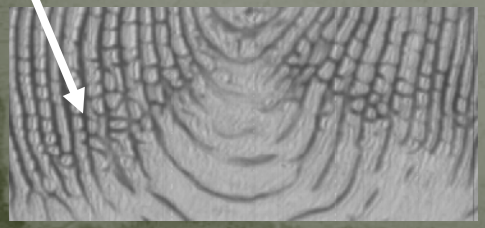
- Features of: Humpy – Pink Salmon Scale

Single saltwater winter check

Lack of Freshwater

Less than 5 complete circuli

Ladder-like reticulation

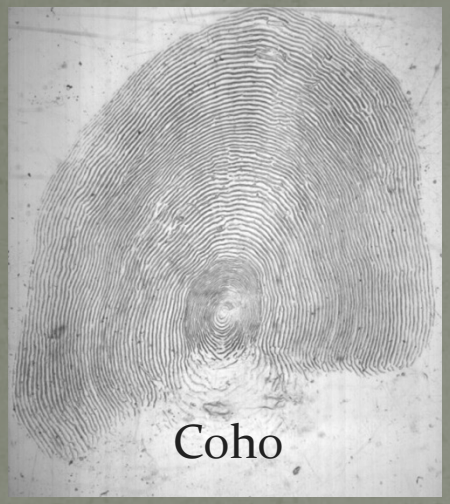


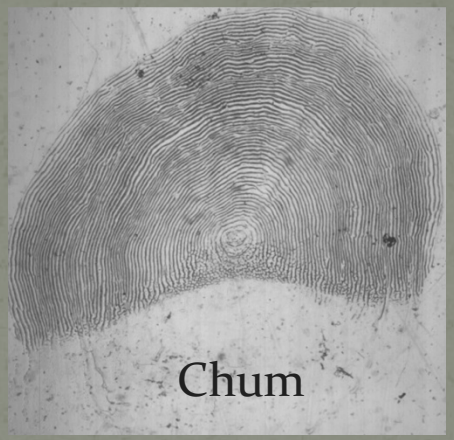
Scales are not actual size.

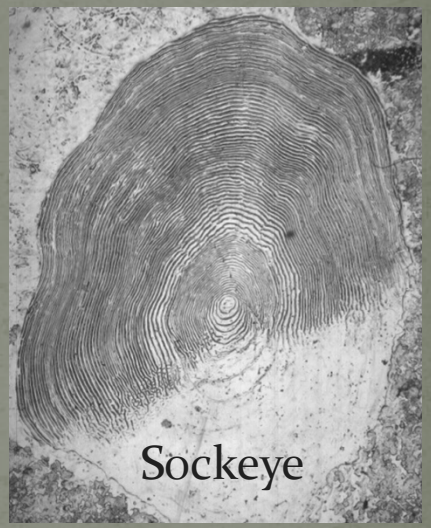
Compare scales and guess the species!

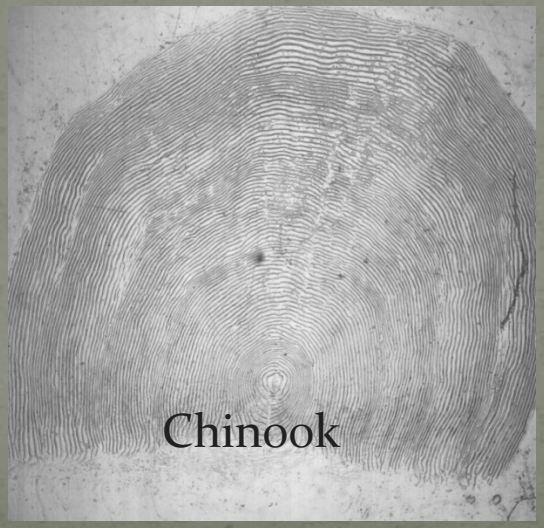
Scales are not actual size.

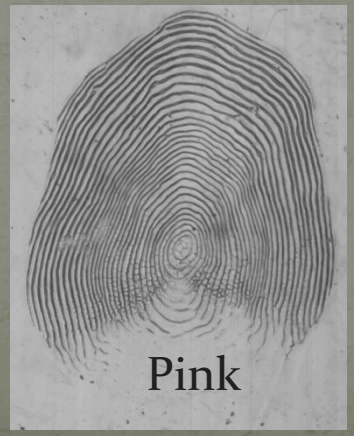
Compare scales and guess the species!


Coho


Chum


Sockeye


Chinook


Pink

Scales are not actual size.

The End