Fish Tech Weekly Outline –
January 14-18

**TOPICS:**

- salmon, trout, and char in Southeast Alaska
- salmonid identification overview
- salmonid life cycle and stages
- salmonid freshwater and marine distribution/residence
- cartography, maps, GPS, GIS

- today’s topics (?)
Alaska’s Pacific salmonids (Family: Salmonidae) – species found here in Southeast Alaska

• Chinook (king) salmon - *Oncorhynchus tshawytscha*
• Coho (silver) salmon - *Oncorhynchus kisutch*
• Sockeye (red) salmon - *Oncorhynchus nerka*
• Chum (dog) salmon - *Oncorhynchus keta*
• Pink (humpy) salmon - *Oncorhynchus gorbuscha*

• Steelhead (rainbow) - *Oncorhynchus mykiss*
• Cutthroat trout - *Oncorhynchus clarkii*
• Dolly Varden - *Salvelinus malma*

** other salmonid species of stocked origin or rare occurrence include **
*Brook trout Salvelinus fontinalis, and arctic grayling Thymallus arcticus*
Alaska’s Pacific salmonids (Family: Salmonidae) – Which one is Which??

- Chinook (king) salmon
- Coho (silver) salmon
- Sockeye (red) salmon
- Chum (dog) salmon
- Pink (humpy) salmon
- Steelhead (rainbow)
- Cutthroat trout
- Dolly Varden
Adult salmonid ID

**How to Identify the Five Salmon Species Found in Alaska**

**King (Chinook, tyee, blackmouth) Salmon:**
Blue-gray back with silvery sides. Small, irregular-shaped black spots on back, dorsal fin, and usually on both lobes of the tail.

**Coho (silver) Salmon:**
Greenish-blue back with silvery sides. Small black spots on the back, dorsal fin, and usually on upper lobe of tail only.

**Spawning coho salmon adults develop greenish-black heads and dark brown to maroon bodies.**

**Sockeye (red) Salmon:**
Dark blue-black back with silvery sides. No distinct spots on back, dorsal fin, or tail.

**Spawning sockeye salmon adults develop dull-green heads and brick-red to scarlet bodies.**

**Chum (dog, keta, calico) Salmon:**
Dull gray back with yellowish-silver sides. No distinct spots on back or tail. Large eye pupil—covers nearly the entire eye.

**Pink (humpy) Salmon:**
Large spots on the back and large black oval blotches on both tail lobes. Very small scales.

**Spawning adults develop olive green coloration on the back with maroon sides covered with irregular dull red bars. Males exhibit many large canine-like teeth.**

**Spawning adults turn dull gray on their backs and upper sides and creamy white below. Males develop a pronounced hump.**
**Rainbow Trout:**
Green to bluish back with silvery to yellowish-green sides. Broad pinkish band along side and black spots on back, sides, and tail. Upper jaw usually does not extend past eye on adult.

**Cutthroat Trout:**
Yellowish-green body with no pinkish band along sides. Many black spots on back, sides, and tail. Upper jaw extends well past eye on adults. Red to orange slash on underside of lower jaw.

**Steelhead:**
Sea-run rainbow trout with bluish gray back and bright silvery sides. Small black spots on back, sides, and tail. Pink/red coloration develops after returning to fresh water to spawn.

**Dolly Varden Char:**
Olive green to blue-gray back with silvery sides. Small yellow, red, or pink spots on sides. Pelvic and anal fins often have a white leading edge.

**Arctic Char:**
Very difficult to distinguish from Dolly Varden. Arctic char are generally found in the Bristol Bay area and throughout western Alaska, and Dolly Varden are found on Kodiak Island, throughout the waters of southcentral and southeastern Alaska, and on the North Slope.

**Arctic Grayling:**
Light brown to dark purple back, fading to bluish gray with black spots on sides. Very large dorsal fin with red and violet spots.
Figure 1: Diagram of Salmonid Features

Key:

1. Pectoral fin
2. Dorsal fin
3. Pelvic fin
4. Anal fin
5. Adipose fin
6. Caudal fin
7. Lateral line
8. Maxillary
9. Branchiostegals
10. Parr mark width
11. Parr mark height
12. Caudal peduncle
External features on an adult
External features on an adult:

- Dorsal fin
- Adipose fin
- Caudal peduncle
- Pectoral fin
- Pelvic fin
- Anal fin
- Caudal fin
- Maxillary
- Lateral line
Distinguishing juvenile salmon from trout

- Chinook (king) salmon
- Coho (silver) salmon
- Sockeye (red) salmon
- Chum (dog) salmon
- Pink (humpy) salmon
- Steelhead (rainbow)
- Cutthroat trout
- Dolly Varden
Distinguishing juvenile trout and char species

**Figure 4: Identification Chart**

**Juvenile trout and Dolly Varden**

- **Atlantic**
  1. Red dots on lateral line on larger fish.
  2. Adipose fin not orange.

- **Dolly Varden or Bull Trout**
  1. Adipose fin orange.
  2. Width of parr marks on lateral line greater than light areas.
  3. Small triangle-shaped pigment spot at base of caudal fin.

- **Brown Trout**
  1. No black spots on back or sides.
  2. Width of parr marks on lateral line greater than light areas.
  3. 9–12 parr marks greater than diameter of eye.
  4. Orange spots, if present, are close to lateral line.

- **CUTTHROAT**
  1. Caudal fin melanophores tend to form in lines along fin rays in fish < 50 mm.
  2. Mid-dorsal parr-like marks usually absent.
  3. White tip on dorsal covers 3 or fewer ray interspaces.
  4. Maxillary reaches past posterior margin of eye (does not separate in trout less than 8 cm).
  5. Hyoid teeth present.

- **Steelhead/Rainbow**
  1. Caudal fin melanophores are evenly distributed, in fish < 50 mm.
  2. Fish > 50 mm, median dorsal parr marks usually present.
  4. Hyoid teeth absent.

**Note:** You may encounter juvenile mountain whitefish in some mainland rivers, especially those that penetrate the coastal mountains to interior regions. Juvenile mountain whitefish have an adipose fin and parr marks; however, their bodies are more slender and pencil-shaped than trout or char. The mouth of a juvenile whitefish is positioned lower down on the jaw and is smaller than that of trout or char. Juvenile mountain whitefish have fewer and thus larger scales than trout or char. Whitefish have 70–90 oblique rows of scales across the lateral line, compared to 100 or more rows on trout or char.

Need for 10x hand lens or binocular microscope.

Melanophores are small black pigment cells about the size of fine pepper. Spots on fish are an accumulation of melanophores. Small black melanophores often show on recently emerged fry but these are not what we refer to as spots.

Examining fish for features marked in red can harm or kill the specimen, and may require 10x or binocular microscope.
Distinguishing juvenile trout and char species
Distinguishing juvenile trout and char species

**Cutthroat Trout**

*Oncorhynchus clarki*

**Fry**

1. Melanophores are in spots or streaks along rays in caudal fin of fry <50 mm. (Note: magnifying glass may be required to observe this trait.)
2. Median-dorsal parr-like marks are usually absent.
3. White tip on dorsal covers 1 to 3 interspaces between dorsal fin rays.
4. First ray is black on fry.
5. Adipose may have 1–2 breaks in pigment on rim and often spotted on parr.
6. Maxillary extends past rear margin of the eye on fish >80 mm.
7. Underside of jaw (on parr) has red or yellow slash.
8. Hyoid teeth are present at the base of the tongue behind first gill arch—see inside lower jaw.

**Steelhead/Rainbow Trout**

*Oncorhynchus mykiss*

**Fry**

1. Melanophores are evenly speckled on caudal fin of fry. (Note: magnifying glass usually required to observe this trait.)
2. Median-dorsal area has parr-like marks, about 5.
3. White tip on dorsal covers 3 to 5 interspaces between dorsal fin rays.
4. First ray is black on fry.
5. Adipose usually has continuous rim of pigment or one break.
6. Maxillary does not extend past back margin of eye of parr.
7. Jaw has no red or yellow slash.
8. There are no hyoid teeth.
Distinguishing juvenile trout and char species

**Live Specimens: Dolly Varden & Trout Fry**

Important diagnostic features visible on the photographs are identified. Refer to Identification Keys and species pages to confirm identifications made from photos. Note length of base of anal fin is less than or equal to length of base of dorsal fin on trout and char.

- **Dolly Varden Fry**
  - Parr marks are uneven.
  - Length: 30 mm.

- **Cutthroat Fry**
  - Cutthroat and rainbow fry are very difficult to distinguish in the field.
  - Specimens over 80 mm (see parr) are usually necessary to distinguish cutthroat from rainbow.
  - Length: 30 mm.

- **Steelhead/Rainbow Fry**
  - See cutthroat fry.
  - Length: 30 mm.

- **Brown Trout Fry**
  - Adipose fin is orange-brown colour.
  - Length: 30 mm.

- **Atlantic Salmon Fry**
  - Pectoral fins are long and reach to or past the insertion of the dorsal fin.
  - Length: 40 mm.

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**Live Specimens: Dolly Varden & Trout Parr**

Important diagnostic features visible on the photographs are identified. Refer to the Identification Charts and species pages to confirm identifications made from photos.

- **Dolly Varden Parr**
  - Parr marks are irregularly shaped.
  - Fins and body have no black spots.
  - Length: 95 mm.

- **Cutthroat Parr**
  - Length of maxillary extends past back of eye.
  - Adipose is spotted.
  - Underside of jaw has red slash mark.
  - White tip on dorsal fin covers 3 or fewer interspaces between rays.
  - Length: 120 mm.

- **Steelhead/Rainbow Parr**
  - No red slash.
  - Maxillary does not reach past back of eye.
  - Adipose has black margin.
  - White tip on dorsal fin covers 3–5 interspaces between rays.
  - Length: 100 mm.

- **Brown Trout Parr**
  - Adipose has orange-brown pigment.
  - Red spots are present.
  - Pectoral fin does not reach insertion of dorsal fin.
  - Length: 80 mm.
Distinguishing juvenile salmon species

**Pink Salmon**

- **Oncorhynchus gorbuscha**
- **Fry**
- Colour & Anatomy:
  1. Parr marks are absent.
  2. Dorsal surface is green, ventral is silver.
- Distribution:
  Pink salmon are found in lower reaches of certain rivers.

**Chum Salmon**

- **Oncorhynchus keta**
- **Fry**
- Colour & Anatomy:
  1. Parr marks smaller than vertical diameter of eye, and faint or absent below lateral line.
  2. Parr mark height is more regular than on sockeye.
  3. Area below lateral line has pale greenish iridescence.
  4. Gill rakers are short and stubby, about half the length of the gill filament, 19 to 26 on first gill arch.
Distinguishing juvenile salmon species

SOCKEYE SALMON

Oncorhynchus nerka

FRY

30 mm

COLOUR & ANATOMY

1. Parr mark length is less than than vertical diameter of eye.
2. Parr marks are irregular—height is irregular.
3. Area below lateral line is silver or white—no greenish sheen.
4. Gill raker length is almost = to length of gill filaments.
5. 30–39 gill rakers on first arch.
Distinguishing juvenile salmon species

**Chinook Salmon**

*Oncorhynchus tshawytscha*

**Coho Salmon**

*Oncorhynchus kisutch*

**Colour & Anatomy**

**Chinook Salmon**

1. Anal fin is not sickle-shaped; leading edge of anal fin is shorter than length of base.
2. Anal fin leading edge is white.
3. Adipose fin has clear centre or “window.”
4. Dorsal fin has dark leading edge and white tip.
5. Species has 16–18 branchiostegals.
6. Species usually has 135–185 pyloric caeca.

**Coho Salmon**

1. Anal fin is sickle-shaped, leading edge is longer than base.
2. Leading edges of anal and dorsal fins have white followed by black.
3. Adipose fin has dark edge, centre is opaque.
4. Caudal, anal and adipose fins are pale orange.
5. Species has 13–14 branchiostegals.
6. Species usually has 45–80 pyloric caeca.
Distinguishing juvenile salmon species

**Live Specimens: Salmon Fry**

Important diagnostic features visible on photographs are identified. Refer to Identification Charts and species pages to confirm identifications made from photos. Note: length of base of anal fin is larger than length of base of dorsal fin on all juvenile salmon.

**Pink Salmon Fry**
- Parr marks are absent.
- Colour is very silver.
- Length: 30 mm.

**Chum Salmon Fry**
- Parr marks are even in length—more above than below lateral line.
- Blue/green sheen shows below lateral line.
- Length: 55 mm.

**Sockeye Salmon Fry**
- Parr marks are uneven length, and some are equal above and below lateral line.
- No green sheen shows below lateral line.
- Length: 50 mm.

**Coho Salmon Fry**
- Dorsal and anal fin margins are sickle-shaped and have white and black stripes.
- Parr marks larger than eye diameter.
- Fins are red or orange.
- Length: 50 mm.

**Chinook Salmon Fry**
- Dorsal has white tip.
- Adipose has clear window.
- Parr marks larger than eye diameter.
- Length: 50 mm.

**Colour & Anatomy**
1. Parr marks are absent.
2. Dorsal surface is green, ventral is silver.
3. Area below lateral line has pale greenish sheen.
4. Gill rakers are short and stubby, about half the length of the gill filaments, 10 to 26 on first gill arch.

**Distribution**
- Pink salmon are found in larger numbers of

**Pink Salmon**
- Oncorhynchus gorbuscha

**Chum Salmon**
- Oncorhynchus keta

**Sockeye Salmon**
- Oncorhynchus nerka

**Coho Salmon**
- Oncorhynchus keta

**Chinook Salmon**
- Oncorhynchus tshawytscha

**Colour & Anatomy**
1. Parr marks are absent.
2. Dorsal fin is shorter than length of anal fin.
3. Area below lateral line is silver or white.
4. Gill rakers are short and stubby, about half the length of the gill filaments, 10 to 26 on first gill arch.
5. Species usually has 50-100 pharyngeal teeth.

**Pink Salmon**
- Oncorhynchus gorbuscha

**Chum Salmon**
- Oncorhynchus keta

**Sockeye Salmon**
- Oncorhynchus nerka

**Coho Salmon**
- Oncorhynchus keta

**Chinook Salmon**
- Oncorhynchus tshawytscha

**Colour & Anatomy**
1. Parr marks are absent.
2. Dorsal fin is shorter than length of anal fin.
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5. Species usually has 50-100 pharyngeal teeth.
Alaska’s Pacific salmonids – Life Cycle and life stages
Life Cycle and life stages

• **Eggs**
  - Salmon: June-February (~ 5-8 months)
  - Dolly Varden: September-February (~ 4-5 months)
  - Steelhead: variable* (~ 1-4 months)
  - Cutthroat trout: April-September (< 2 months)

• **Eyed Eggs/alevin** – all species generally ~ 1-2 months

• **Fry (freshwater residence, before *smolting*)**
  - pink/chum - ~ 1-2 months
  - Chinook – 1-2 years
  - Sockeye – 0-4 years
  - Coho – 1-4 years
  - Steelhead – 1-4 years
  - Dolly Varden, cutthroat trout – *it depends!!*
Life Cycle and life stages

Smolt, smolting durations.....

.....depends on where in the watershed juvenile fish over-wintered OR...where the eggs hatched (for pink and chum)
Salmon ocean distribution & duration: 
(smolt – adult: 0-5 years*)

• pink – 1 year (odd & even year runs are genetically different)
• coho – 1-2 years
• sockeye – 1-3 years
• Chinook – 1-5 years
• chum – 3-4 years

• steelhead – ~2 years & then return to natal stream every year thereafter to spawn again!!
• rainbow trout that do NOT go to the ocean to mature are not called Steelhead, rather they remain resident rainbows (similar to DV, CT)

• Dolly Varden and cutthroat trout - some fish remain in freshwater their whole lives (resident); other fish spend summers feeding in estuaries and nearshore habitats and return to freshwater systems to spawn (anadromous) and eventually overwinter in lakes
<table>
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<td>1-2 months</td>
<td>1 year</td>
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<tr>
<td>Chum salmon</td>
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<td>3-4 years</td>
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<td>Coho salmon</td>
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<td>Sockeye salmon</td>
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<td>Chinook salmon</td>
<td>1-2 years</td>
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<tr>
<td>Steelhead</td>
<td>1-4 years</td>
<td>2 years</td>
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</tbody>
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A salmon that spends 2 years in freshwater, and then goes to the ocean to mature for 3 years is denoted as 2:3 or 2.3.

A salmon that spends only 1-2 months (0 years) in freshwater, and then goes to the ocean to mature for 1, 2, or 3 years would be.....??
Salmon Freshwater distribution

Anadromous waters in Southeast Alaska

Anadromous waters in the Juneau Area

Anadromous Waters Catalog: All Species
Activity #1 (10-15 MIN): [break into groups of 2] using the internet, find 10 different images for each assigned species (each group gets assigned 1 species) that exhibit different life stages (egg, alevin, fry, parr, smolt, adult) and/or different phenotypic characteristics and copy these into a folder or word document.

As a class, we will look at all images for each species & lifestage to better understand the diversity of characteristics (phenotypes) and growth of salmon.