#### The Salmonid Species

- N. American salmon (2 more Asian species)
  - Chinook ("King")
  - Coho ("Silver")
  - Sockeye
  - Chum ("Dog")
  - Pink ("Humpy")
- Sea-run trout
  - Steelhead, Cutthroat, Dolly Varden

www.wa.gov/wdfw/outreach/fishing/salmon.htm Ocean/ENVIR 260 Winter 2006 Lecture 3 © 2006 University of Washington







#### Definitions of Salmonid Clans



- "Evolutionarily Significant Unit" (ESU)
  - Definition used for purposes of Endangered Species Act
  - Group of populations or stocks
    - Similar to metapopulation
  - Reproductively isolated

-And-

- Important component of the evolutionary legacy of the species
  - Genetics, geography, habitat adaptation

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# The Salmonid Life Cycle

- Fry
  - Emerge from redd late winter
  - Swim & feed in stream
  - Must take refuge from current & predators
- Parr
  - Develop vertical stripes
  - Slowly migrate downstream few weeks to 2 years

- Reach salt water April - August Ocear/ENVIR 260 Winter 2006 Lecture 3 © 2006 University of Washington

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- Spend 2-5 years in the ocean
  - Depending on species
- Migrate long distances to feed
  - · Along West Coast to Alaska or into open Pacific

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- Depending on species
- Spawners
  - Return to stream of origin in Oct.-Nov.
    - Some species return in spring & summer

### The Salmonid Spawning Ritual



- · Usually seek smaller tributaries
  - Gravelly "riffles"
    - Faster-moving shallow water
  - Simple courtship behavior
    - Simultaneous release of eggs & "milt"
    - Both must fertilize within minutes or become inviable
  - Female agitates gravel with tail
    - Buries eggs 2-3" deep in gravel
    - Adults die

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#### The Salmonid Life Cycle: Variations



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- Fresh water
  - May reside from a few days to an entire year or longer
- Ocean
  - May return after 3 months ("jacks")
  - Most return after 2-4 years (range 1-6)
  - Diverse migratory routes in ocean

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### The Salmonid Life Cycle: Variations



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- Spawning varies widely by river & stock
  - Spring returners tend to spawn upstream
    - Many early Puget Sound runs believed extinct
  - Fall returners tend to spawn in lower reaches
    - Dominant in Puget Sound
    - Peak late August to mid-October
- · Some straying to rivers adjacent to origin
  - Reduces risk that a stock will be eliminated
  - Variable timing a hedge on annual variability











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- · Gravel in stream bottom
  - Spaces admit salmon eggs
  - Clean water supplies oxygen & removes wastes
- Flow environment

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 Areas of slow flow to allow eggs, alevins, fry to remain in nursery grounds

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 Areas of rapid flow to help parr move downstream when ready

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Essential Features of Stream Environment



- Riparian (=streamside) vegetation
  - Shades stream to keep water cool
  - Supports insects that fry eat
  - Provides refuge from predators
  - Stabilizes banks
- "Large woody debris" (LWD)
  - Used to be removed because it obstructs flow
  - But creates pools & side channels
    - Provide refuge from high flows
  - Provides cover from sun & predators <sup>20</sup>

### Essential Features of Stream Environment



#### • Wetlands

- Reservoirs for surface & ground water
  - Absorb water during high flow to reduce floods
  - Release water during drought to maintain stream flow
  - Filter pollutants & excess nutrients
- Salmon habitat
  - Side-channels & pools for rearing of fry
    - Reduced flow environment

Rich food supply

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#### Essential Features of Stream Environment



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- Spawned-out adult carcasses
  - Provide nutrients to stream

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- Support production of prey for fry
- Food source for terrestrial animals
  - 22 species of birds & mammals
  - Fertilize terrestrial plants in turn

## Impacts on Salmon in Streams



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- Siltation—fine sediment particles
  - Fill gravel spaces & smother eggs & alevins
- Floods
  - Sweep gravel downstream & deposit silt
- Removal of riparian vegetation
  - Allows bank erosion & siltation
  - Allows overheating of water
  - Removes refuge for fry
- Blockage by roads, culverts, etc.

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### Alterations of **Estuarine Habitat**



- Diking, dredging, filling of coastal wetlands & mud flats
  - Farmland, ports
- Elimination of vegetation
  - Shading by piers & buildings, excess sediment
- "Armoring" of the shore
  - Sea walls & bulkheads
  - Increased wave energy removes fine

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sediment
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#### Human Impacts on Salmon Stocks • The Four H's - Habitat (our main focus) - Hydropower

- · Dam & irrigation impacts on rivers
- Blockage of up- & downstream salmon passage
  - Fish ladders aren't everything
  - Not a major issue on Puget Sound
- Alteration of up- & downstream flow
- Hatcheries
- Harvest

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- Salmon Stock Status Peak chinook salmon return to Puget Sound 1908 (Shared Strategy Chapter 1) - Estimated return of 690,000 fish based on cannery output - Mid-1990's returns of "wild" fish much lower • 13,000 North Sound
  - 11.000 South Sound
  - Most return to Skagit & Snohomish watersheds

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- Vulnerable to localized impacts
- 9 of 31 original stocks believed extinct

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Difficult to determine how many fish spawn in the wild
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