US Army Corps
of Engineers
Northwestern Division

Salmon and Dams: Issues and Actions

Rudd Turner

Fishery Biologist

U.S. Army Corps of Engineers

Northwestern Division

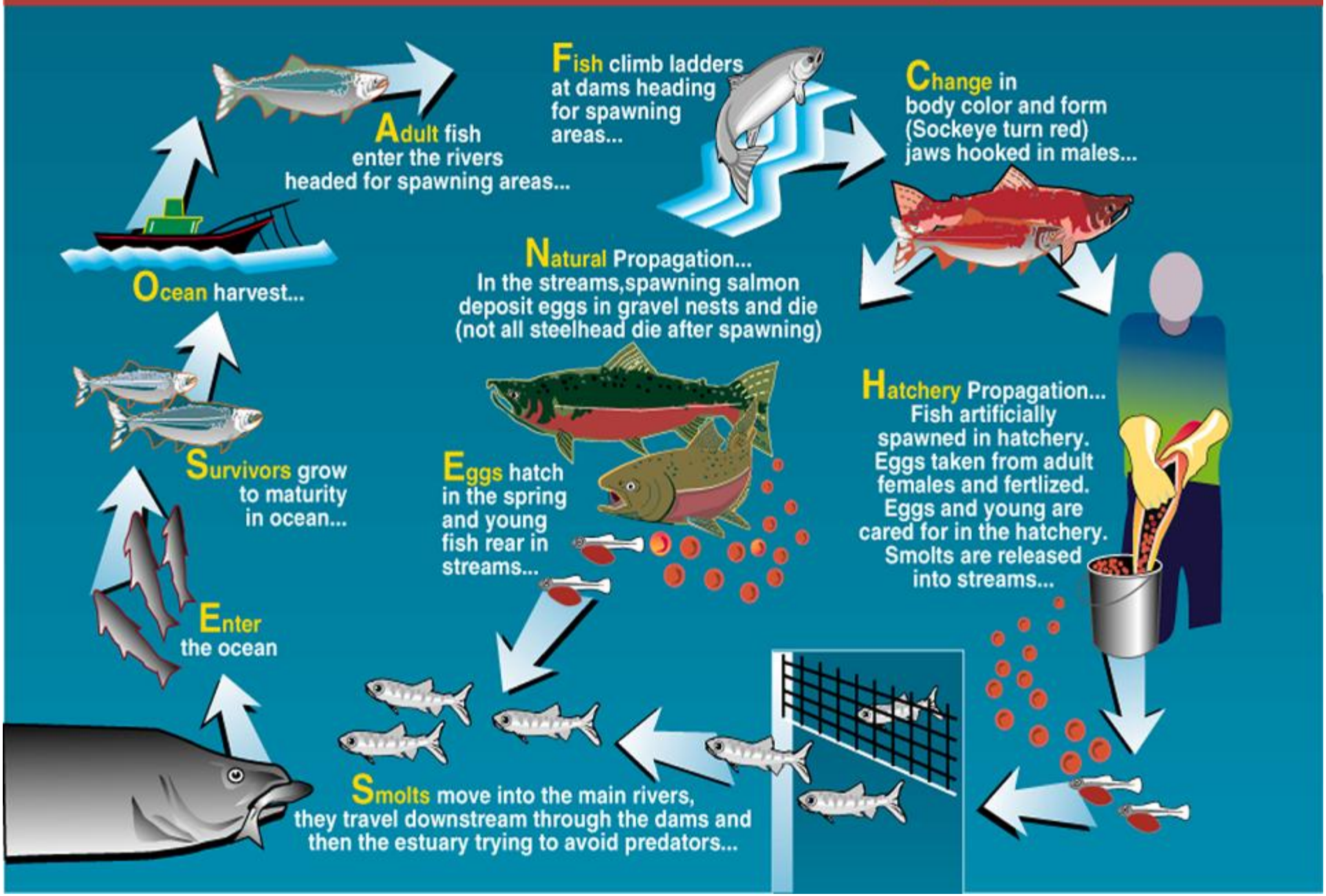
April 28, 2008

US Army Corps
of Engineers
Northwestern Division

Topics

- Salmon life cycle and migration timing
- Fish Operations
- Fish Passage Research
- Laws and policies
- Coordination

Anadromous Fish Life Cycle



US Army Corps
of Engineers
Northwestern Division

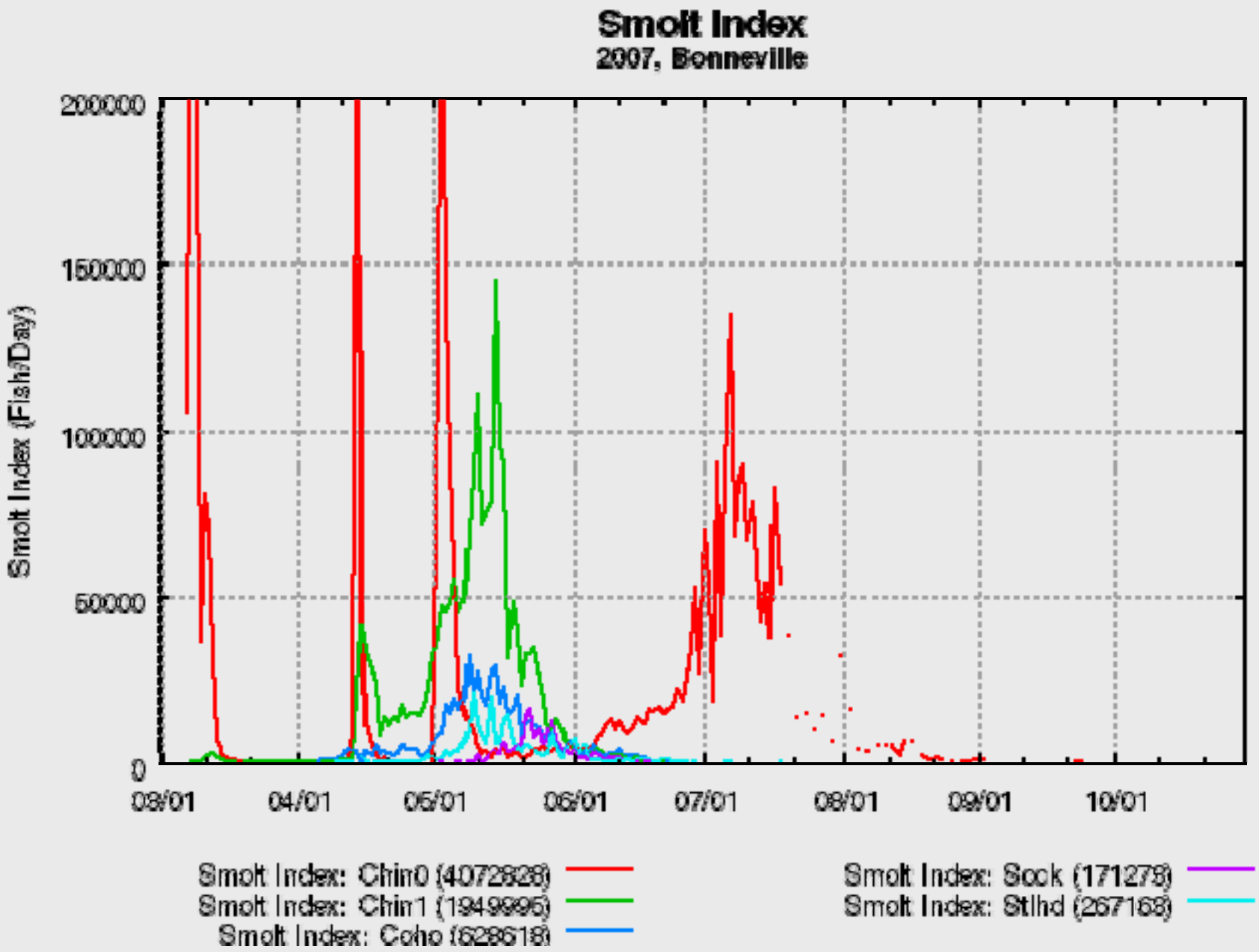
Chinook salmon

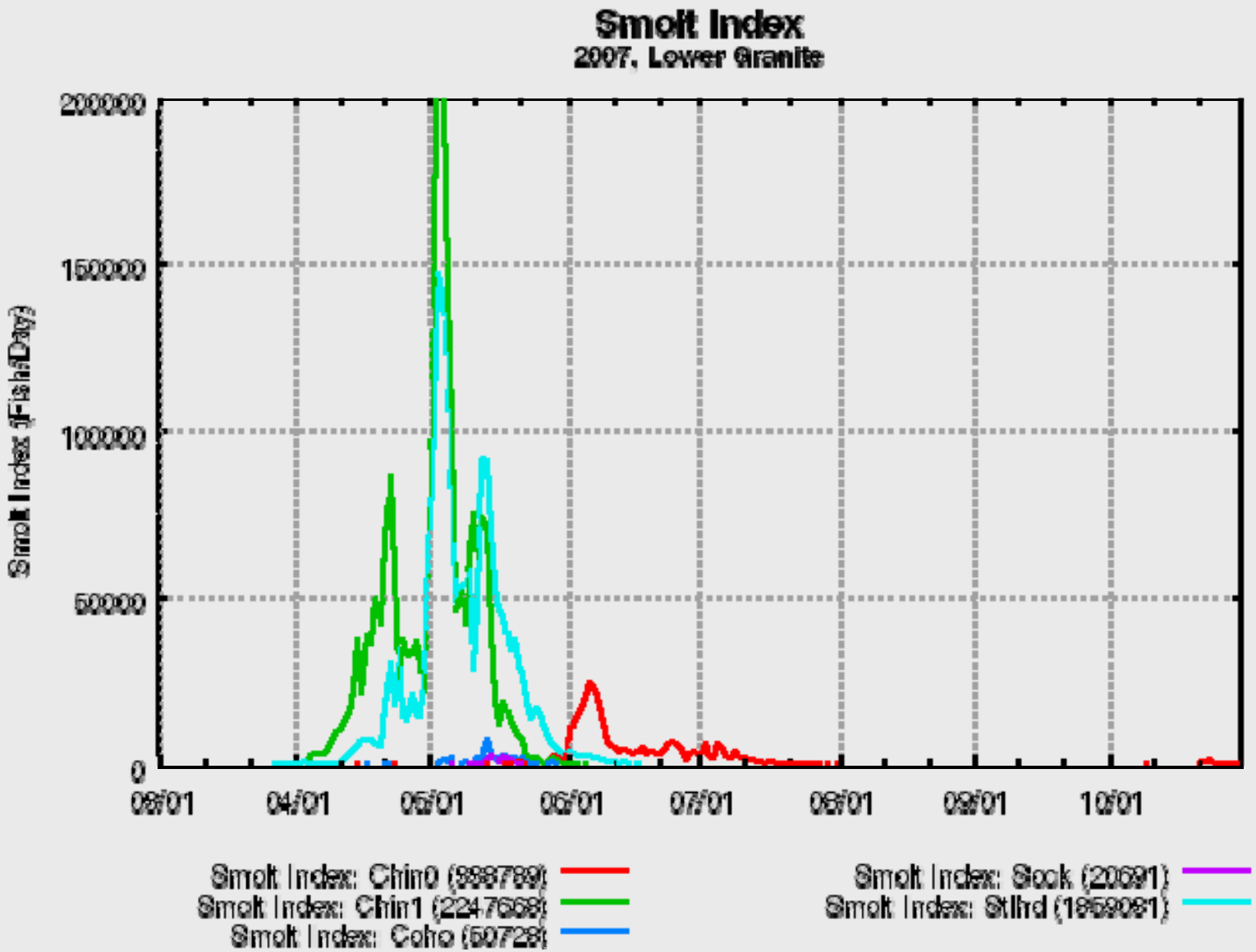
Chum Salmon
Columbia River (threatened)
Chinook Salmon
Snake River Fall (threatened)
Snake River Spring/Summer (threatened)
Lower Columbia River (threatened)
Upper Columbia River Spring (endangered)
Upper Willamette River (threatened)
Steelhead
Snake River Basin (threatened)
Lower Columbia River (threatened)
Middle Columbia River (threatened)
Upper Columbia River (endangered)
Upper Willamette River (threatened)
Sockeye Salmon
Snake River (endangered)
Coho
Lower Columbia River (threatened)
White Sturgeon
Kootenai River (endangered)
Bull Trout
Clark Fork (threatened)
Canadian Dams
Federal Dams
Non-Federal Dams
Blocked Passage
Canada
U.S.
Columbia
Kootenai
Clark Fork
MT
N
Snake
WA
Puget Sound
PACIFIC OCEAN
Columbia
Snake
Willamette
OR
ID
Snake
NV
CA
Columbia River Basin

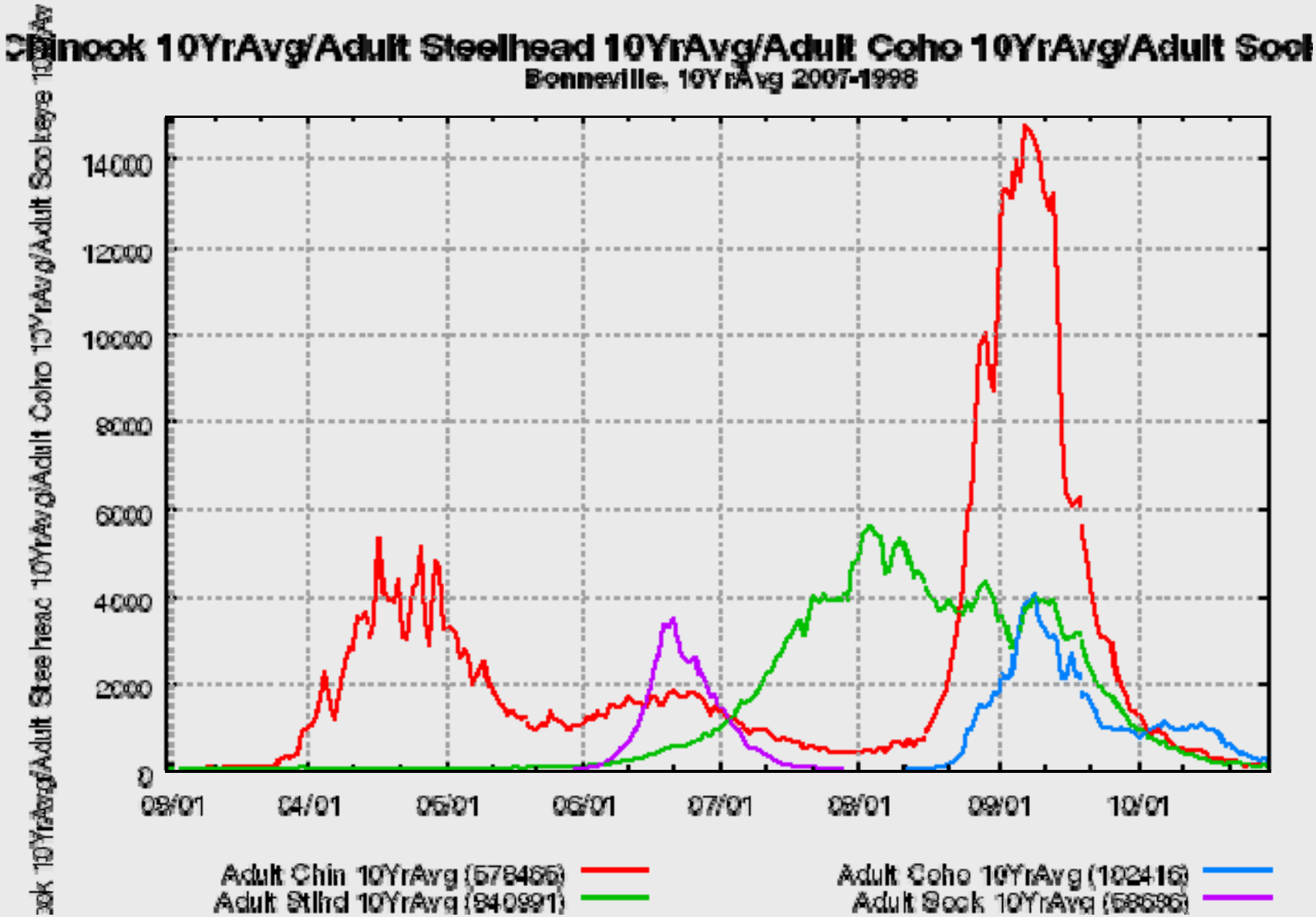
US Army Corps of Engineers
Northwestern Division

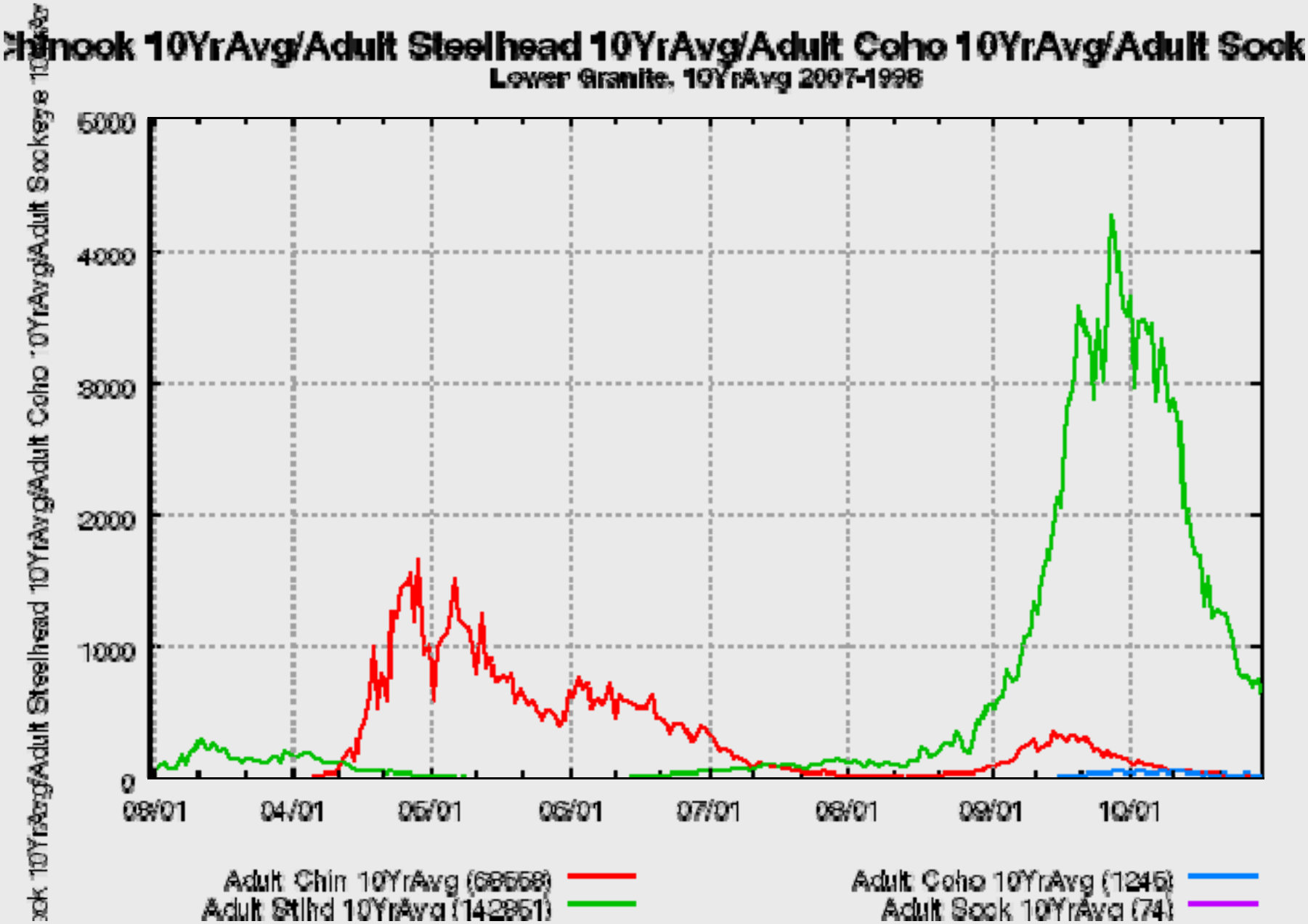
Fish Migrations

- Juvenile, downstream passage
  - Spring: yearling spring/summer Chinook, steelhead, sockeye, chum (early)
  - Summer: subyearling fall Chinook, sturgeon (early)
- Adult, upstream passage
  - Chinook: spring, summer, fall
  - Steelhead: winter, early spring, summer, fall
  - Sockeye: early summer
  - Sturgeon: early summer


Smolt Index
2007, Bonneville
Smolt Index (Fish/Day)
200000
150000
100000
50000
0
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
Smolt Index: Chin0 (4072828)
Smolt Index: Chin1 (1949995)
Smolt Index: Coho (628618)
Smolt Index: Sock (171278)
Smolt Index: Stlhd (267168)


Smolt Index
2007, Lower Granite
Smolt Index (Fish/Day)
200000
150000
100000
50000
0
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
Smolt Index: Chin0 (888789)
Smolt Index: Chin1 (2247668)
Smolt Index: Coho (50728)
Smolt Index: Stock (20691)
Smolt Index: Stlhd (1859091)


Chinook 10YrAvg/Adult Steelhead 10YrAvg/Adult Coho 10YrAvg/Adult Sock
Bonneville, 10YrAvg 2007-1998
14000
12000
10000
8000
6000
4000
2000
0
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
Adult Chin 10YrAvg (578466)
Adult Stlhd 10YrAvg (940991)
Adult Coho 10YrAvg (102416)
Adult Sock 10YrAvg (58636)


Chinook 10YrAvg/Adult Steelhead 10YrAvg/Adult Coho 10YrAvg/Adult Sock
Lower Granite, 10YrAvg 2007-1998
5000
4000
3000
2000
1000
0
03/01
04/01
05/01
06/01
07/01
08/01
09/01
10/01
Adult Chin 10YrAvg (68568)
Adult Stlhd 10YrAvg (142851)
Adult Coho 10YrAvg (1245)
Adult Sock 10YrAvg (74)

US Army Corps
of Engineers
Northwestern Division

John Day Dam: Fish ladder and spill

US Army Corps of Engineers
Northwestern Division

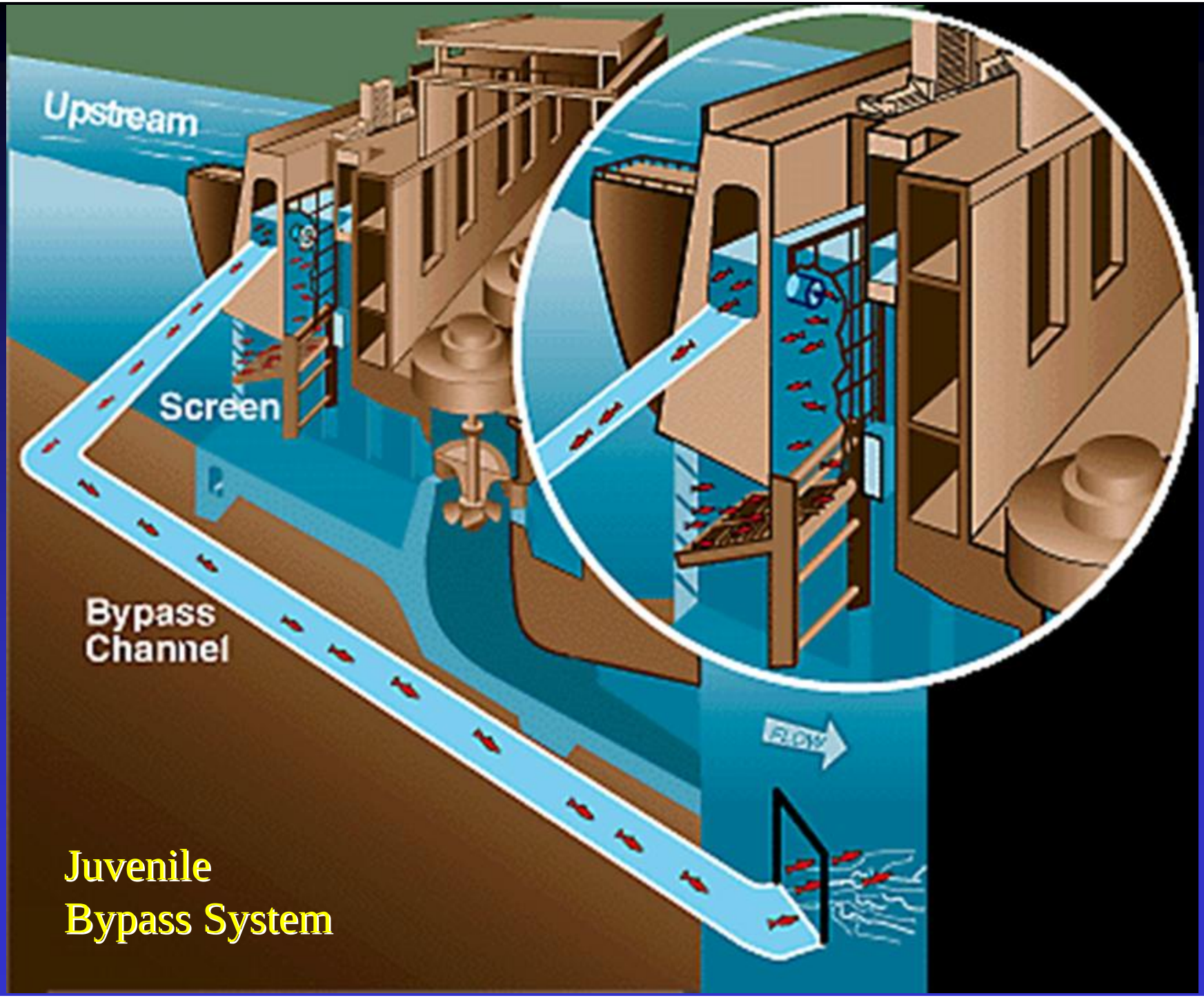
Adult fish (upstream migration)

- Fishways: collection channel with tailrace entrances
- Fish ladders: inclined water channel with weirs
- Turbine operating priorities
- Spill patterns and discharge limits

US Army Corps of Engineers
Northwestern Division

Juvenile fish (downstream migration)

- Juvenile bypass systems
- Transportation
- Spill
- Surface bypass
- Turbines
- Predator control



Juvenile
Bypass System

US Army Corps of Engineers
Northwestern Division

Juvenile Bypass Systems

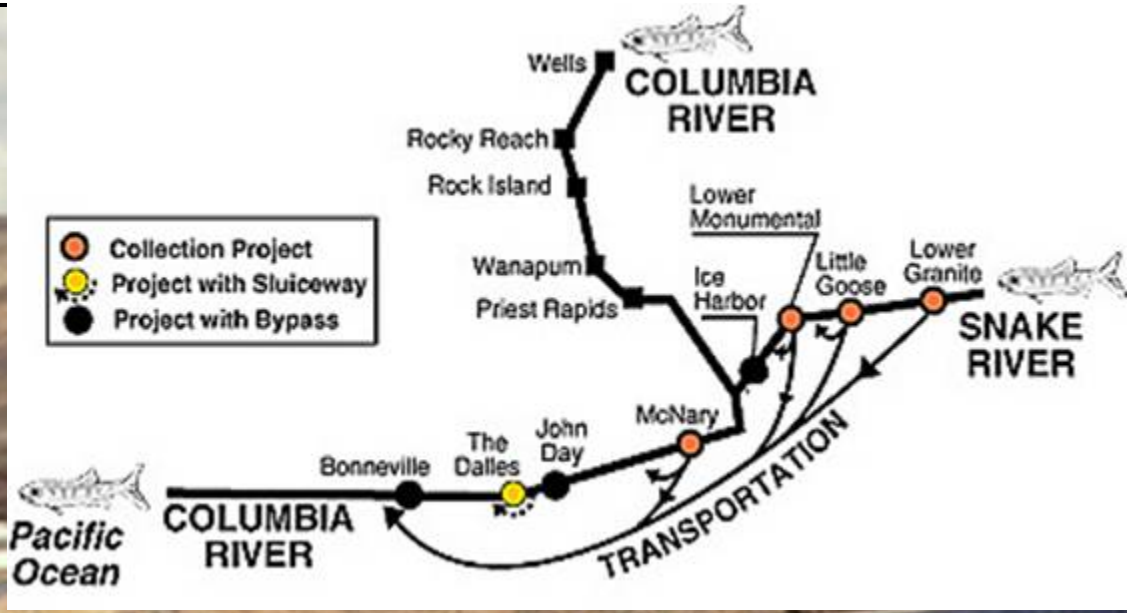
- Submersible screens, gatewell slots, transportation channel, dewatering facility, outfall
- Pros:
  - Reduce turbine passage thereby increasing survival
  - Can collect and sample fish (transportation, monitoring)
- Cons:
  - May delay fish in the forebay
  - Disrupts spatial distribution of fish
  - Damaged or clogged components can cause fish injury/mortality
  - Predation often occurs at outfalls

US Army Corps of Engineers
Northwestern Division

Transportation

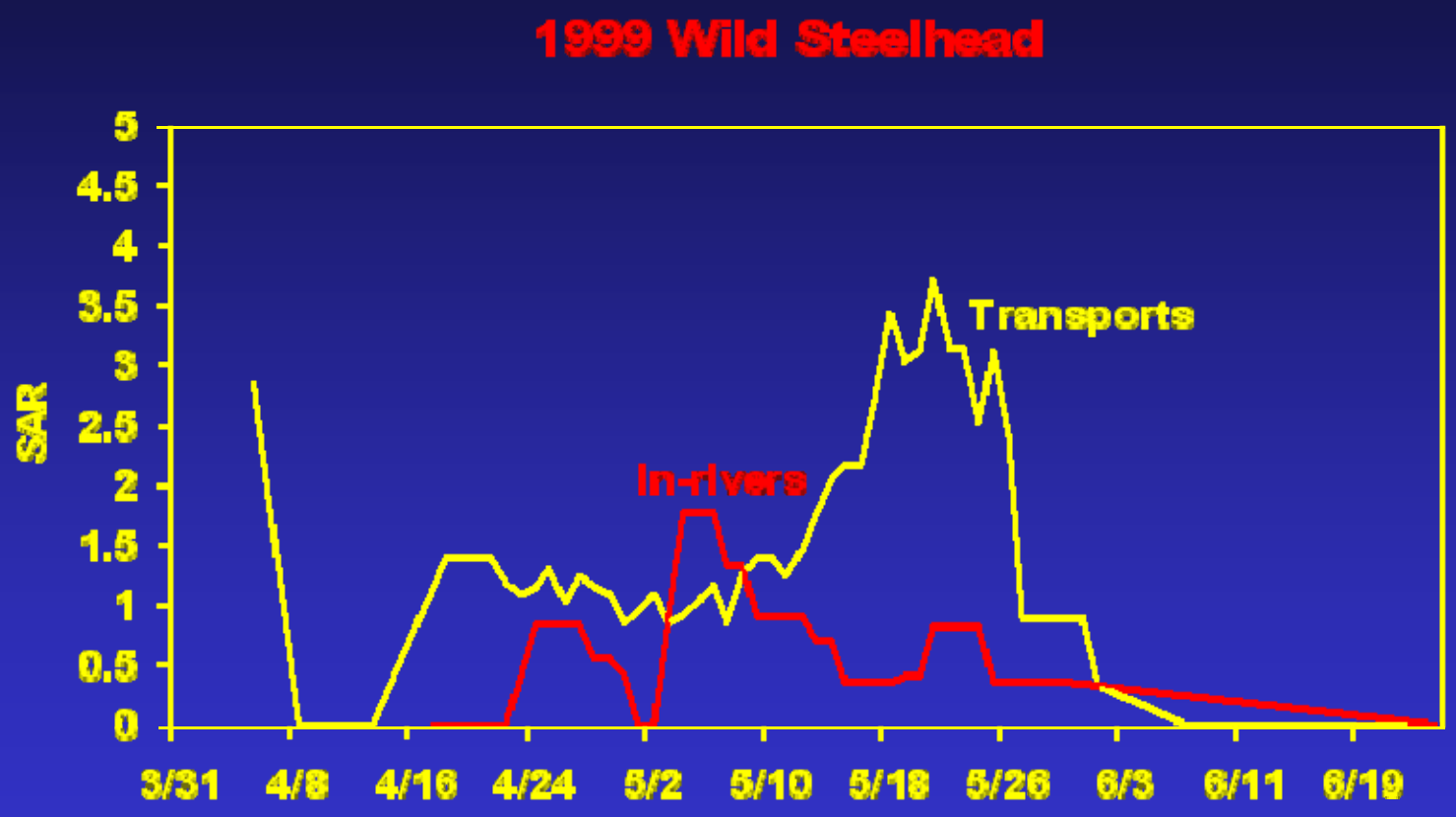
- Fish collected at 4 dams and moved downstream in barges or trucks
- Pros:
  - Avoid dam & reservoir mortality
  - WQ: When TDG levels are high, gas can be reduced
  - Cost effective: ~$4 million/year to move 10 – 20 million fish
  - Allows for spreading the risk across migratory pathways
- Cons:
  - Potential for delayed mortality
  - Potential for disease transmission
  - A level of homing impairment

Juvenile Fish Transportation Program



Collection facilities at four dams
Nearly 22 million transported in 2005

Transport and Delayed Mortality Evaluations



National Marine Fisheries Service

US Army Corps
of Engineers
Northwestern Division

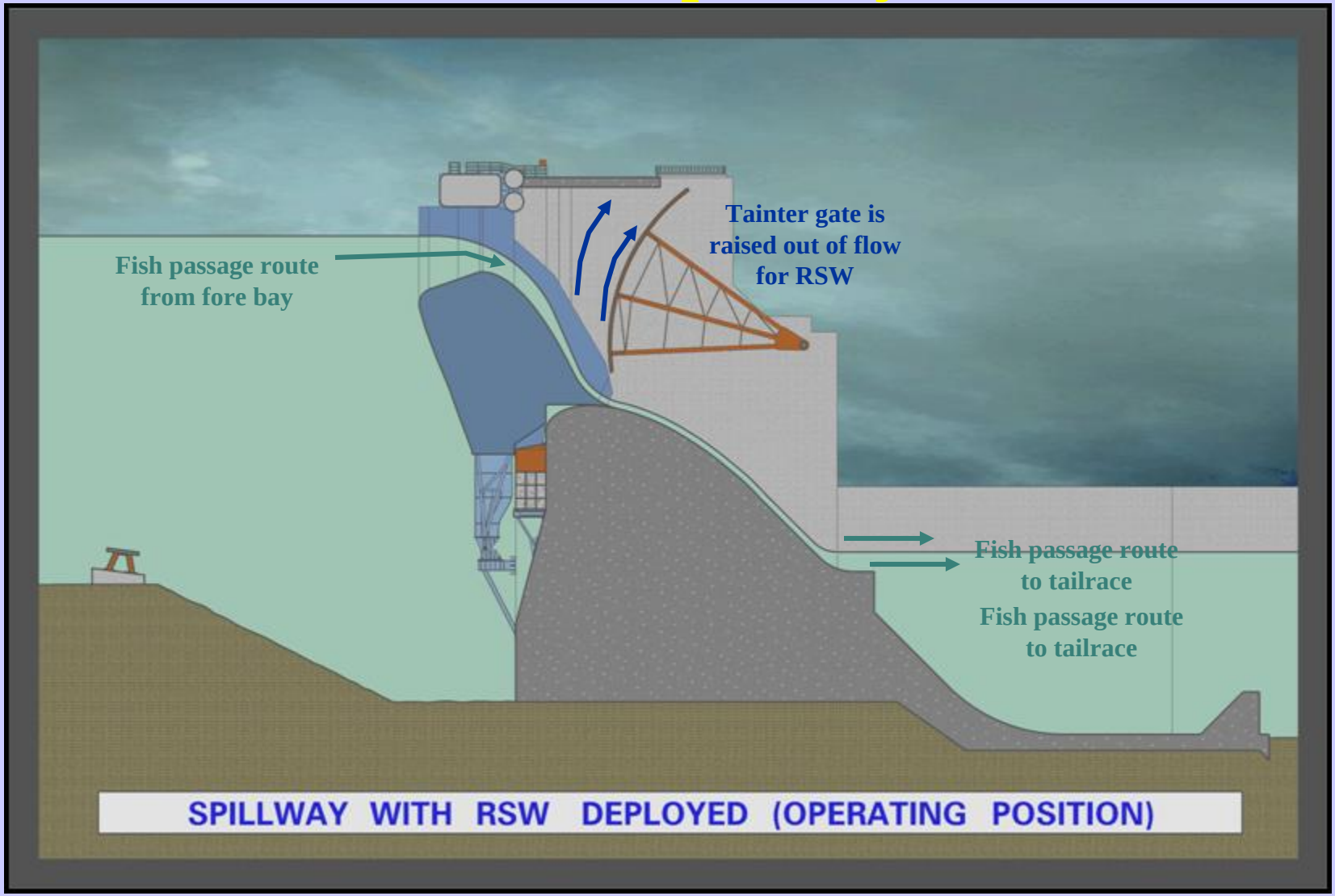
Bonneville Dam spillway

US Army Corps of Engineers
Northwestern Division

Spill

- Operate spillways April – August for fish passage
- Pros:
  - Provides a major non-turbine passage route at the dam
  - Reduce forebay delay and predation
  - Generally higher survival of all of the dam passage routes
- Cons:
  - Adult fallback
  - Degrades water quality: total dissolved gas
  - Large power cost ~$100 million/year
  - Potential spillway erosion

Removable Spillway Weir



US Army Corps of Engineers
Northwestern Division

Surface Bypass

- Pros:
  - Safe fish passage
  - Reduced forebay residence time (delay) at the dam
  - Reduced gas super-saturation; improved water quality
  - Provides for project purposes (adult fish passage, navigation, power, etc.)
  - Maintain adequate spillway capacity for major flood events
- Cons:
  - High construction cost (as an “add-on”)
  - Experimental – project specific testing

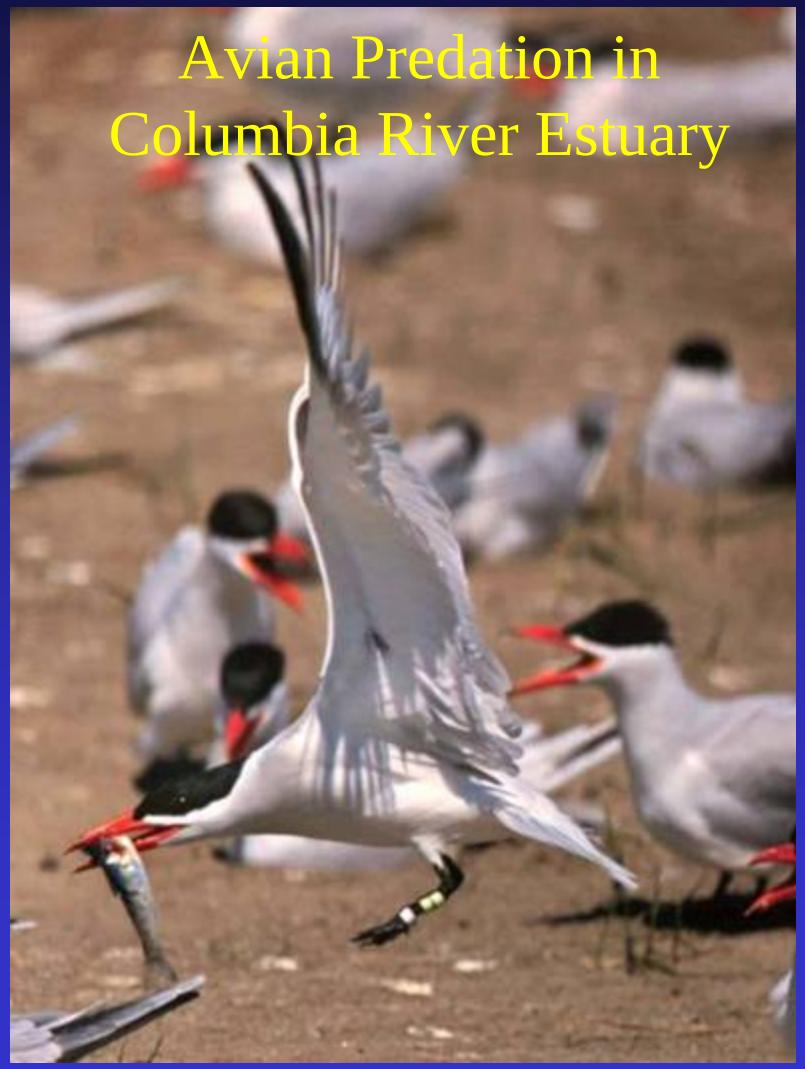
US Army Corps of Engineers
Northwestern Division

Turbines

- Fish move through operating powerhouse turbine units
- Pros:
  - Large flows
  - Can operate close to best efficiency to improve survival
  - Unit operating priorities can shape flows to aid fish passage
  - Fish-friendly designs are available – more efficient, minimum gaps
  - Provides for revenue for power production
- Cons:
  - Generally lower survival than other passage routes
  - Injury

US Army Corps of Engineers
Northwestern Division

Predator Control



Marine Mammal predation below Bonneville Dam

US Army Corps of Engineers
Northwestern Division

Anadromous Fish Evaluation Program: Purpose

"A program to provide information to assure that the Columbia and Snake River Project facilities that are designed, constructed and operated by the Corps of Engineers provide safe and efficient passage for anadromous fish"

US Army Corps of Engineers
Northwestern Division

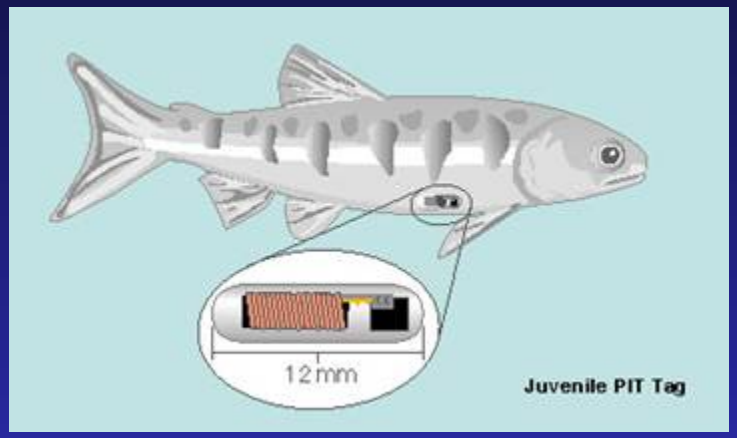
Fish Research Needs

- 1950s – Need for adult design information
- 1970s – Dissolved Gas information
- 1980s – Bypasses and transportation
- 1990s to present – Endangered Species Act

US Army Corps of Engineers
Northwestern Division

AFEP Today

- Purpose: produce scientific information to assist engineering, design, and operations decisions to support safe, efficient passage of fish
- Baseline Information: Collect data necessary for design of improvements
- Decision Support: Hydroproject Configuration, Prototype Development, Operations
- Monitoring: Support of Biological Opinions, Confirmation of Decisions



Juvenile fish passage can be monitored with the use of Passive Integrated Transponder, or PIT-tags inserted into research fish

US Army Corps
of Engineers
Northwestern Division

Estuary Research

Studies Initiated for BiOp Requirements

Habitat use study

Survival Estimations

Ocean Entry Timing

US Army Corps of Engineers
Northwestern Division

What Is Known

- All fish passage measures have advantages and disadvantages.
- No single fix will solve all problems.
- Projects have individual features and constraints and often require different solutions.
- Research results in new knowledge that can change actions and strategies.

US Army Corps of Engineers
Northwestern Division

Fish Passage Actions

- The salmon recovery program focuses on all passage routes
- Project specific solutions are required
- BiOp performance standards: project and reach survival goals of 96% for spring fish, 93% for summer fish
- Adaptive Management = be flexible
- Adopt the most cost effective means of achieving the needed project and reach survivals
- Goal is long term sustainability of natural resources, including recovery of threatened or endangered fish species

US Army Corps of Engineers
Northwestern Division

Fish Program Annual Costs

- Corps construction and testing (CRFM): ~$90 million
- Project Operations and Maintenance: ~$25 million
- Additional costs: spill and flow augmentation, BPA program (fish research, habitat, predation control)

US Army Corps of Engineers
Northwestern Division

Fish Program
Long Term Costs

- 2 major BiOps – FCRPS & Willamette
- $80 - $130 million yearly over next 5 years
- $1.3 - $1.6 billion (or greater) over the next 10 years
- Based on retrofits of existing dams

US Army Corps of Engineers
Northwestern Division

Environmental Statutes

- National Environmental Policy Act (1969)
- Fish & Wildlife Coordination Act (1958)
- Endangered Species Act (1973)
- Clean Water Act (1948, 1972)
  - State Water Quality Standards
- Northwest Power Planning & Conservation Act (1980)
  - Fish and Wildlife Program

****Treaties** with sovereign Native American tribes (1855, others)

US Army Corps of Engineers
Northwestern Division

ESA Consultation

- NOAA Fisheries issued Biological Opinions in 1995, 2000, and 2004 which were set aside by the Federal District Court.
- 2005 – 2008: Collaboration among Feds, tribes, & states to produce a new Biological Opinion
- 2008 Biological Opinion
  - Release date: May 5, 2008

US Army Corps of Engineers
Northwestern Division

FISH AND WILDLIFE

- Implement NMFS and USFWS Biological Opinions
  - Protect 14 ESA-listed species: salmon, steelhead, sturgeon, and bull trout
- Year-Round coordination with all regional agencies
  - Chair TMT
  - Prepare and implement Annual Water Management Plans and seasonal updates
  - Consider both short- and long-term goals and objectives
- Participate in: Regional Forum, Federal Execs., Regional Execs.

US Army Corps of Engineers
Northwestern Division

Environmental Operating Principles

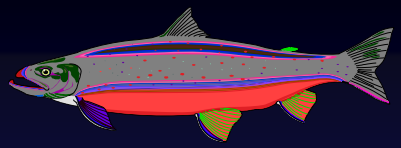
- Strive to achieve environmental sustainability.
- Recognize the interdependence of life and the physical environment.
- Seek balance and synergy among human development activities and natural systems.
- Continue to accept corporate responsibility and accountability under the law.
- Seek ways and means to assess and mitigate cumulative impacts.
- Build and share an integrated scientific, economic, and social knowledge base.
- Respect the views of individuals and groups interested in Corps activities, actively listen, and learn from their perspectives.

US Army Corps of Engineers
Northwestern Division

Annual Plans

- Water Management Plan *(1980s – present)*
  - Fall/winter update
  - Spring/summer update
- Fish Passage Plan *(1970s – present)*
  - Project operating criteria
- Fish Operations Plan *(2006 – 2008)*
  - Spill, AFEP research, and transportation

Salmon Program Coordination



Federal Family

- BOR
- BPA
- NMFS
- USFWS
- COE

Interest Groups

CRITFC: Columbia River Inter-Tribal Fish Commission

CBFWA: Columbia Basin Fish & Wildlife Authority

ENVIRONMENTAL

American Rivers
Federation of Fly Fishers
Idaho Steelhead & Salmon Unlimited
Idaho Rivers United
Institute for Fishery Resources
NWF--National Wildlife Federation
NRDC--Natural Resources Defense Council
NRIC--Northwest Resource Information Center
NSIA--Northwest Sportfishing Industry Assn
ONRC--Oregon Natural Resources Council
PCFFA--Pacific Coast Federation of Fishermens Assns
PRC--Pacific Rivers Council
SOWS--Save Our Wild Salmon
Sierra Club
Trout Unlimited
Washington Trollers Assn

INDUSTRY

CRA--Columbia River Alliance
DSIs--Direct Service Industries
IPC--Idaho Power Company
NPP--Northwest Power Pool Coordinating Pool
NWPPA--Northwest Public Power Assn
PNGC--Pacific Northwest Generating Cooperative
PNUCC--Pacific Northwest Utilities Conference Committee
PNWA--Pacific Northwest Waterways Assn
PPC--Public Power Council
River Partners

Tribes

Burns Paiute Indian Colony
Coeur D'Alene Tribe of the Coeur D'Alene Res
Confederated Salish and Kootenai Tribes of the Flathead Res
Confederated Tribes of the Bands of the Yakama Indian Nation of the Yakama Res
Confederated Tribes of the Colville Res
Confederated Tribes of the Umatilla Res
Confederated Tribes of the Warm Springs Res
Kalispel Indian Community of the Kalispel Res
Kootenai Tribe of Idaho
Nez Perce Tribe of Idaho
Shoshone/Bannock Tribes of the Fort Hall Res
Shoshone-Pauite Tribes of the Duck Valley Res
Spokane Tribe of the Spokane Res

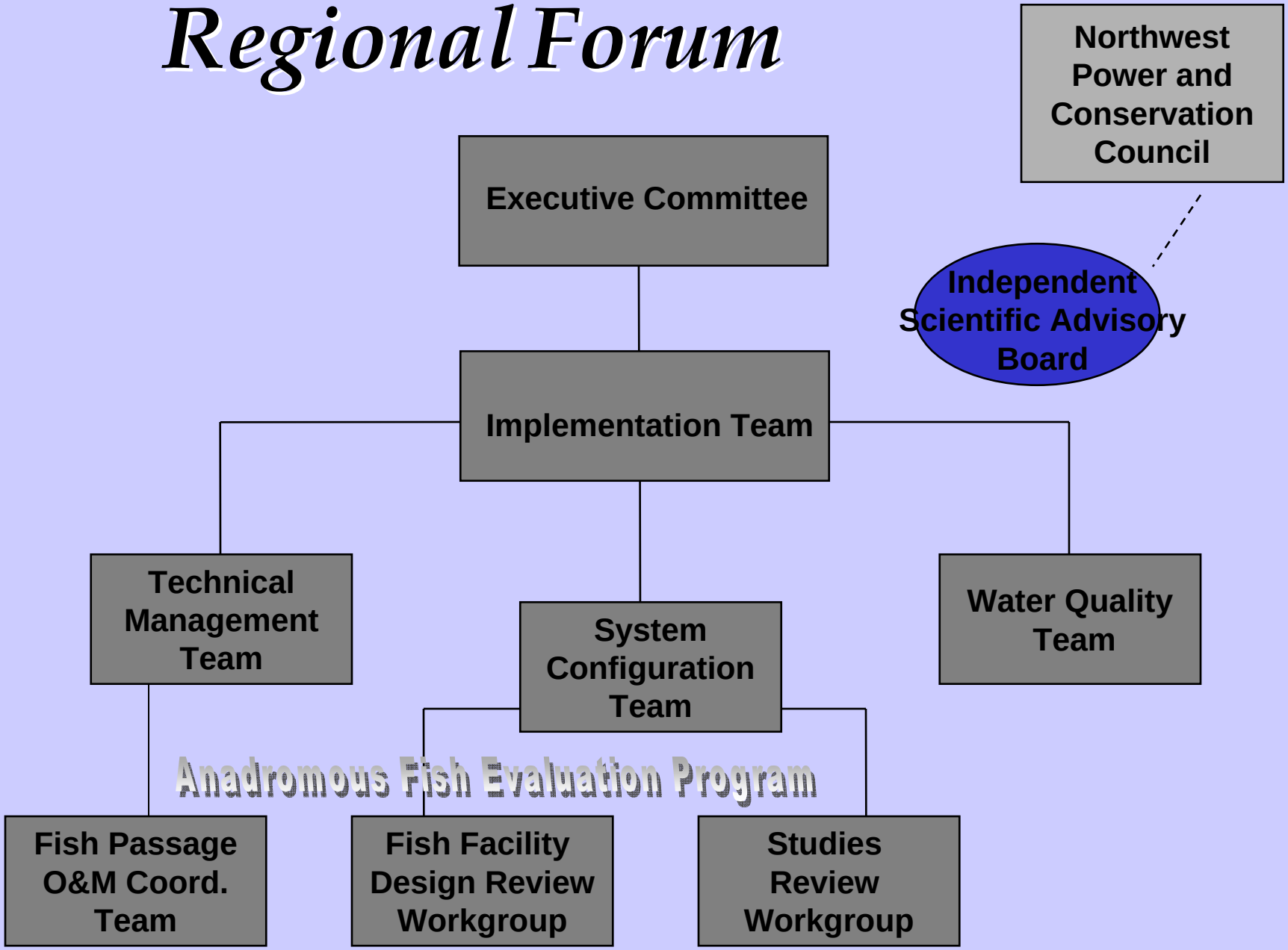
States

Idaho Dept of Fish & Game
Oregon Dept of Fish & Wldlfe
Washington Dept of Fish & Wldlfe
Montana Dept of Fish, Wldlfe & Parks

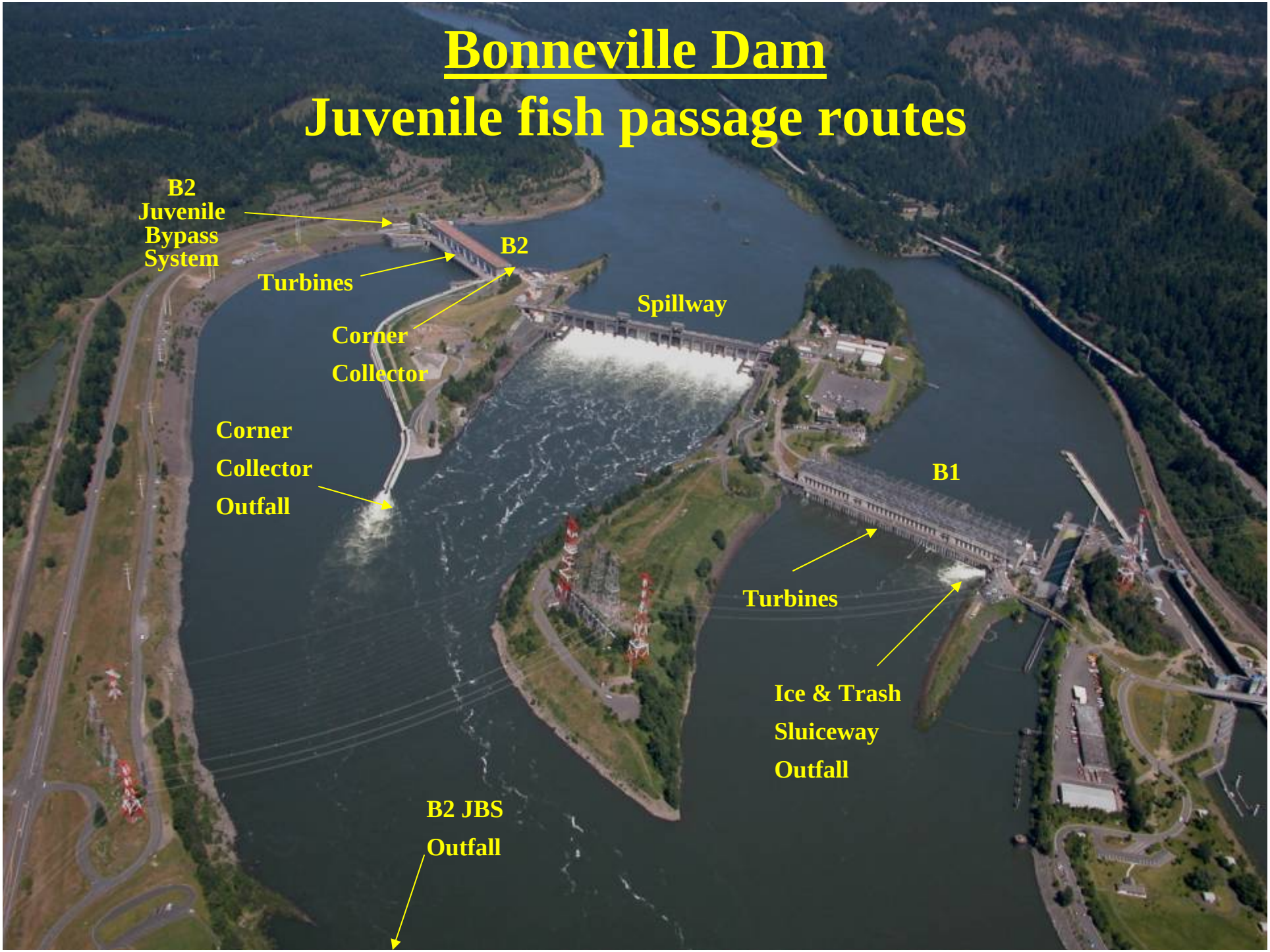
Northwest Power and Conservation Council

Idaho Members
Montana Members
Oregon Members
Washington Members

Regional Forum



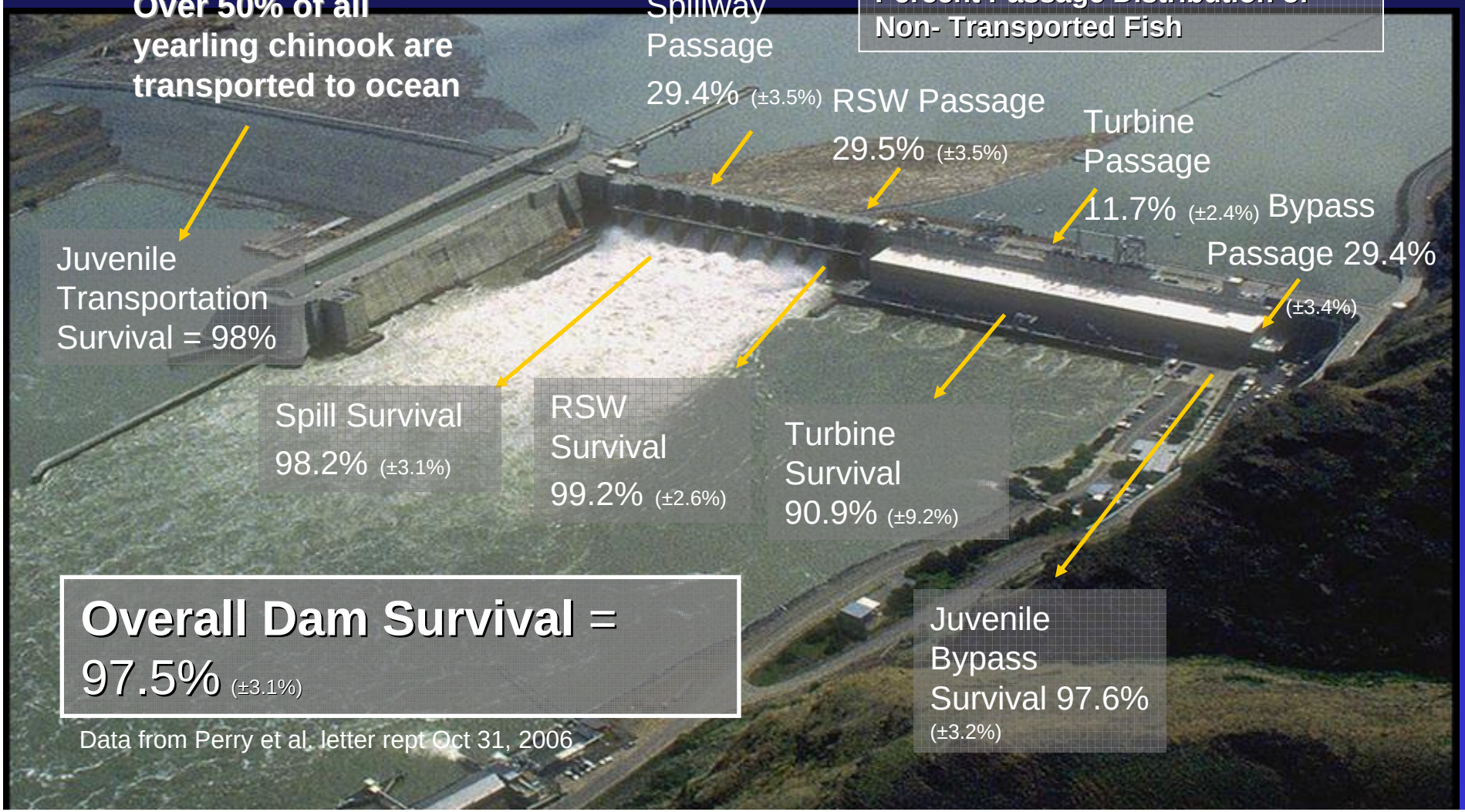
Bonneville Dam
Juvenile fish passage routes



US Army Corps of Engineers
Northwestern Division

Lower Granite Dam

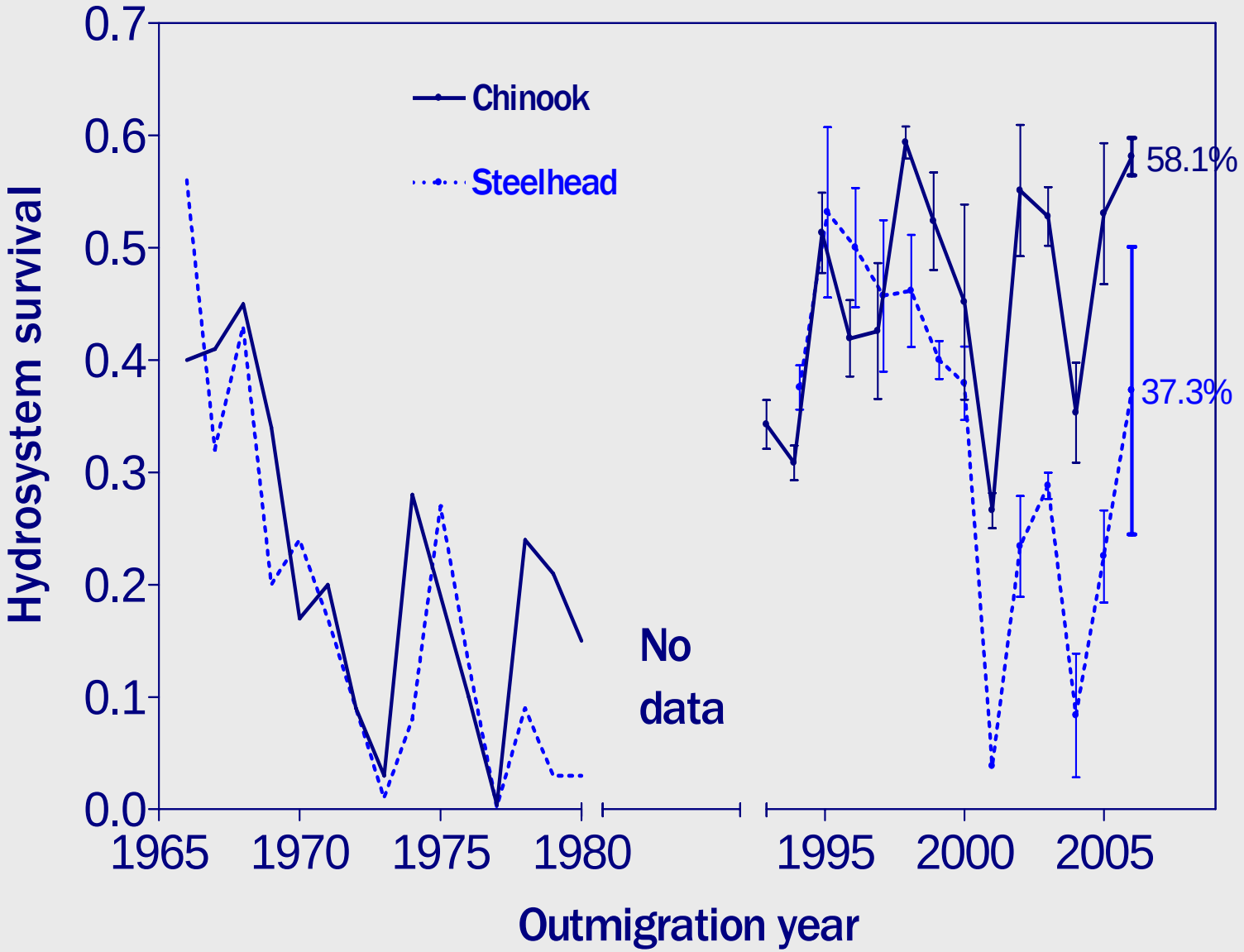
2006 Passage & Survival Estimates



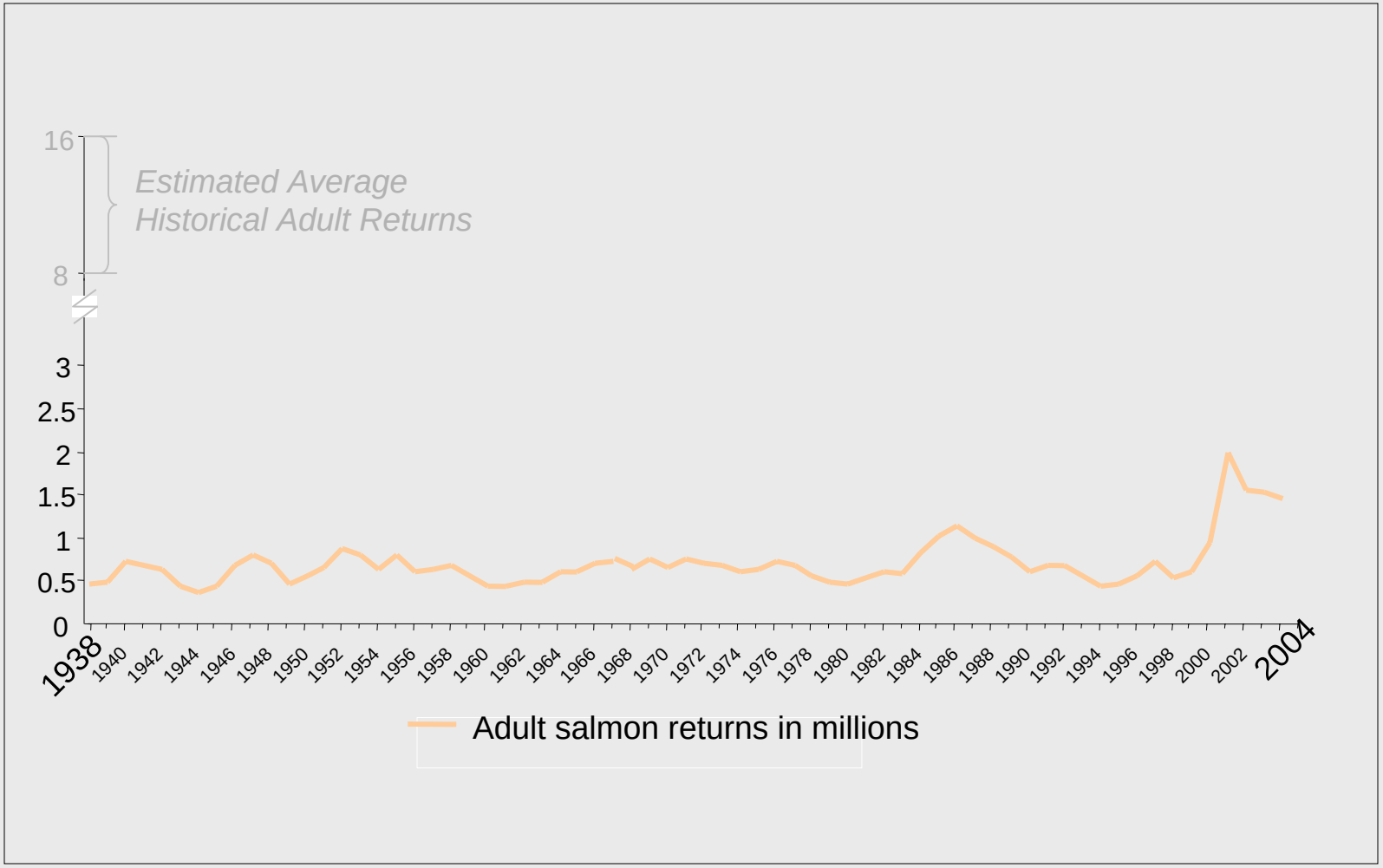
Data from Perry et al. letter rept Oct 31, 2006

Snake River Trap to Bonneville Dam Tailrace

Per-project expansion in some years



Adult Salmon Counts at Bonneville Dam from 1938 to 2004



US Army Corps of Engineers
Northwestern Division

QUESTIONS ???