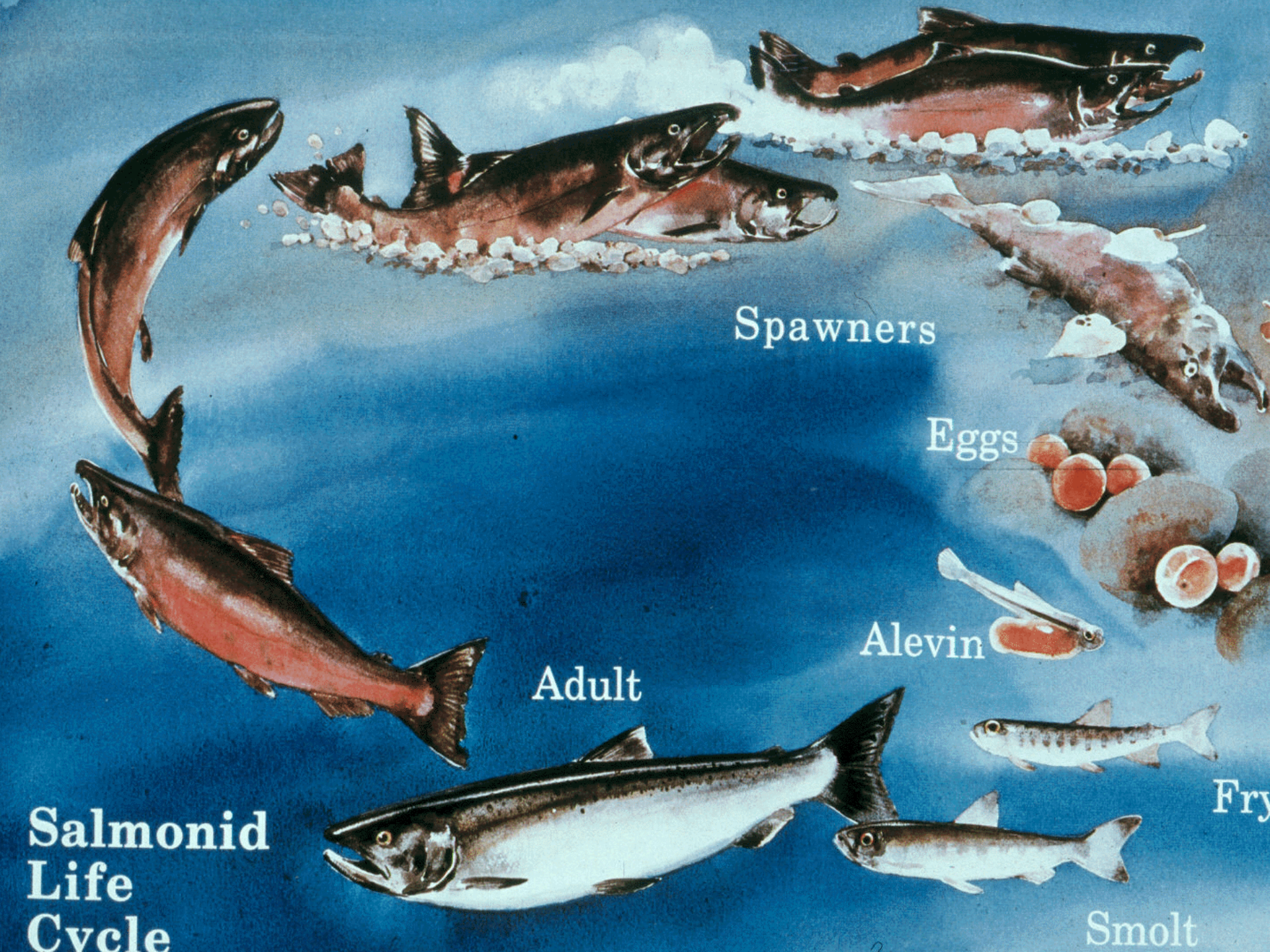
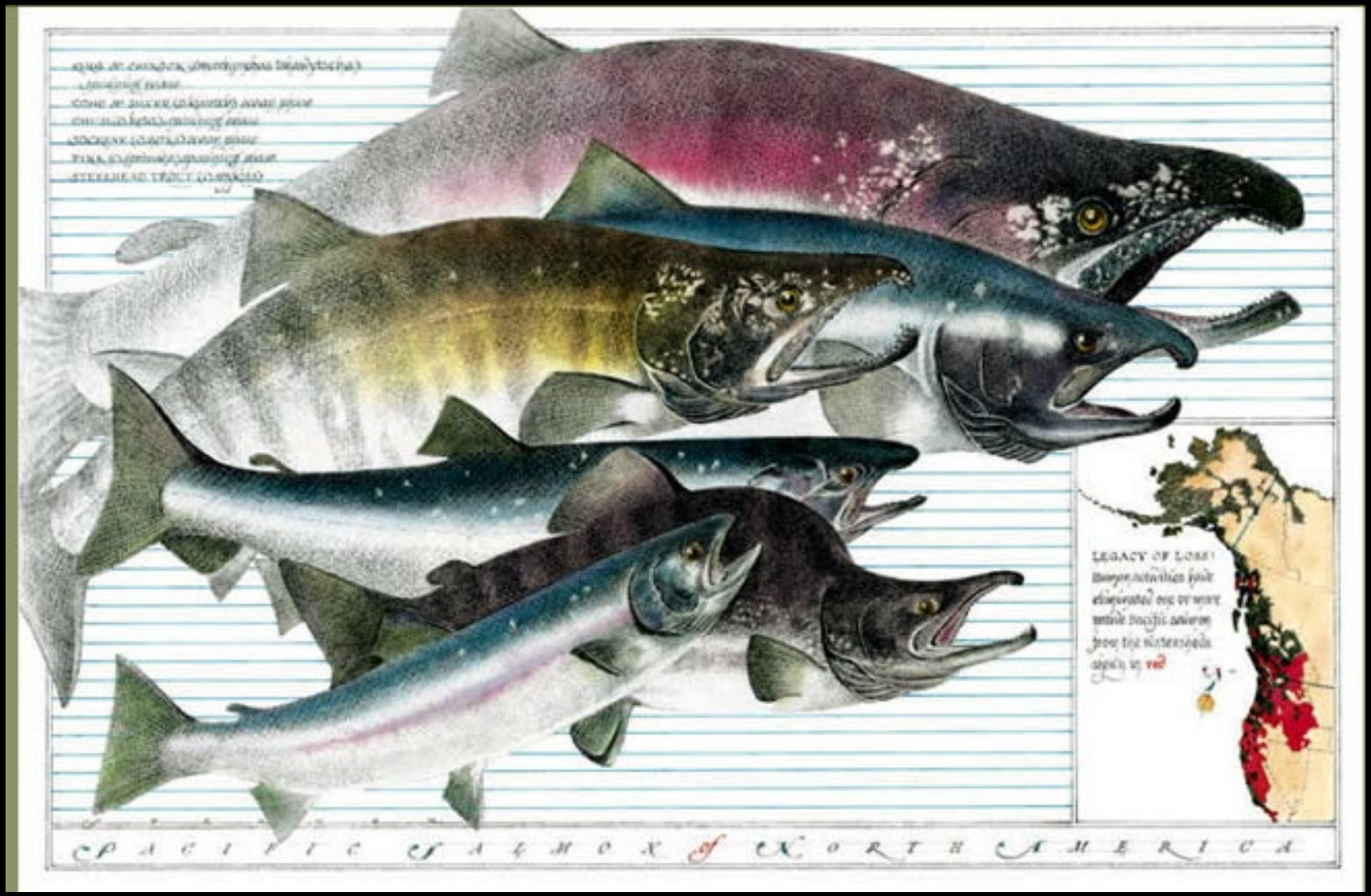
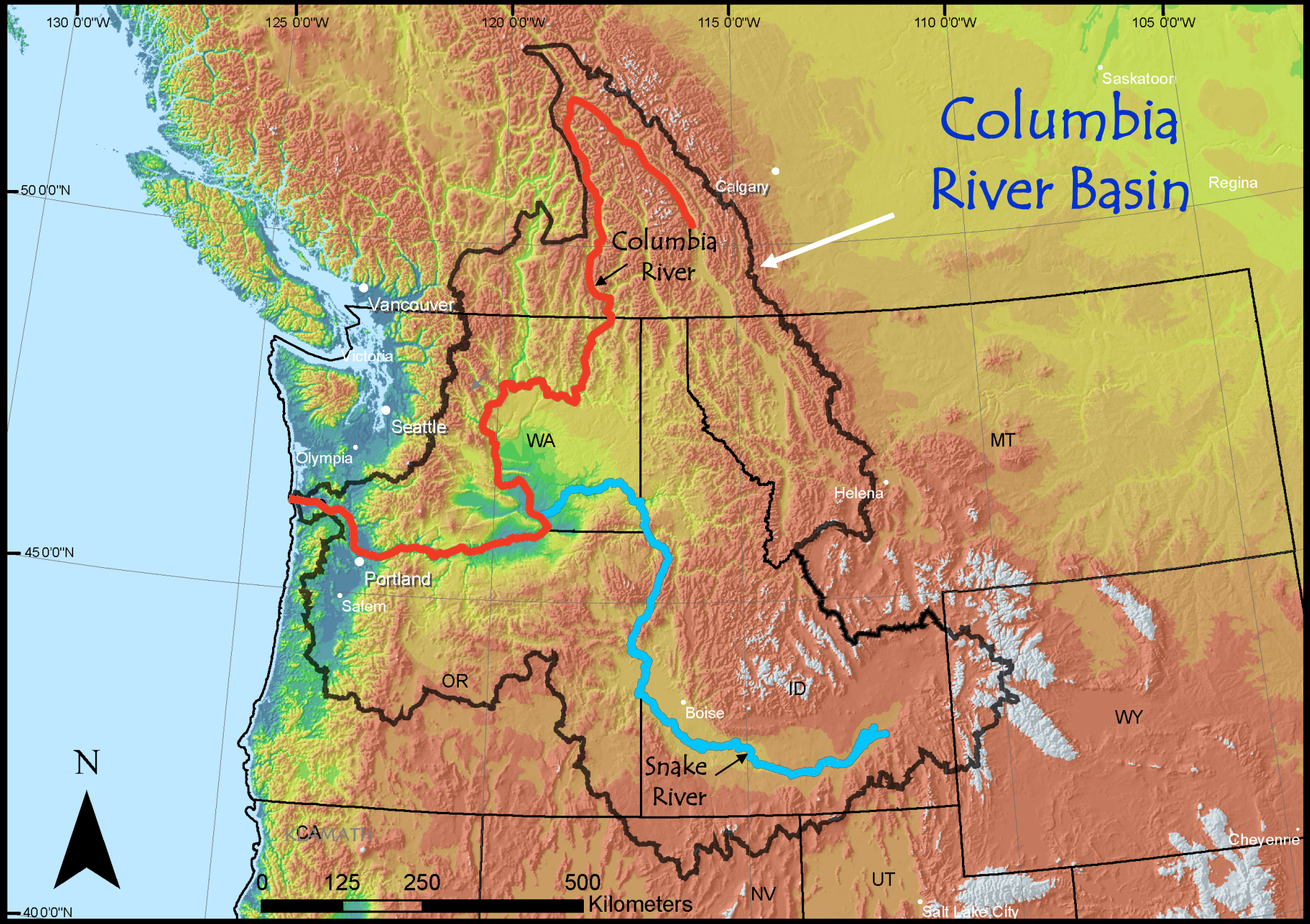
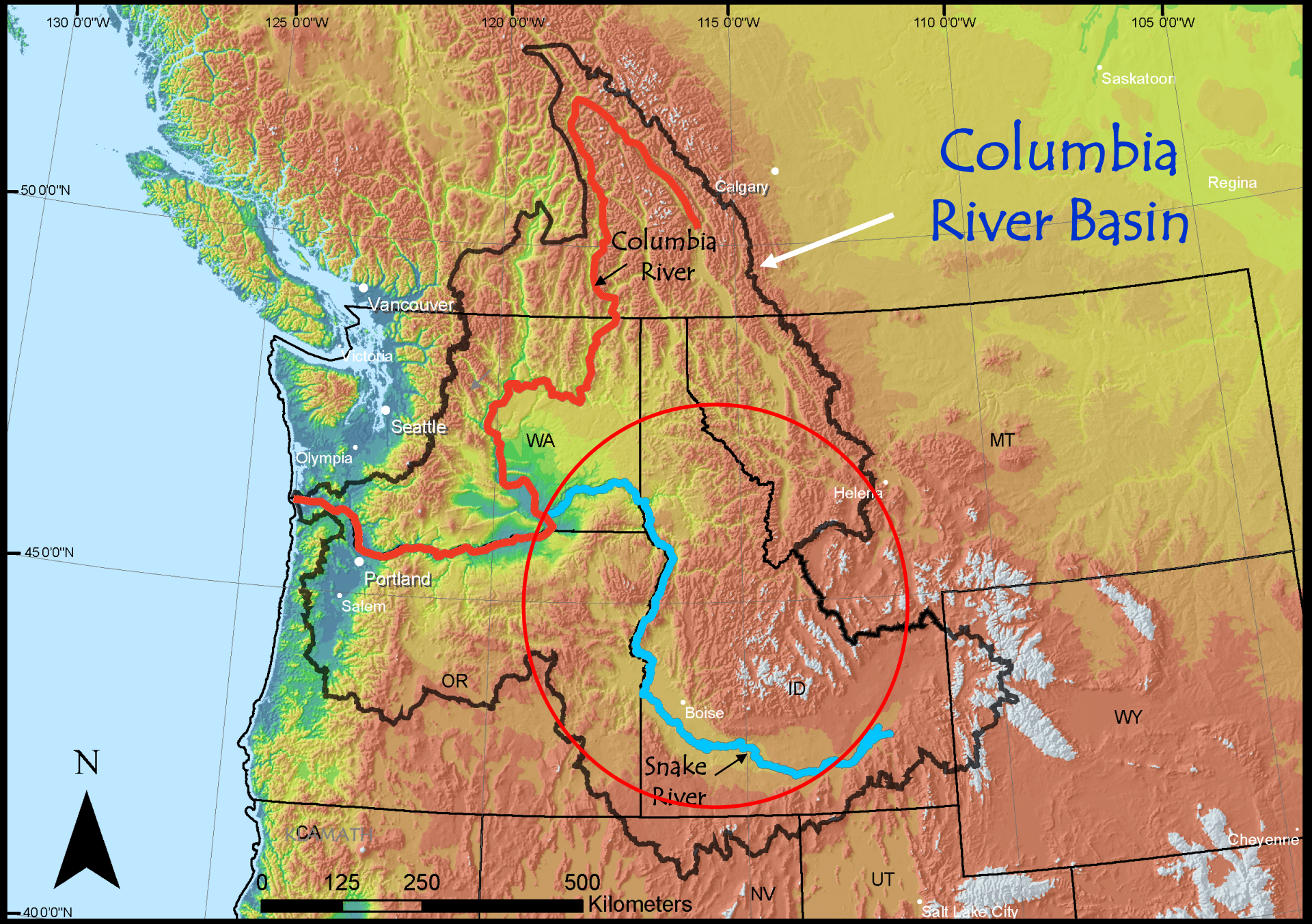

Spawners
Eggs
Alevin
Adult
Fry
Smolt
Salmonid
Life
Cycle

Pacific Salmon
Oncorhynchus




Columbia River Basin
Columbia River
Snake River
130 0'0"W
125 0'0"W
120 0'0"W
115 0'0"W
110 0'0"W
105 0'0"W
50 0'0"N
45 0'0"N
40 0'0"N
Saskatoon
Calgary
Regina
Vancouver
Victoria
Seattle
Olympia
Portland
Salem
WA
OR
CA
MT
ID
WY
NV
UT
Helena
Boise
Cheyenne
Salt Lake City
KLAMATH
N
0
125
250
500
Kilometers


Columbia River Basin
Columbia River
Snake River
130 0'0"W
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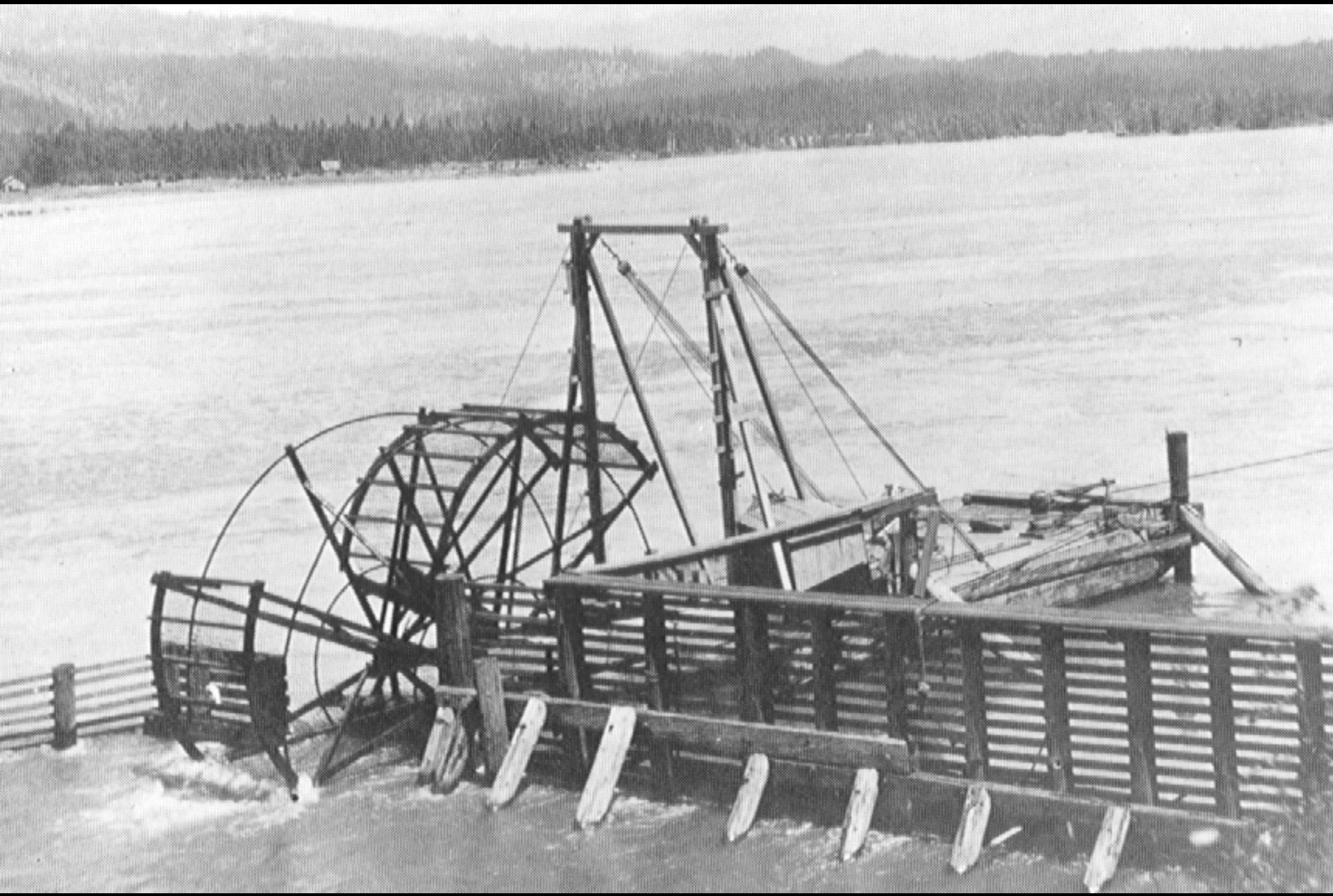
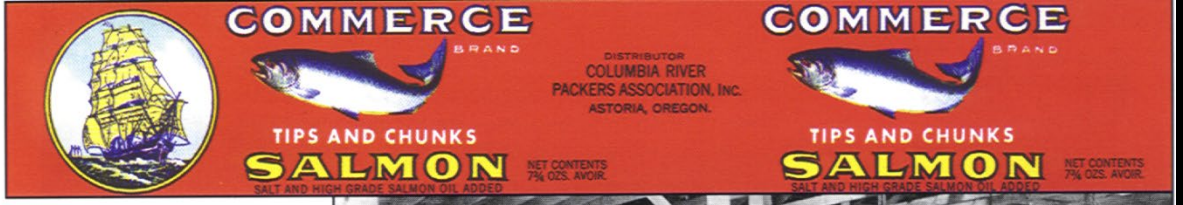
115 0'0"W
110 0'0"W
105 0'0"W
50 0'0"N
45 0'0"N
40 0'0"N
Saskatoon
Regina
Calgary
Vancouver
Victoria
Seattle
Olympia
Portland
Salem
Helena
Boise
Salt Lake City
Cheyenne
WA
OR
CA
ID
MT
WY
NV
UT
KLAMATH
N
0
125
250
500
Kilometers


ARKive

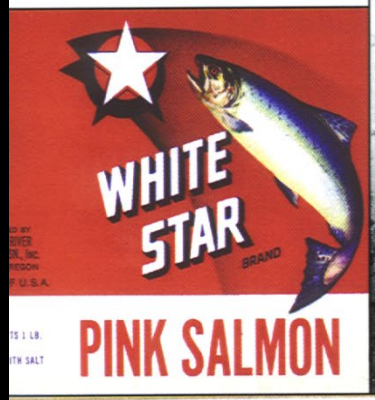


“The Great Barbecue”

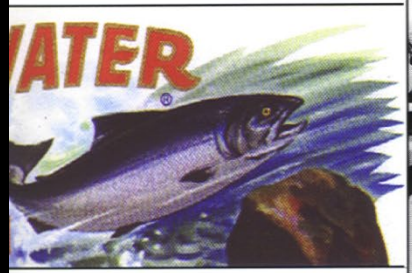

SALMON CANNERY - ASTORIA, O

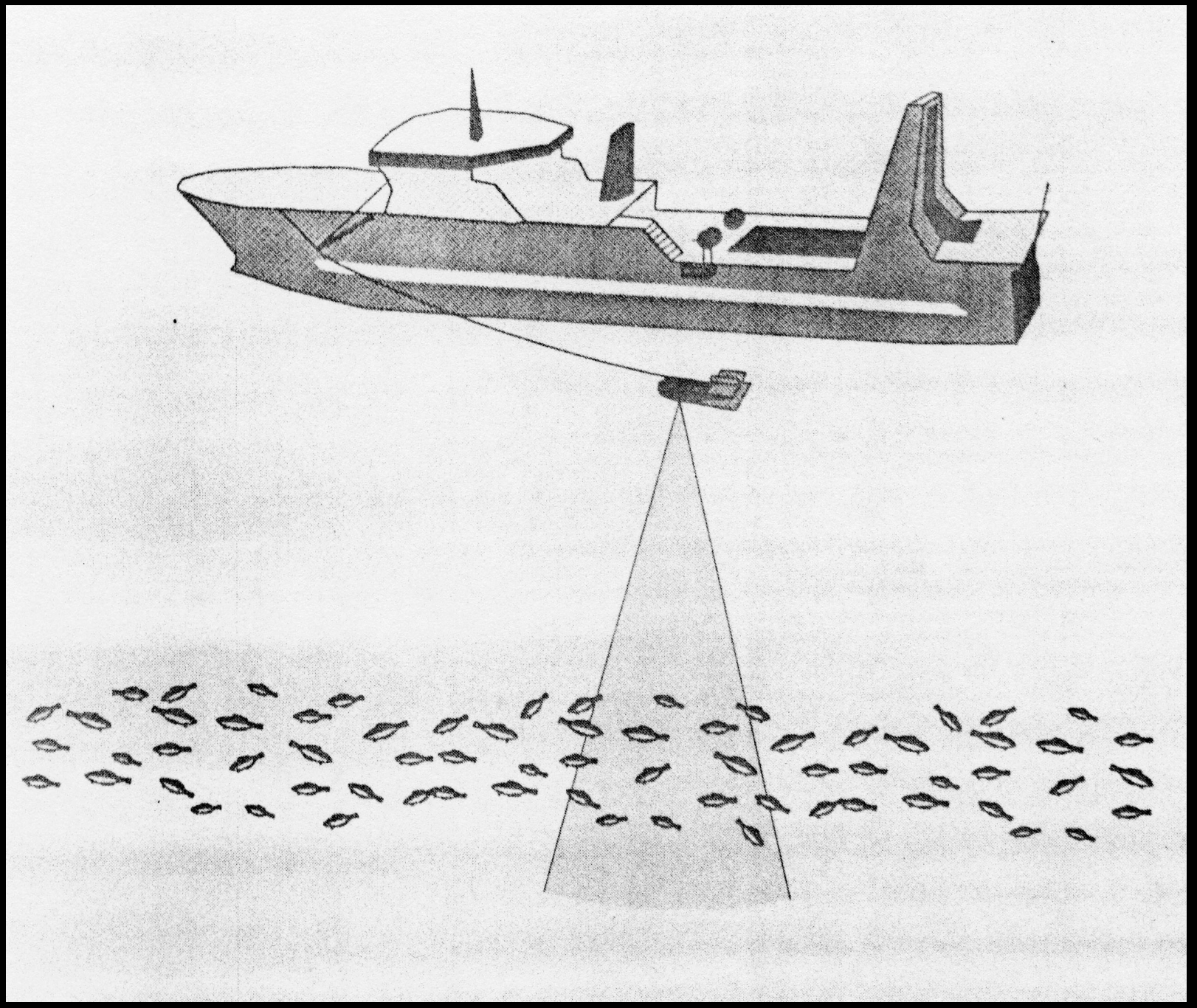


Cannery workers pack salmon for shipping.



Canning, Astoria, Oregon.





ACOE involvement

- Navigation
- Flooding
- The Rivers and Harbors Act of 1927
  - Comprehensive river-basin studies on approximately 200 waterways
    - For navigation
    - For hydropower
  - Columbia = comprehensive 10- dam plan (Grand Coulee- Bonneville)

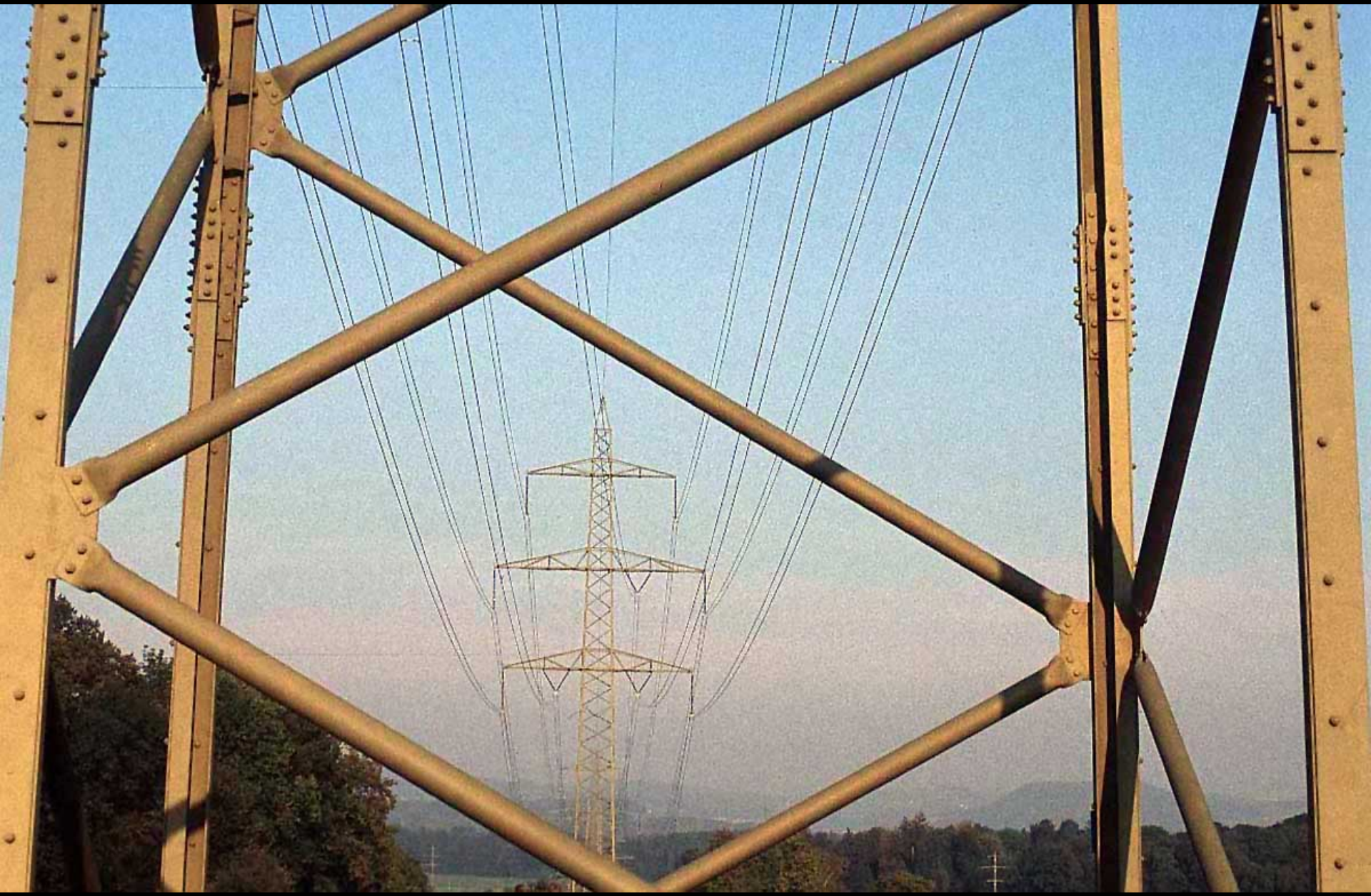
Steamboats Entering Cascade Locks

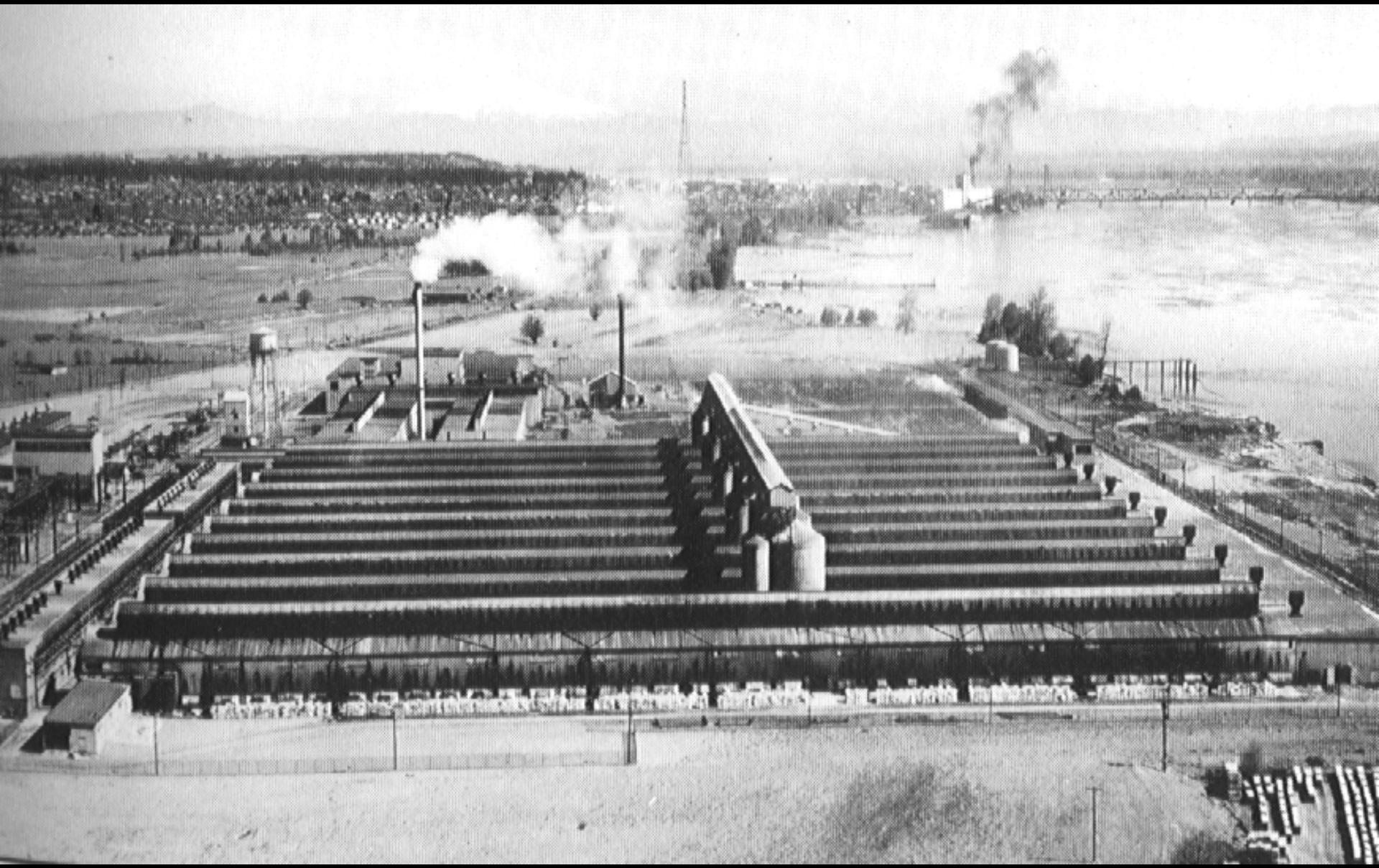
- image courtesy of the Portland District - US Army Corps of Engineers


HOLMES BUSINESS COLLEGE
HARDWARE & STOVES
MAIN OFFICE OF
W.U. TELEGRAPH


Oregon
Washington
Bonneville Dam


NO SMOKING



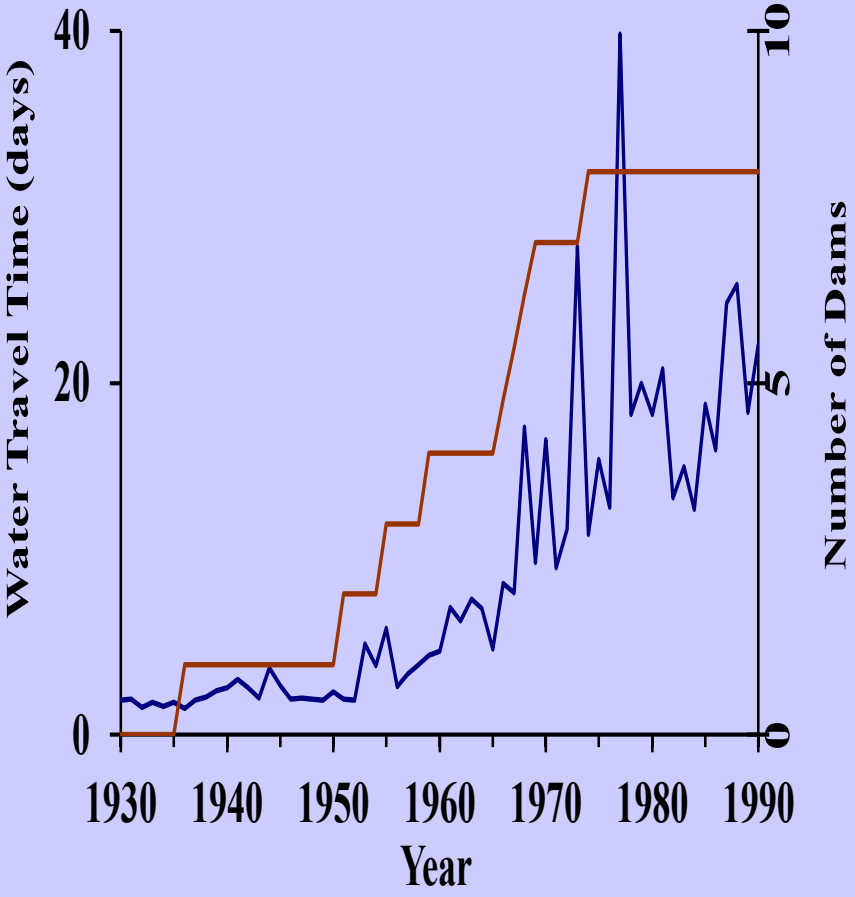


Hydropower System Development

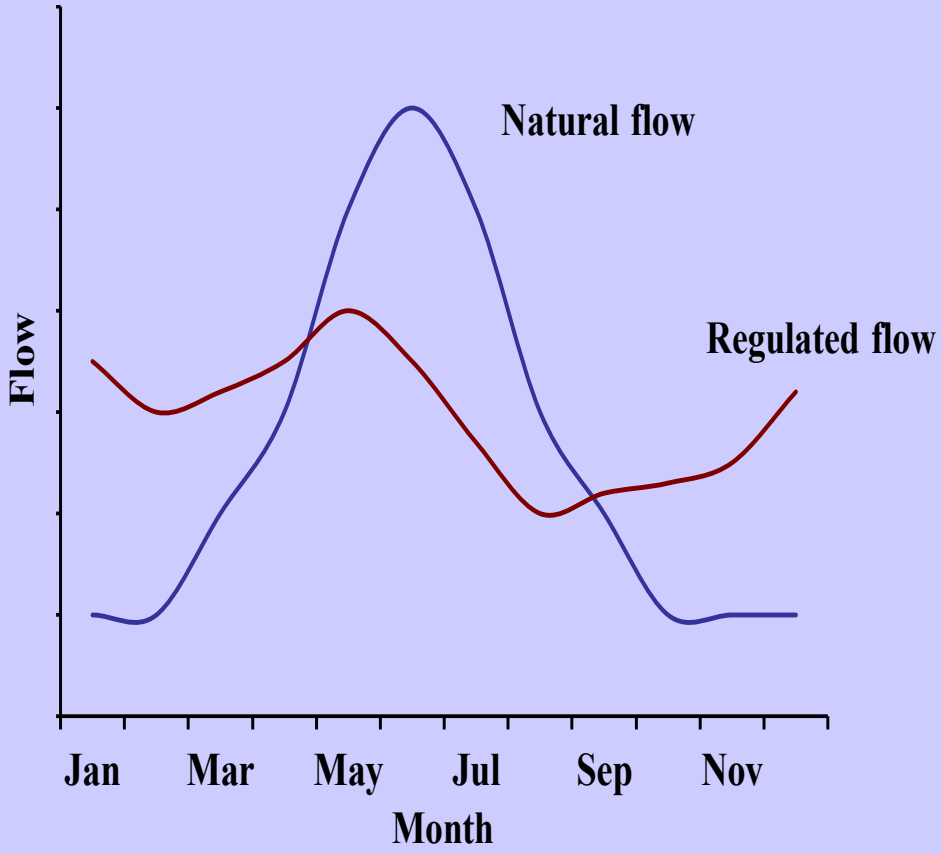
- Blocked spawning areas
- Obstructed migration
- Flooded Habitat

Hydropower System Development

- Increased water travel time



- Changed flow patterns

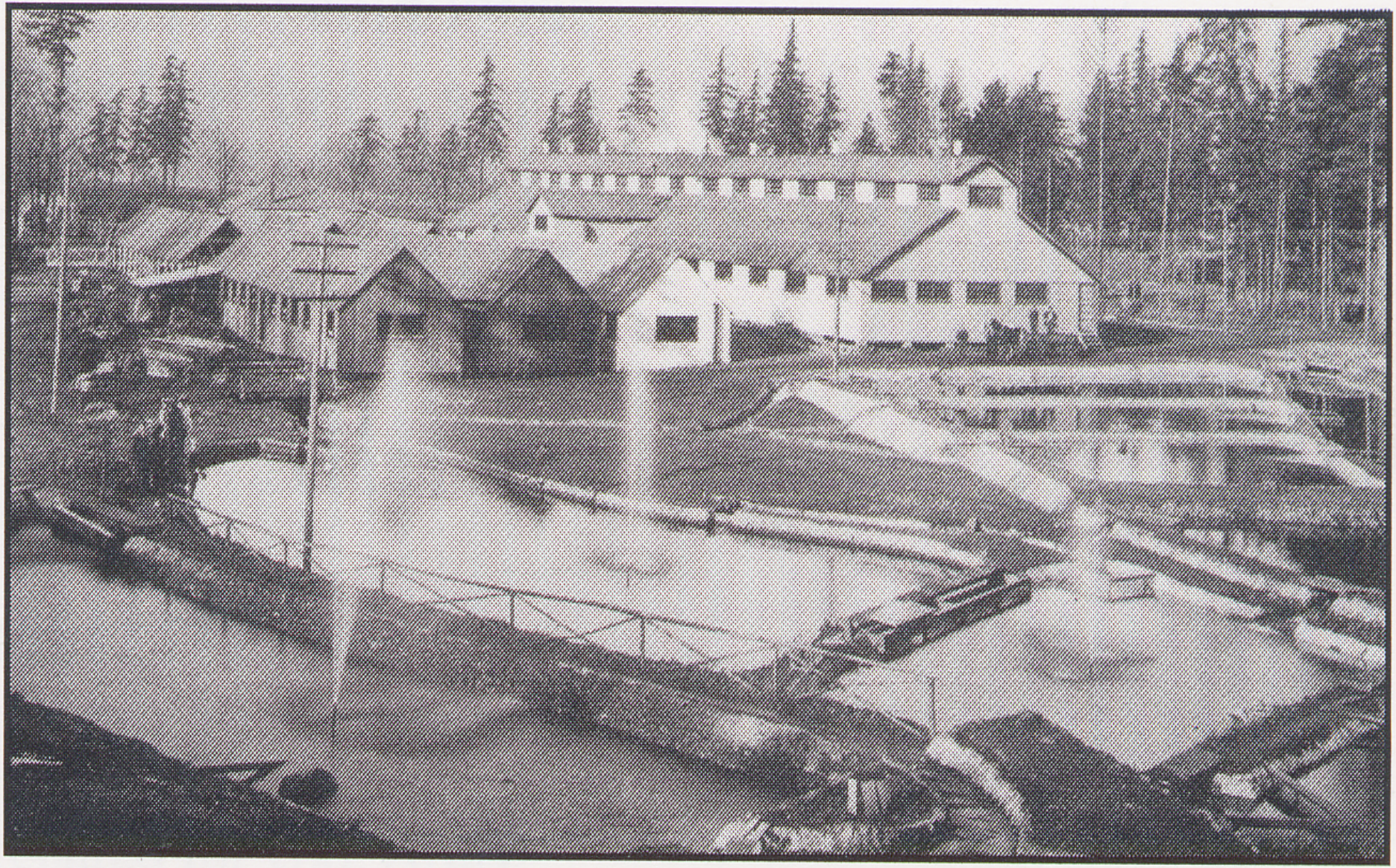


The 4 Hs

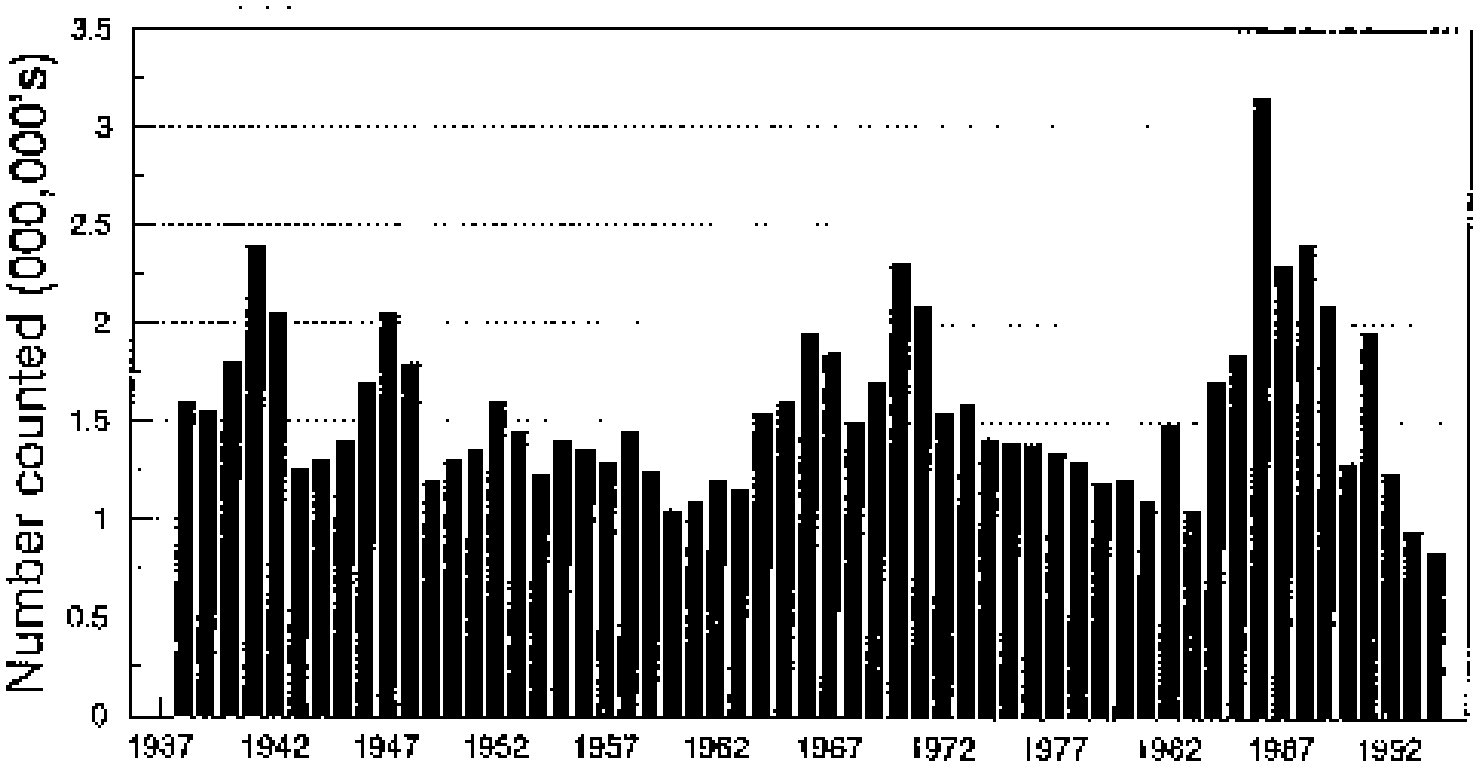
- Hatcheries
- Harvest
- Habitat
- Hydro


image courtesy of Portland District-
US Army Corps Of Engineers


image courtesy of Portland District-
US Army Corps Of Engineers



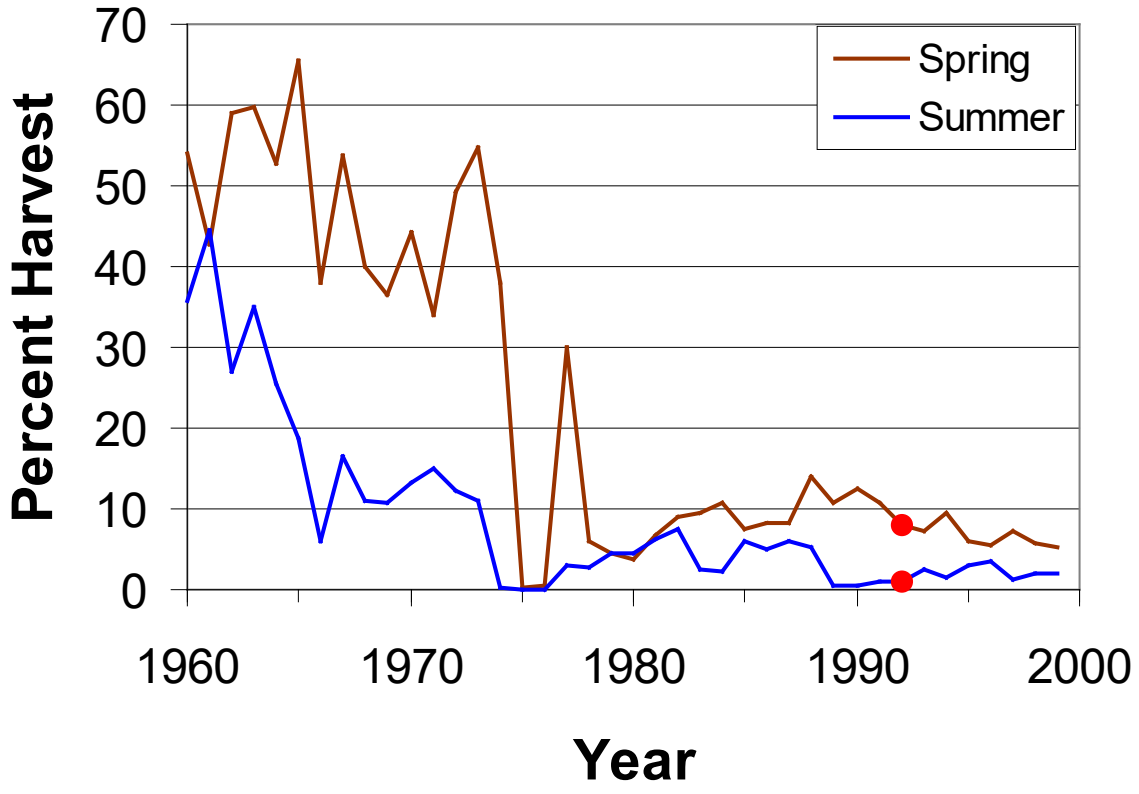
Central Salmon Hatchery in August, 1921, showing ponds, buildings, and incubation building.

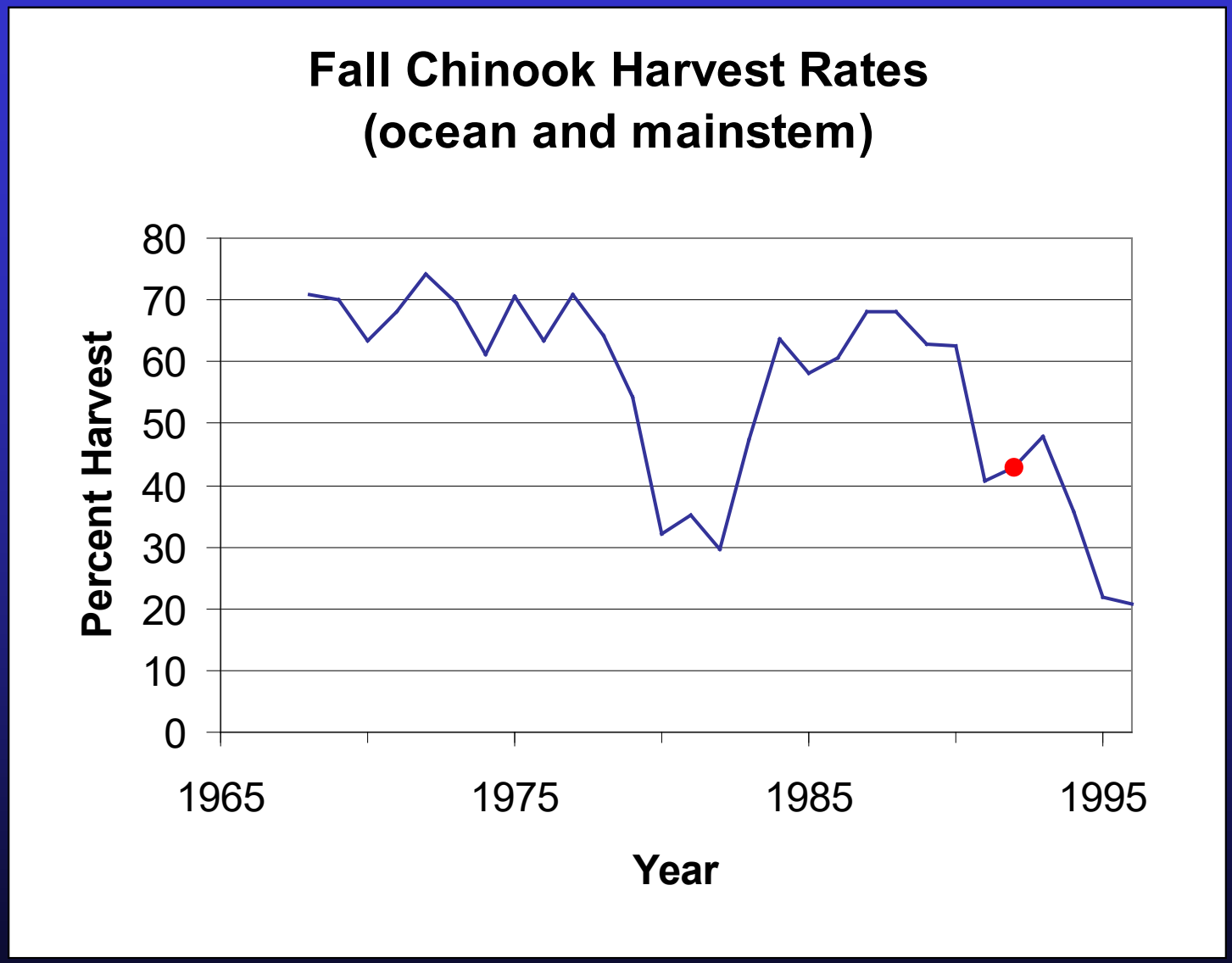


From NPPC (1999)


No 75 FISHWHEEL

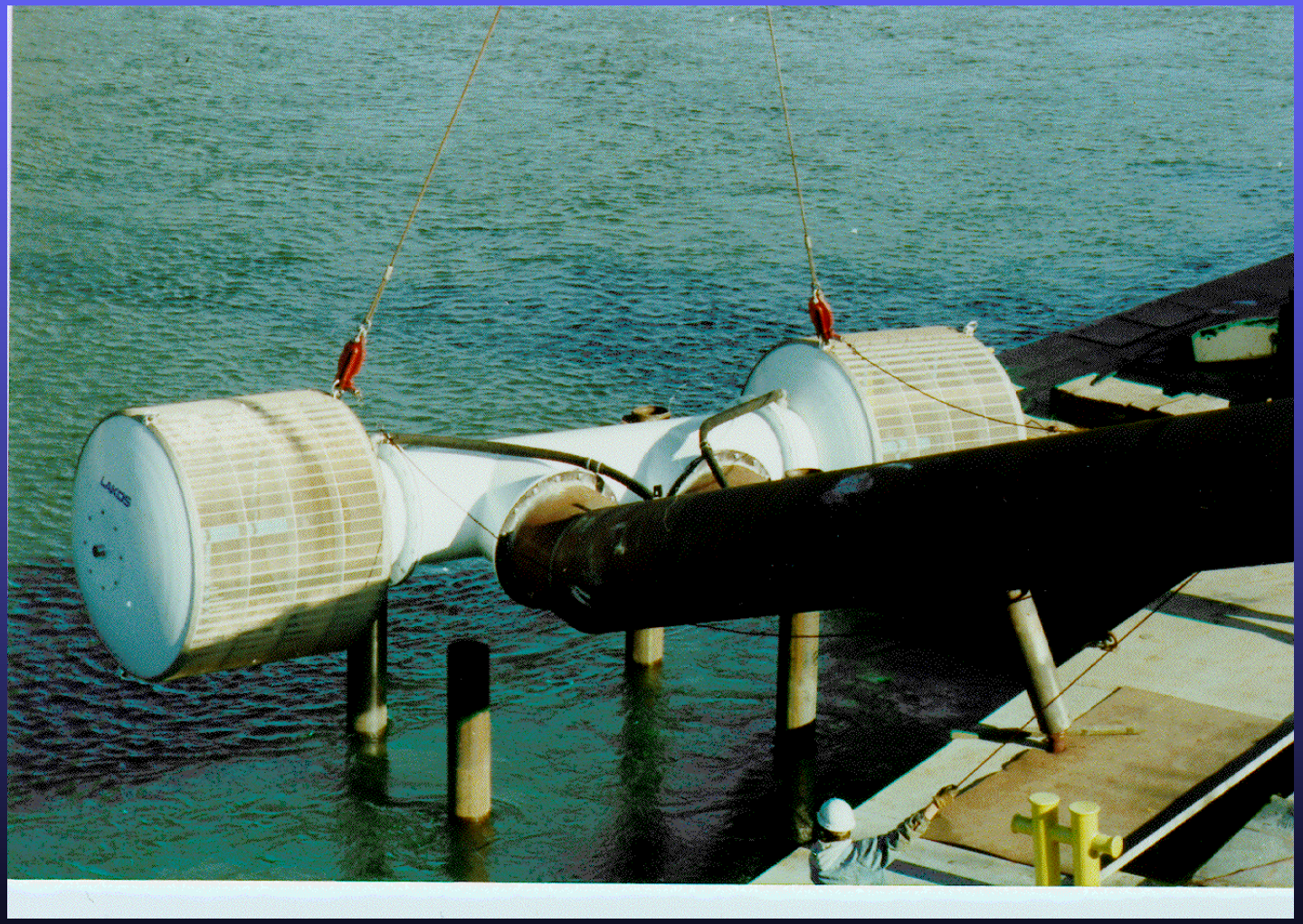
Spring and Summer Chinook Harvest Rates




Fall Chinook Harvest Rates
(ocean and mainstem)
Percent Harvest
80
70
60
50
40
30
20
10
0
1965
1975
1985
1995
Year

Rotary Drum Screen - ~ 7 cfs

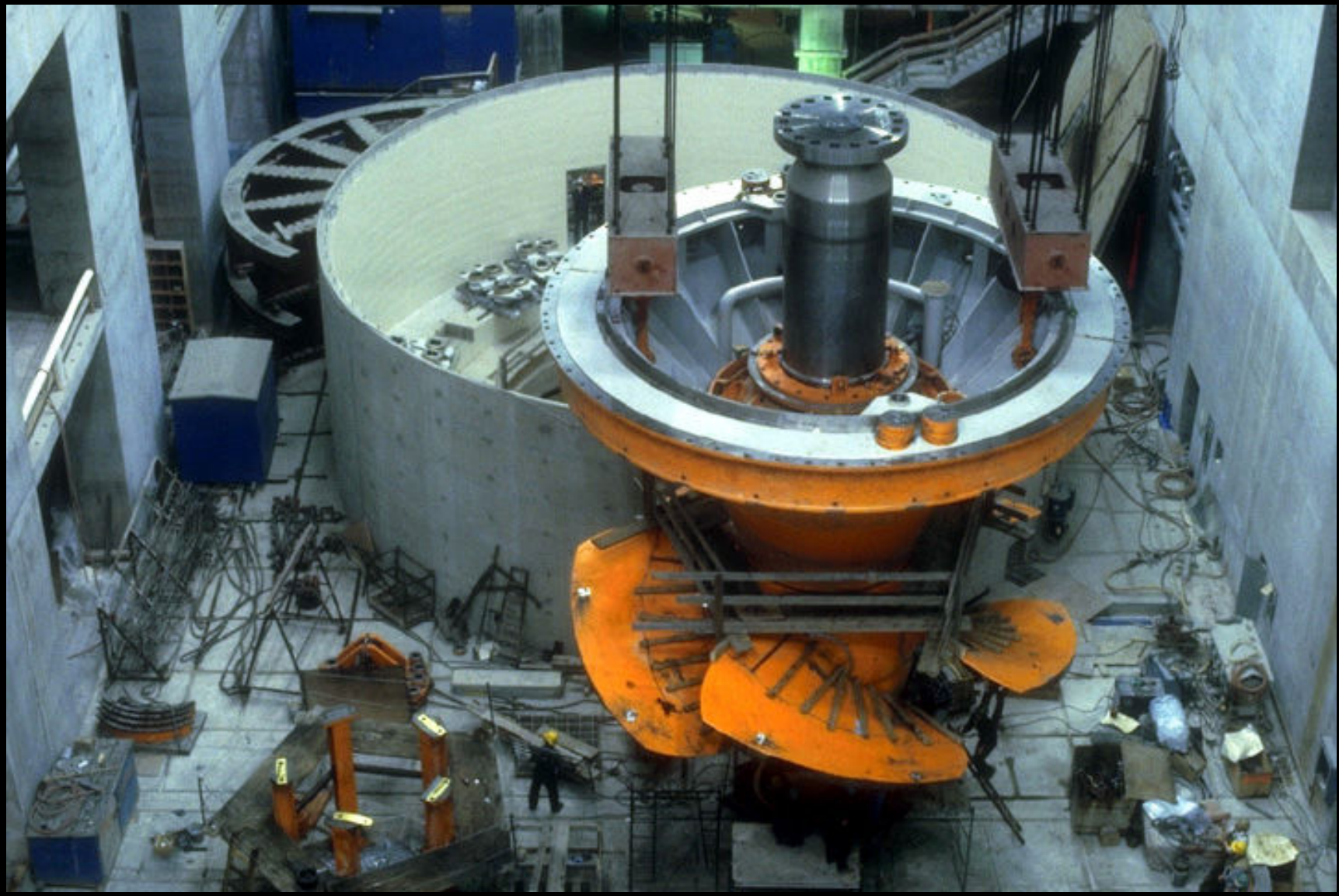
Pump Screen - > 75 cfs
(most pump screens <10 cfs)

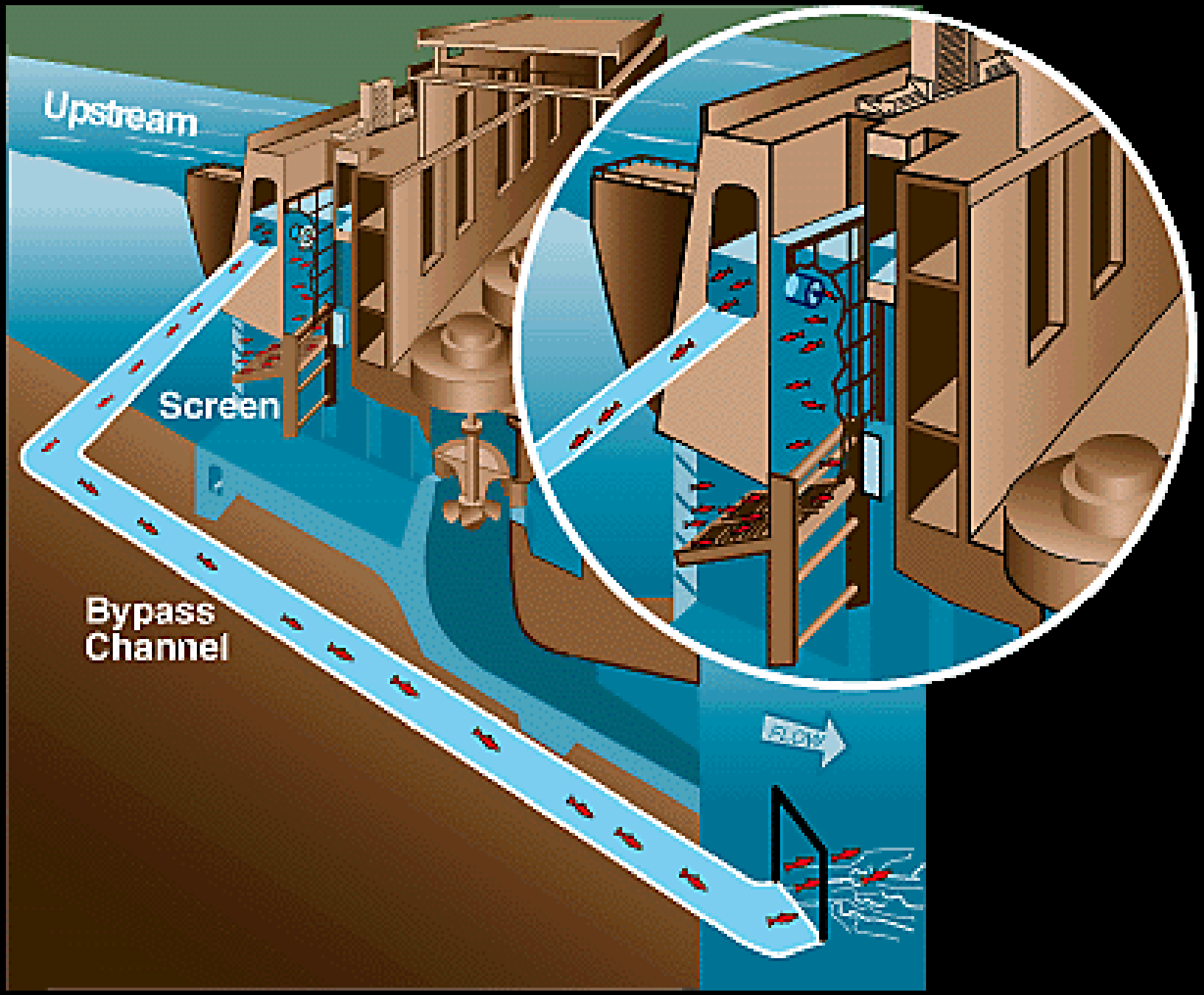


Embedded Pipe Screen - moderate flows

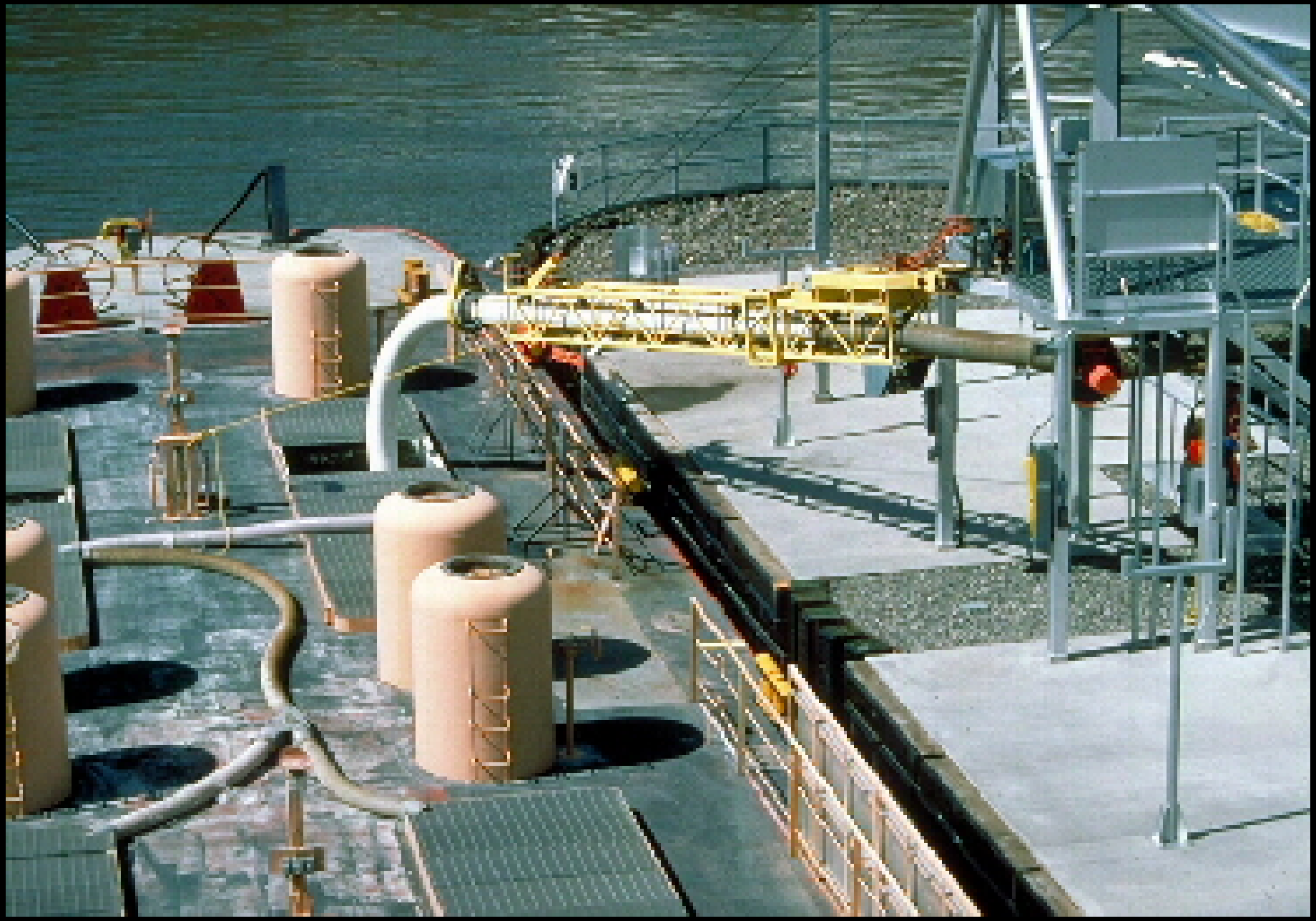
Vertical Flat Plate Screen - 180 cfs


LOWER

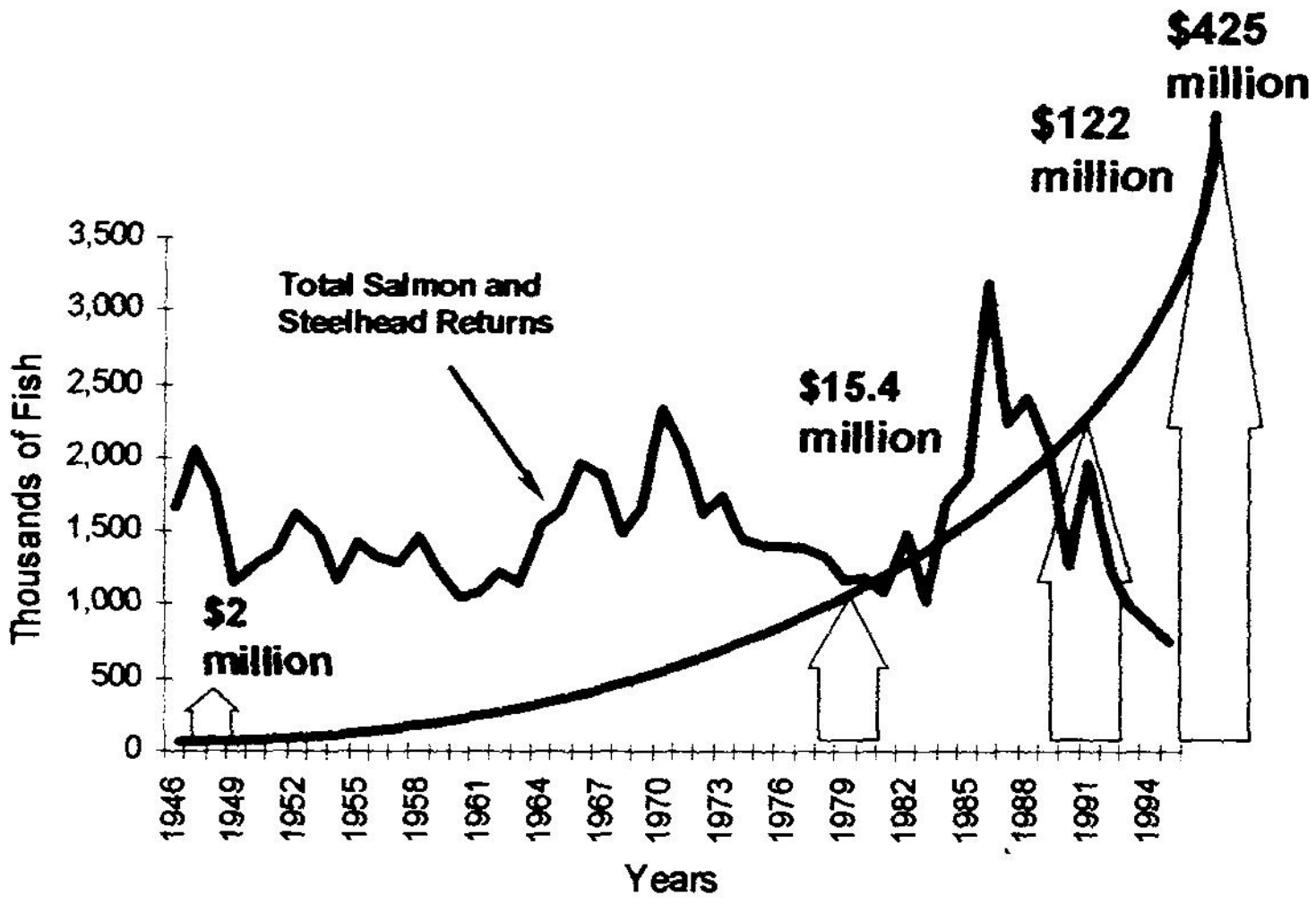



Upstream
Screen
Bypass
Channel


OPERATION FISH KILL

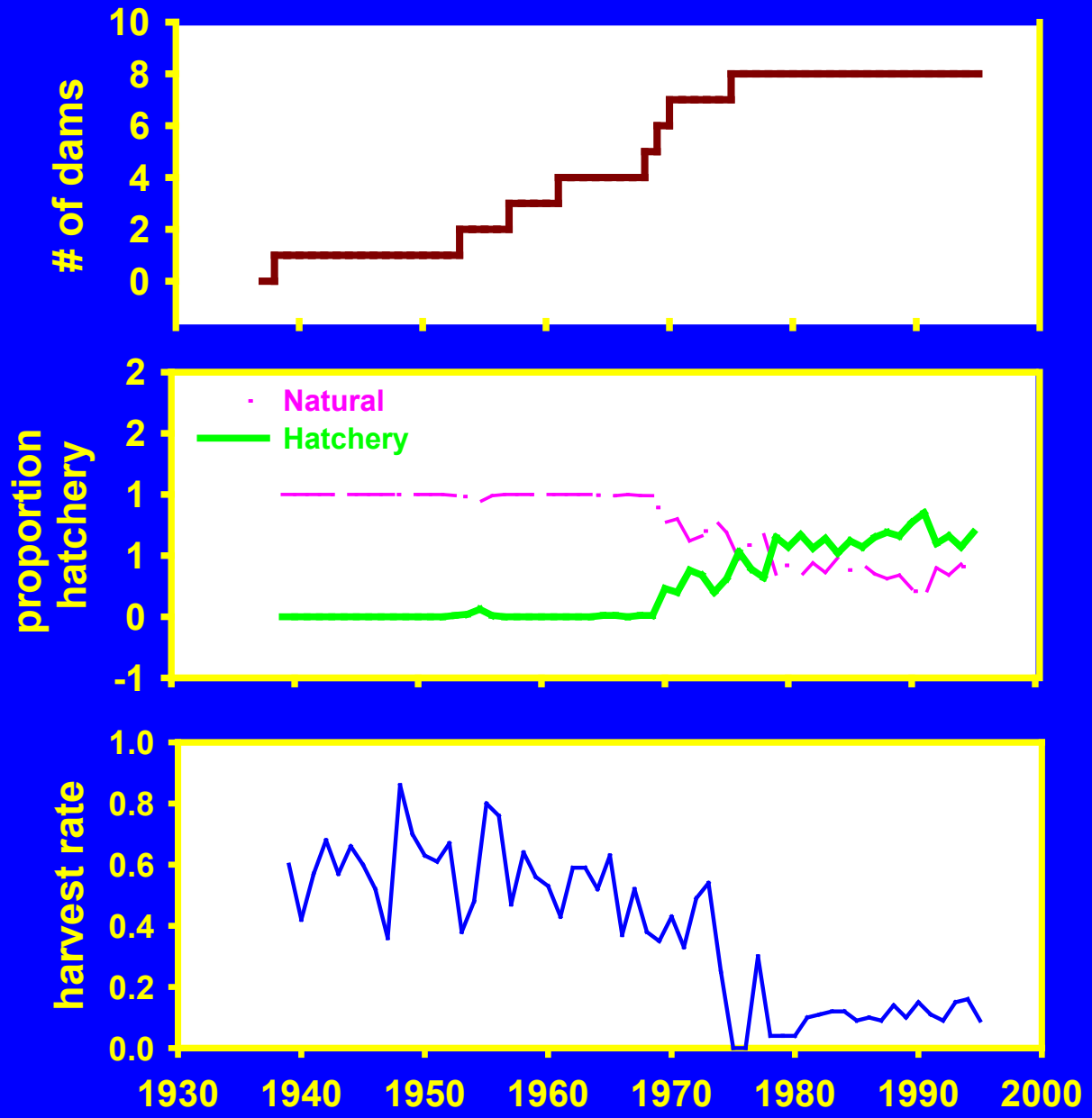


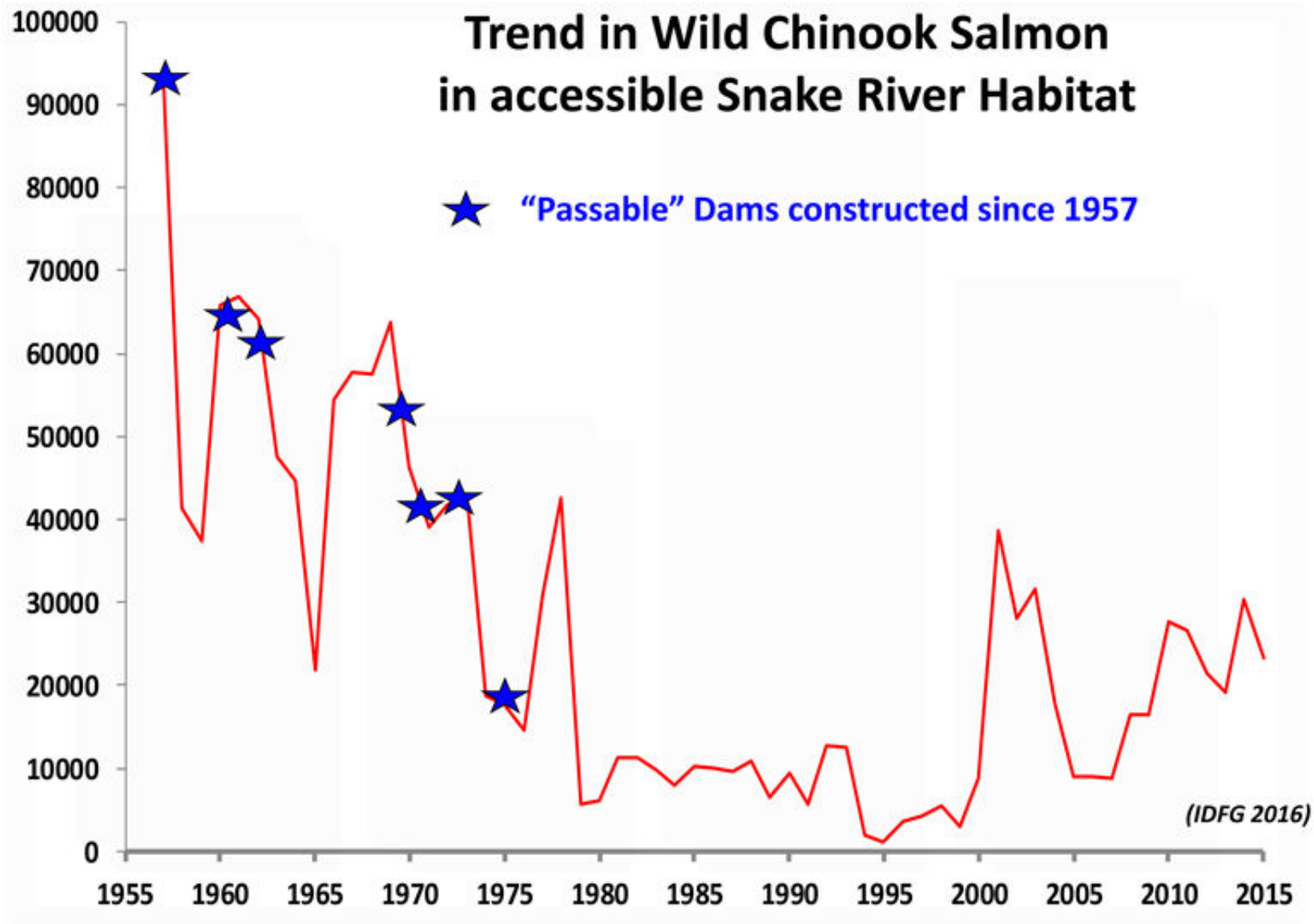

Juvenile Fish
Transportation



From: Lichatowich 1999

Spr/Sum
Chinook




Trend in Wild Chinook Salmon
in accessible Snake River Habitat
"Passable" Dams constructed since 1957
(IDFG 2016)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

ESA Listings in Snake Basin

- **Spring and Summer Chinook**
  Threatened, April, 1992
- **Fall Chinook**
  Threatened, April, 1992
- **Steelhead**
  Threatened, August, 1997
- **Sockeye**
  Endangered, December, 1991


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.
Kootenai
Columbia
Clark Fork
MT
N
Snake
WA
Puget Sound
PACIFIC OCEAN
Columbia
Snake
Willamette
OR
ID
Snake
NV
CA
Columbia River Basin

ESA Listings
in the Columbia Basin

Biological Opinion

2000, 2004, 2008, 2014, 2019 + Supplements

On the operation of the Columbia River Hydropower System

NOAA Fisheries

The All-H Recovery Plan

Bureau of Reclamation

Army Corps of Engineers

Bonneville Power Administration

NOAA Fisheries

Fish and Wildlife Services

Bureau of Land Management

Bureau of Indian Affairs

Environmental Protection Agency

Forest Service

RPA of the FCRPS BiOp

The 4 Hs

- Hydro
- Habitat
- Harvest
- Hatcheries

RM&E

Funding

All-H Problems: All-H Solutions

Examples from the 2008 FCRPS, Upper Snake & US v. OR Biological Opinions

HARVEST

Sliding Scale Harvest to reduce impact on listed fish in years of low abundance

HYDRO

Adult

HATCHERIES

Use local broodstock to minimize impacts on listed fish

Eggs

Smolts

Fresh Water HABITAT

Fix impaired fish passage by replacing or screening culverts and irrigation structures

HYDRO

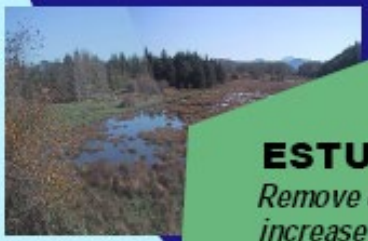
Use surface bypass to reduce delays & predation in forebays

PREDATION

Relocate terns to reduce mortality

ESTUARY

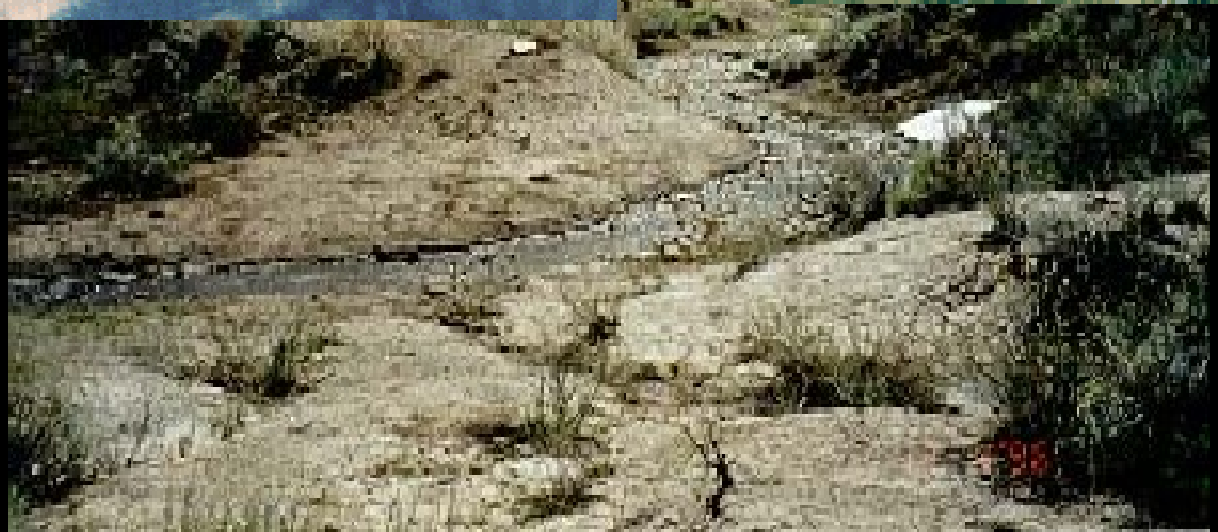
Remove dikes to increase rearing habitat



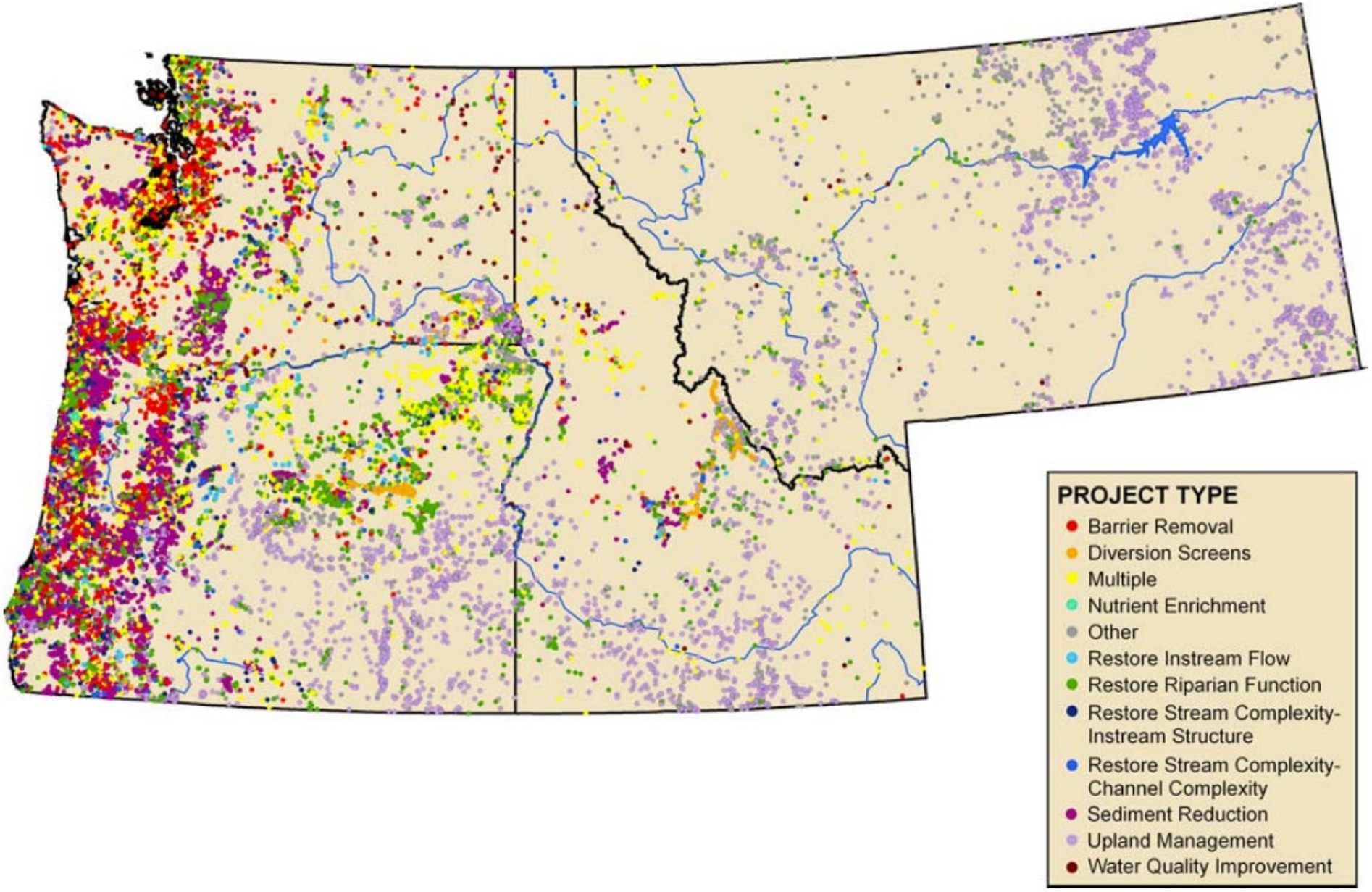
OCEAN

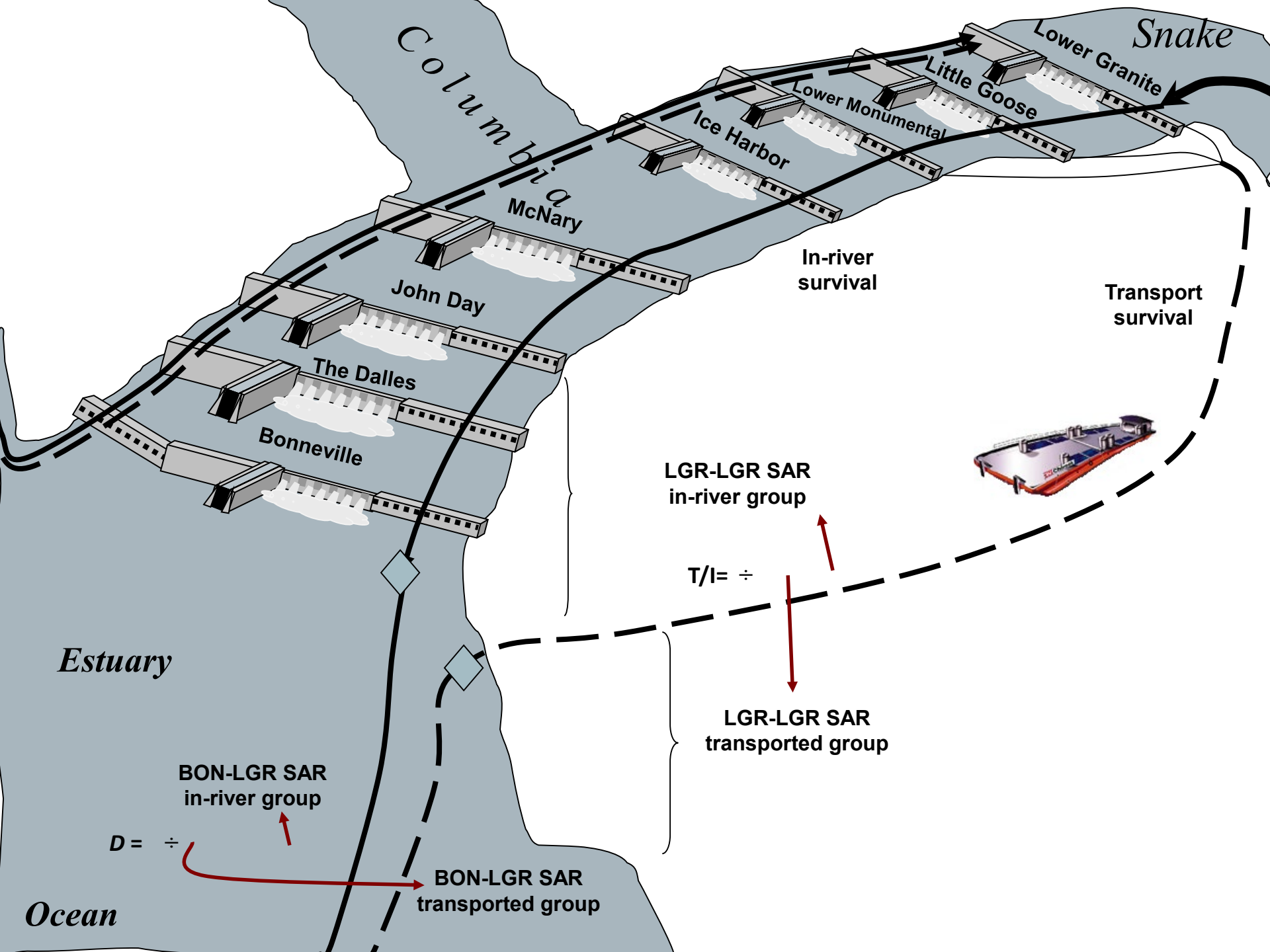
Strategy	Substrategy	RPA Action Num
Protect & Enhance Tributary Habitat	Tribuary Passage	149
Protect & Enhance Tributary Habitat	Tribuary Passage	149

Project Title	Lead Agency	02 Work Expectation
Mainstem & Middle Fork John Day Habitat Work	BPA	Riparian planting on Middle Fk and mainstem John Day River tributaries.
Mainstem & Middle Fork John Day Habitat Work	BPA	Instream work on Middle Fk and mainstem John Day River tributaries.



Over 35,000 restoration projects for salmonids since in PNW




Columbia
Snake
Lower Granite
Little Goose
Lower Monumental
Ice Harbor
McNary
John Day
The Dalles
Bonneville
In-river survival
Transport survival
LGR-LGR SAR in-river group
T/I= ÷
LGR-LGR SAR transported group
Estuary
BON-LGR SAR in-river group
D = ÷
BON-LGR SAR transported group
Ocean