Snake River Fall Chinook

A Primer:1900-1975

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Acknowledgements

- Staff from many agencies contributed to this presentation – without which it would not exist!
- A few notable contributors:
  - Billy Connor, Jim Chandler, Stuart Rosenberger, IPC - GIS Division, Jay Hesse, Pete Hassemer
- Our funding Entities –

Bonneville Power Administration

LOWER SNAKE RIVER COMPENSATION PLAN
Hatchery Program

Purpose of this Presentation

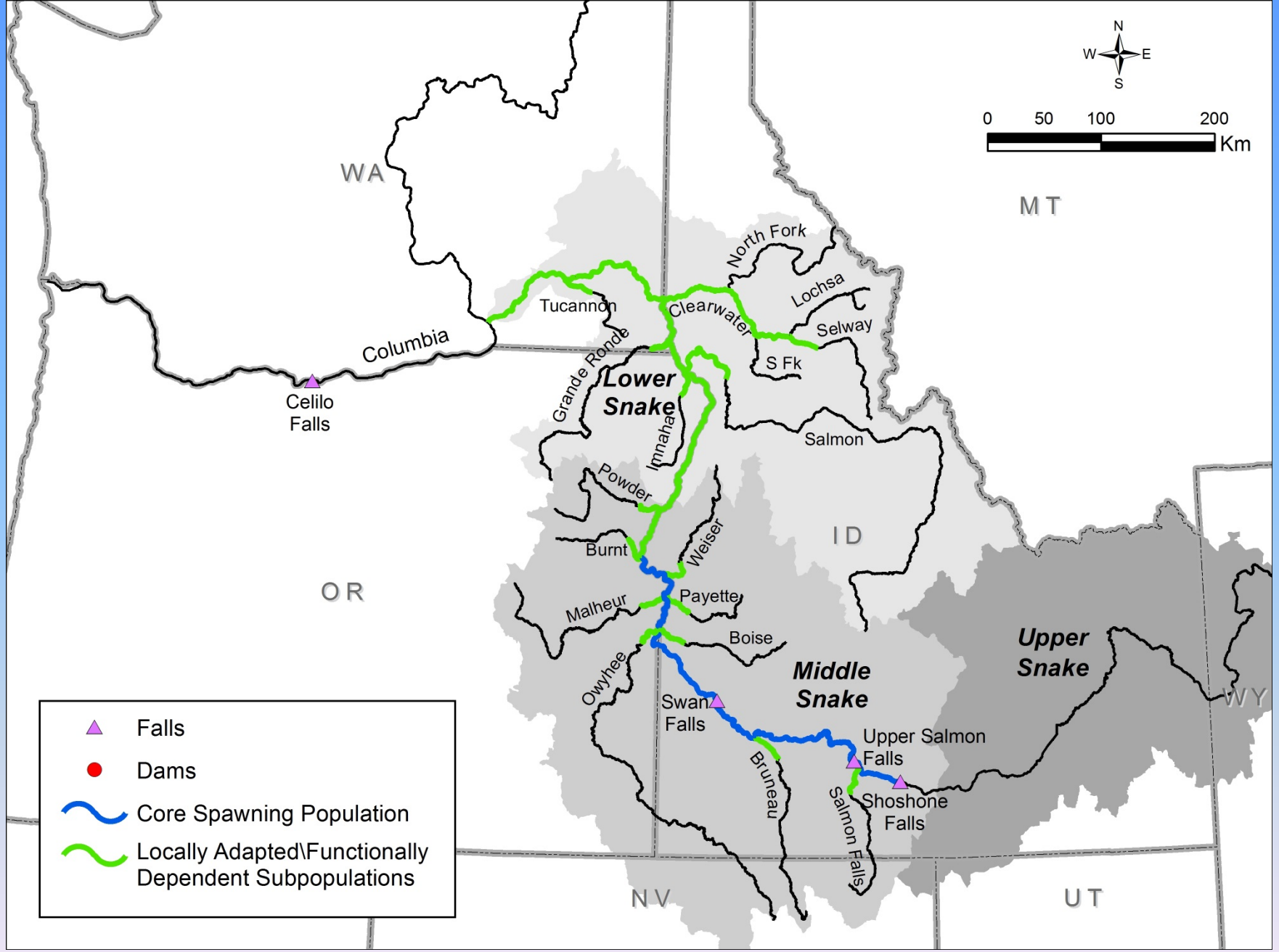
- History of the near demise of Snake Fall Chinook
- Review the actions that resulted in the need for and authorization of the LSRCP in 1975
- Put everyone on the same plane so that they better understand fall Chinook history
- Can’t know where we are going if we don’t know where we’ve been

"CHINOOK"

- Cultural Icon – King, Tyee
- Legendary size and Columbia R. abundance
- Staple food of native peoples
- Adaptive
  - Spring, summer, fall runs
- Upriver Bright falls for Snake – big mainstem spawners.
- Snake – historically large producer of Chinook

Maladies for Decline

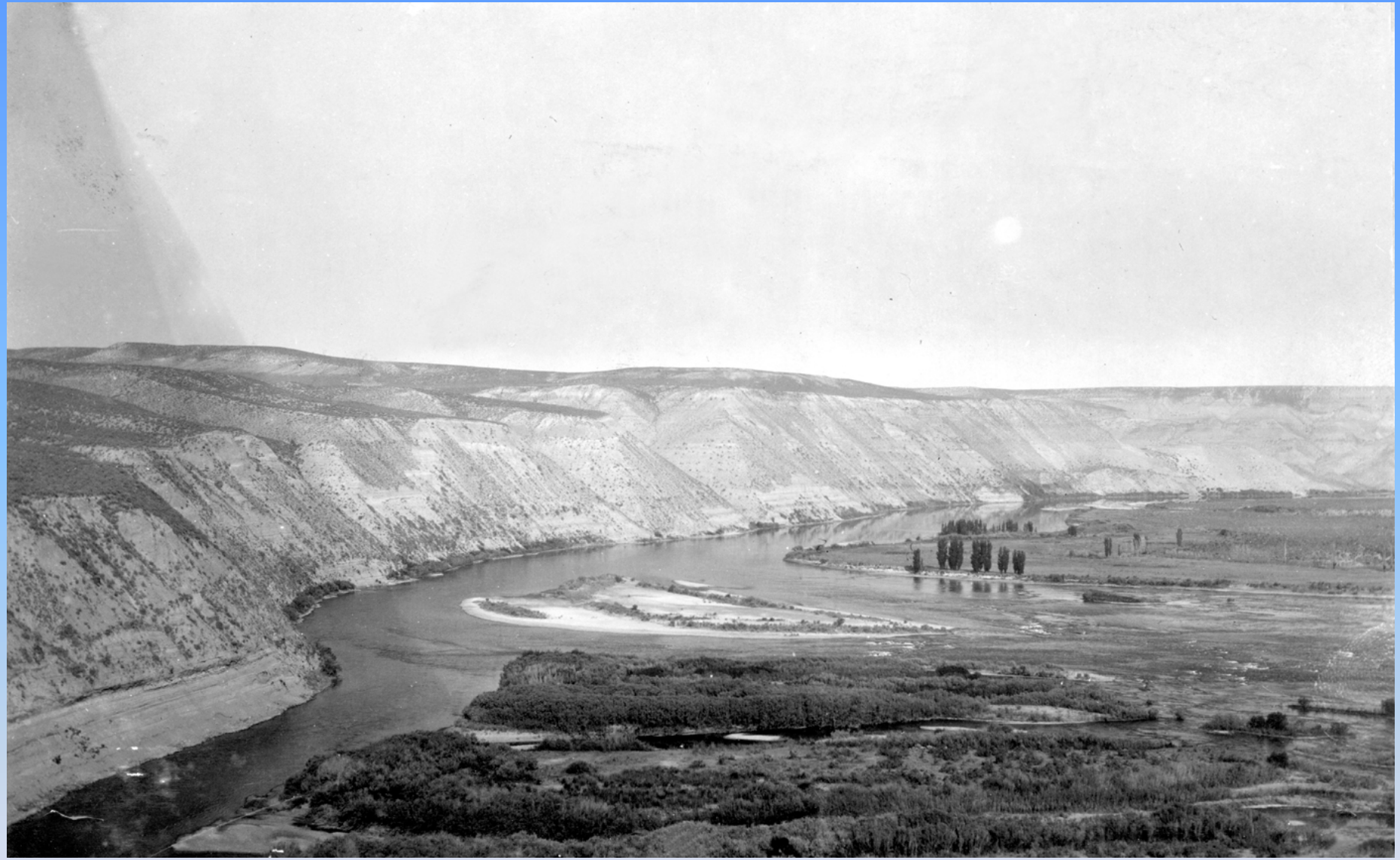
- **Anthropogenic**
  - Over harvest
  - Habitat loss
    - **Irrigated Agriculture (water removal + sediments)**
    - **Logging**
    - **Gold Dredging**
    - **Dam construction**
  - Hatchery efforts w/ questionable old methods
- **Natural**
  - Drought
  - Ocean Productivity



Possible historic distribution of habitat utilized by fall Chinook salmon

Typical Pre-development Snake Habitat

Thousand Springs region of Snake R. (1902). Eastern Snake Aquifer had significant effect on thermal regime of the Snake River in historical fall Chinook core spawning area. Collectively springs contributed 4,000 to 5,000 cfs of 58 Degree F. inflow. (USGS Survey library)



Typical Pre-development Snake Habitat

Photo of Millett Island (1902), just below Upper Salmon Falls. Historic monitoring site for fall Chinook spawning. Described in Everman, c. 1894. (USGS Survey library)

Typical Pre-development Snake Habitat

Photo of Lower Salmon Falls (1902). Site about 11 Rkm below Millett Island. Accounts of salmon jumping the falls in the fall. (Idaho Power Archive)

Historical Abundance

- Little real knowledge for Snake prior to 1901
  - John Fremont's Expedition (1843) described the "Fishing Falls" and 1000's of salmon jumping.
  - Gilbert and Evermann (1894)
- Commercial Fisheries in L. Columbia 1870-1900
  - **26.7 M pounds** avg. annual landings of Chinook*
  - Equivalent to **<u>1.07 – 1.78 M fish annually</u>**
- Initiation of low levels of commercial fishing in the Idaho Region (1894).

* Netboy, A. 1980. Columbia River Salmon and Steelhead Trout: Their Fight for Survival.

From native subsistence to rapid over use and habitat abuse.

THE BEGINNING OF DECLINE

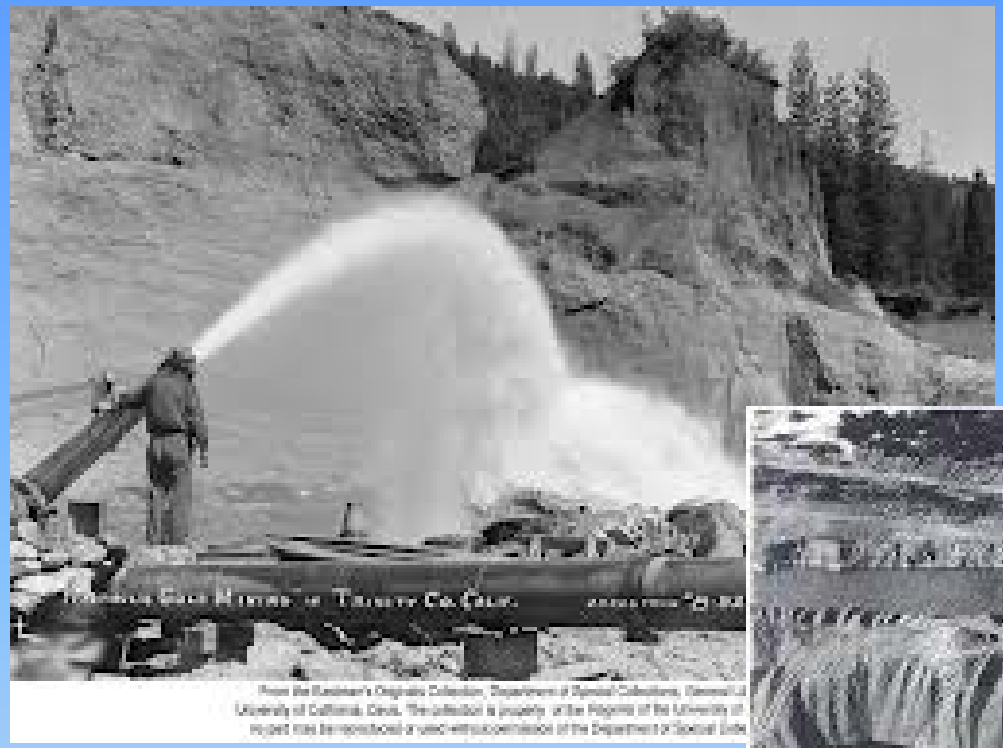
Chinook Abundance & Harvest

- Fisheries continued unabated
  - 1900-1937 landings of Chinook averaged just over **24 million pounds** annually.
  - Equivalent to **0.96 – 1.6 million fish** harvested annually to feed populations from Hawaii to London and San Francisco to New York.
  - 1915-19 could have been **1.25 M Chinook** at Columbia Mouth and about **460,000 for Snake***
- Settlement within the Snake River frontier accelerated, expanding the demand for salmon and other resources.

* Chapman, D.W. 1986

Water diversions to feed the burgeoning population through agriculture.

"Water appropriators …. have vested rights which could not be taken away from them unless they were paid for such rights….. ***I do not believe any serious argument could be made that the water should be taken from the farms and orchards to improve fishing conditions***." B.E. Stoutmeyer, to the U.S. Commissioner of Fisheries, 1931.



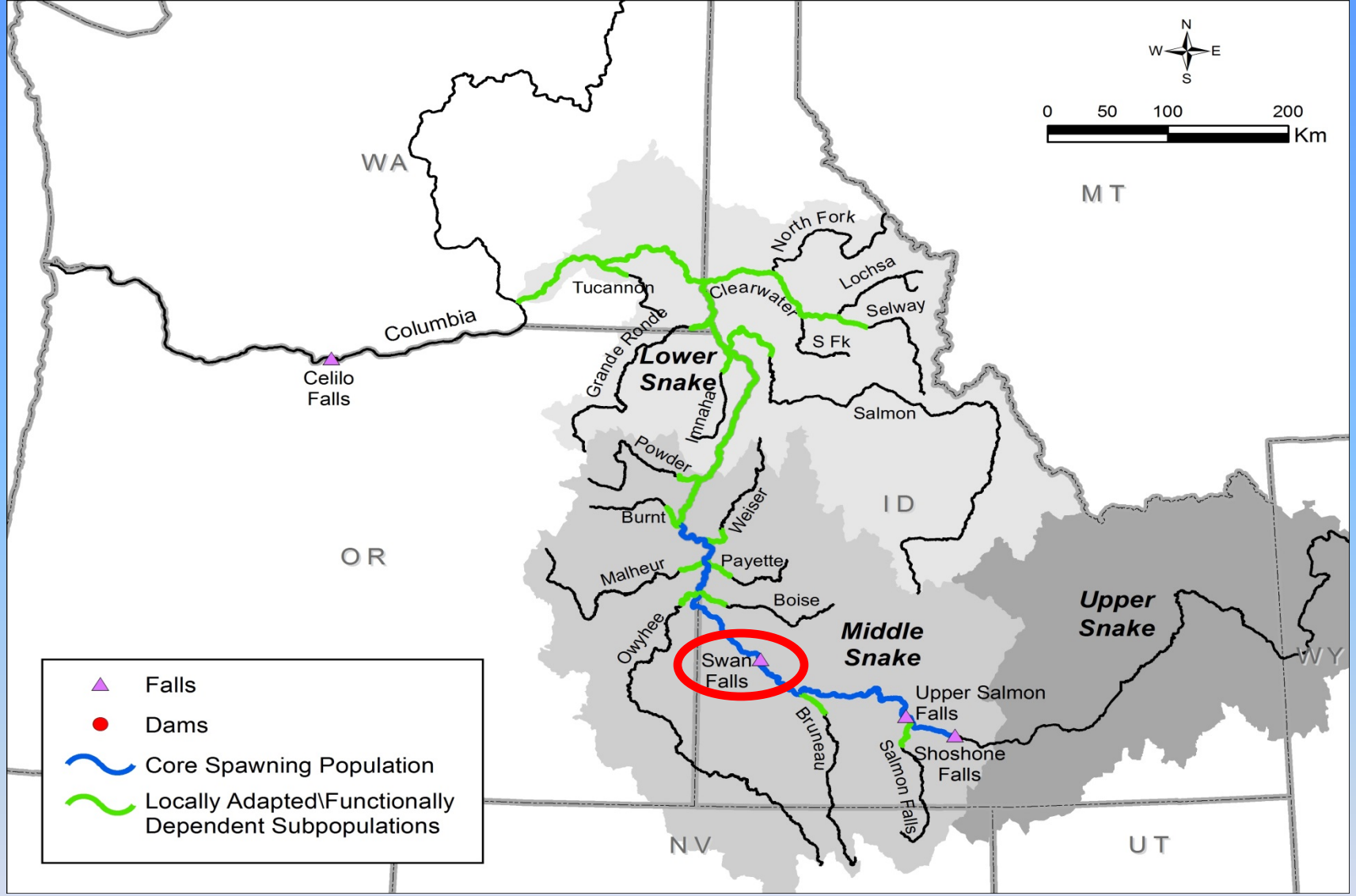
Gold dredging was active throughout the region.

Floating dredge that “turned the valley over” leaving a decimated habitat unsuitable for spawning or rearing, and Hydraulic dredging that flooded rivers with silt.

USDA, Forest Service.

Logging denuded hillsides

Early logging practices contributed to sediments that degraded habitat, especially in the low gradient, preferred spawning habitat for fall Chinook



Earliest Dam to directly affect Snake Fall Chinook – Swan Falls.

Eliminated 253 Rkm of core spawning and rearing habitat (25.5% of Snake River below Shoshone Falls)

Swan Falls Dam, c. 1901 (Idaho Power Archive)

As populations burgeoned, cities needed dams for commerce and electrical generation.

Lewiston Dam was constructed in 1927 and although fitted with an adult fish ladder, it was not functional to pass fall Chinook until 1939, however the Clearwater population was considered extirpated at that point.

c. 1930

c. 1900

With dams and reservoirs and desire for new fishing opportunity came new predator species as well improved habitat for native predators.

Multiple forms of mass harvest

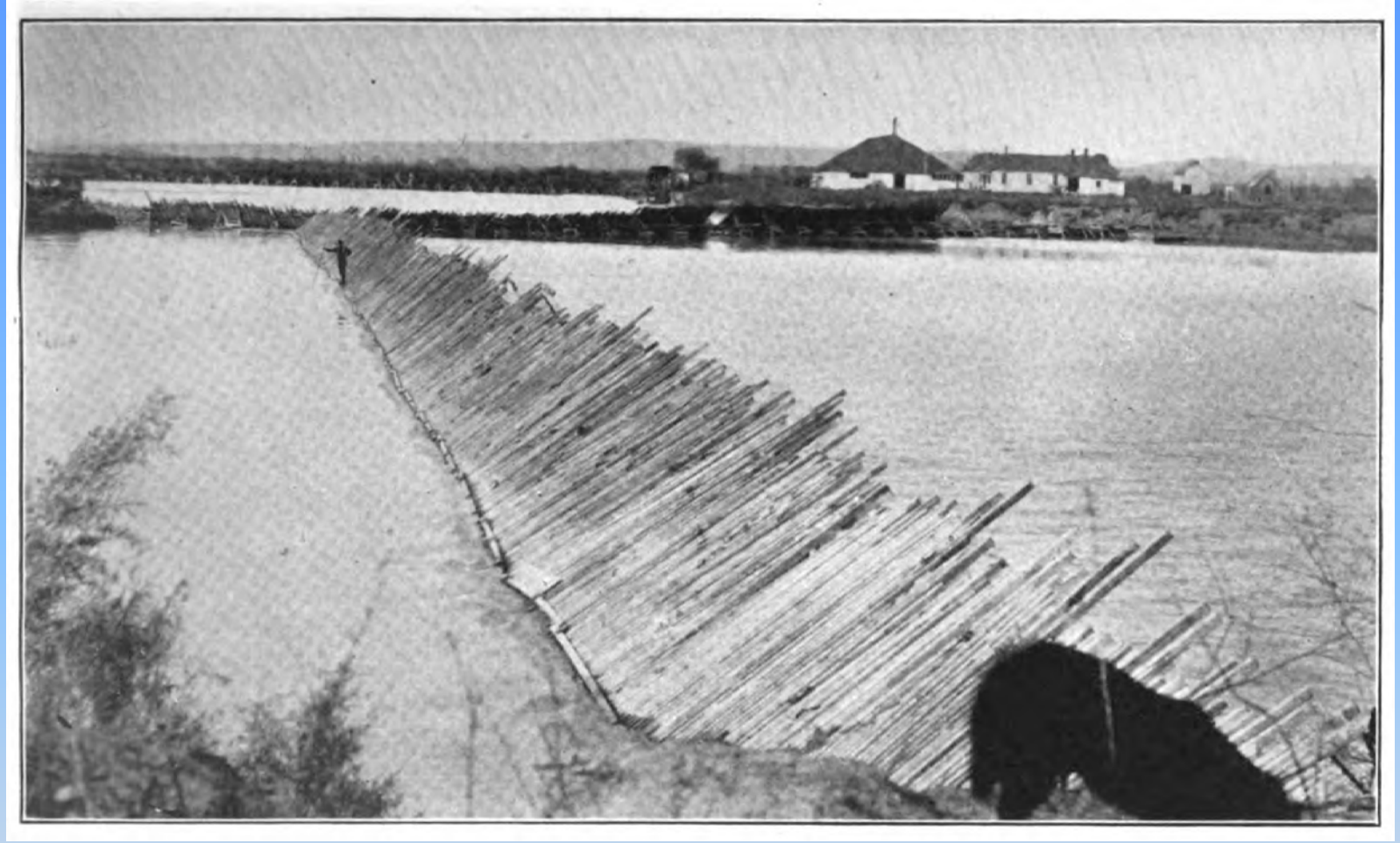
Salvaging the resource to prevent extinction.

THE EARLY ERA OF HATCHERY INTERVENTION

Fish Declines Alarm Managers

- Continuing over harvest identified
- Completion of first big dam that blocked habitat for fall Chinook

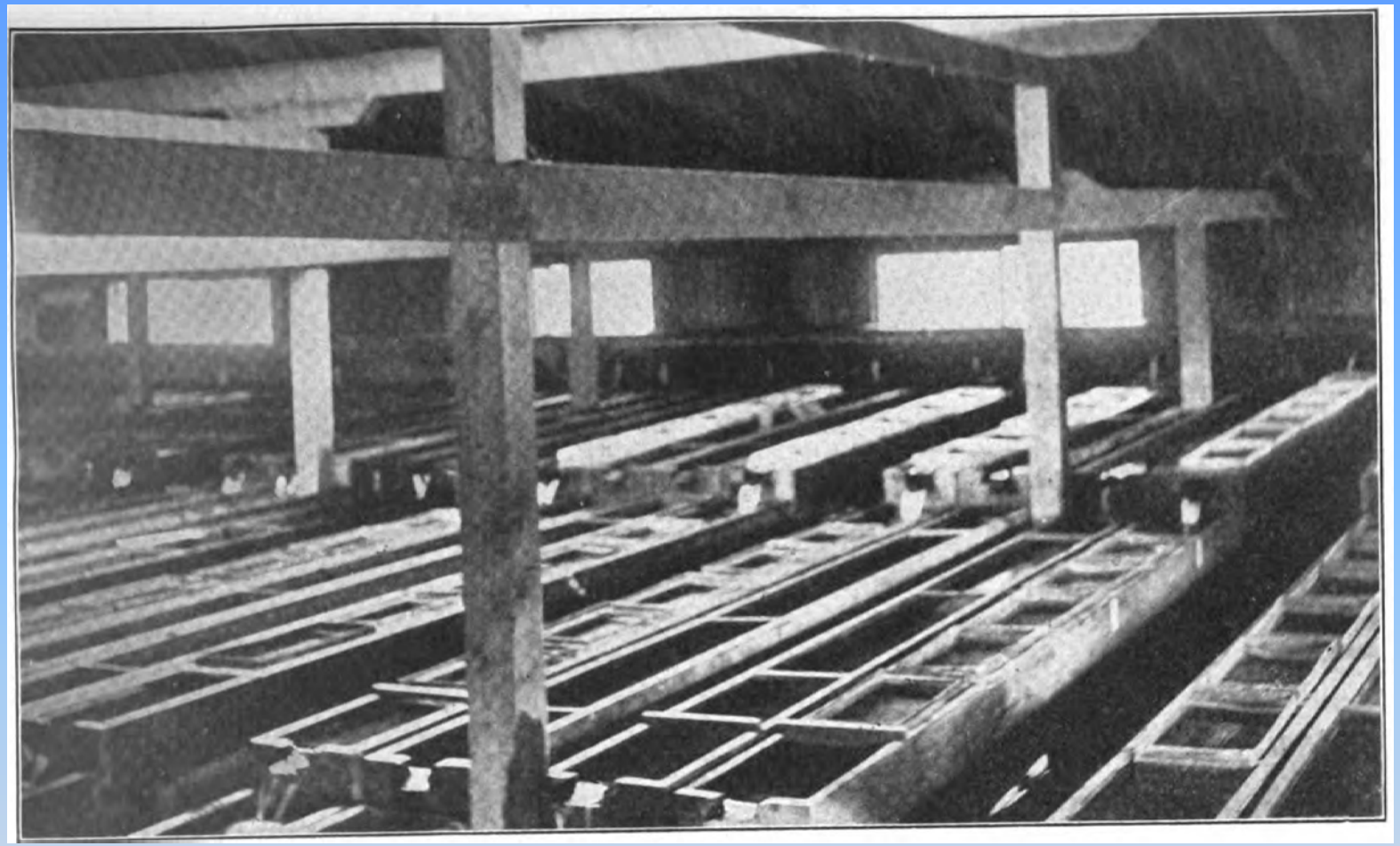
- Convinced then Master Fish Warden Van Dusen to take hatchery based actions to maintain fisheries.
  - "**Corralled**" fish at Swan Falls Dam in 1901 and took 544,000 eggs for hatchery rearing.



Early efforts were expanded with a hatchery at Ontario, Oregon c. 1902

Ontario Hatchery and one of the two stop racks (likely the downstream rack as an opening is apparent to the right of the hatchery worker) placed from the Oregon shore at Ontario Hatchery to Morton Island; used for the collection of brood stock.

(Creator: Benjamin Gifford. Digital image: bb000074. Oregon Historical Society. Copying not permitted.)

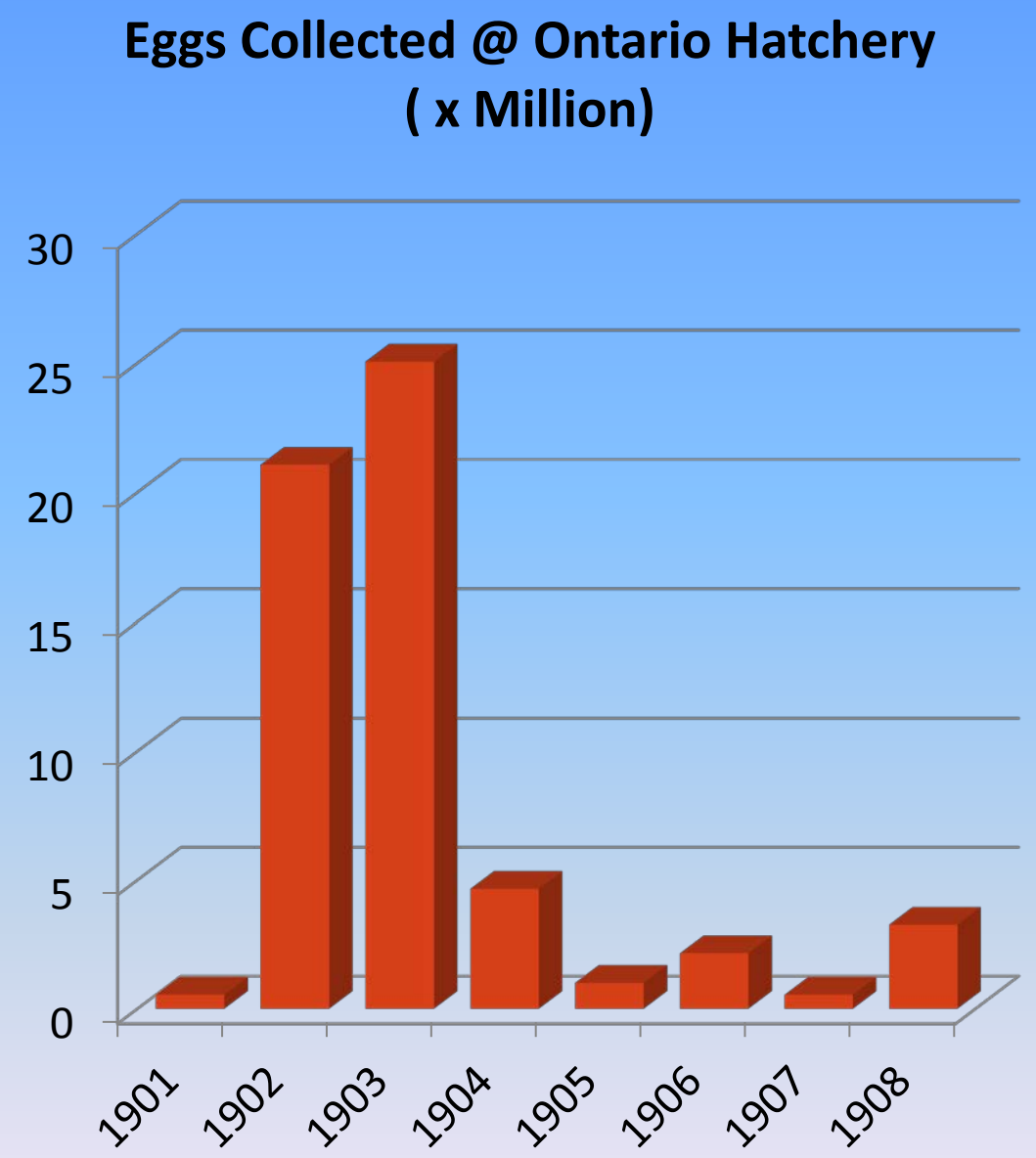


Hand constructed “hatching house”

May be the house near Ontario, 1902, described by Van Dusen. Egg capacity 5.5 M. The remaining 16 M eggs taken in 1902 were “planted in gravel bars locally”. (The photograph is from McAllister, 1909. Creator: Kiser Photo Company. Digital image: bb000184.Oregon Historical society. Copying not permitted.)

Resource Depletion was almost immediately evident.

- Abundant at first
- Adults quickly diminished
- Water conditions not to blame.
- Down River actions soon came under more scrutiny.



McAllister, 1909.

"From the knowledge that I have with this stream during the past three years… I believe that construction of the [Swan Falls] dam is …. ***probably the entire cause of the matter***… for it was a complete stop to salmon and ***shut them entirely from their native spawning grounds***, and in their efforts to get above…were destroyed by the thousands and those that did not kill themselves in...their efforts… ***were caught out below by the fishermen***".

Frank Brown, Ontario Hatchery Manager to Master Fish Warden Van Dusen, 1904

Although native fishing techniques had been applied for centuries, new technology quickly over harvested resources (Fish wheel @ Celilo Falls c. 1905: Oregon Historical Society)

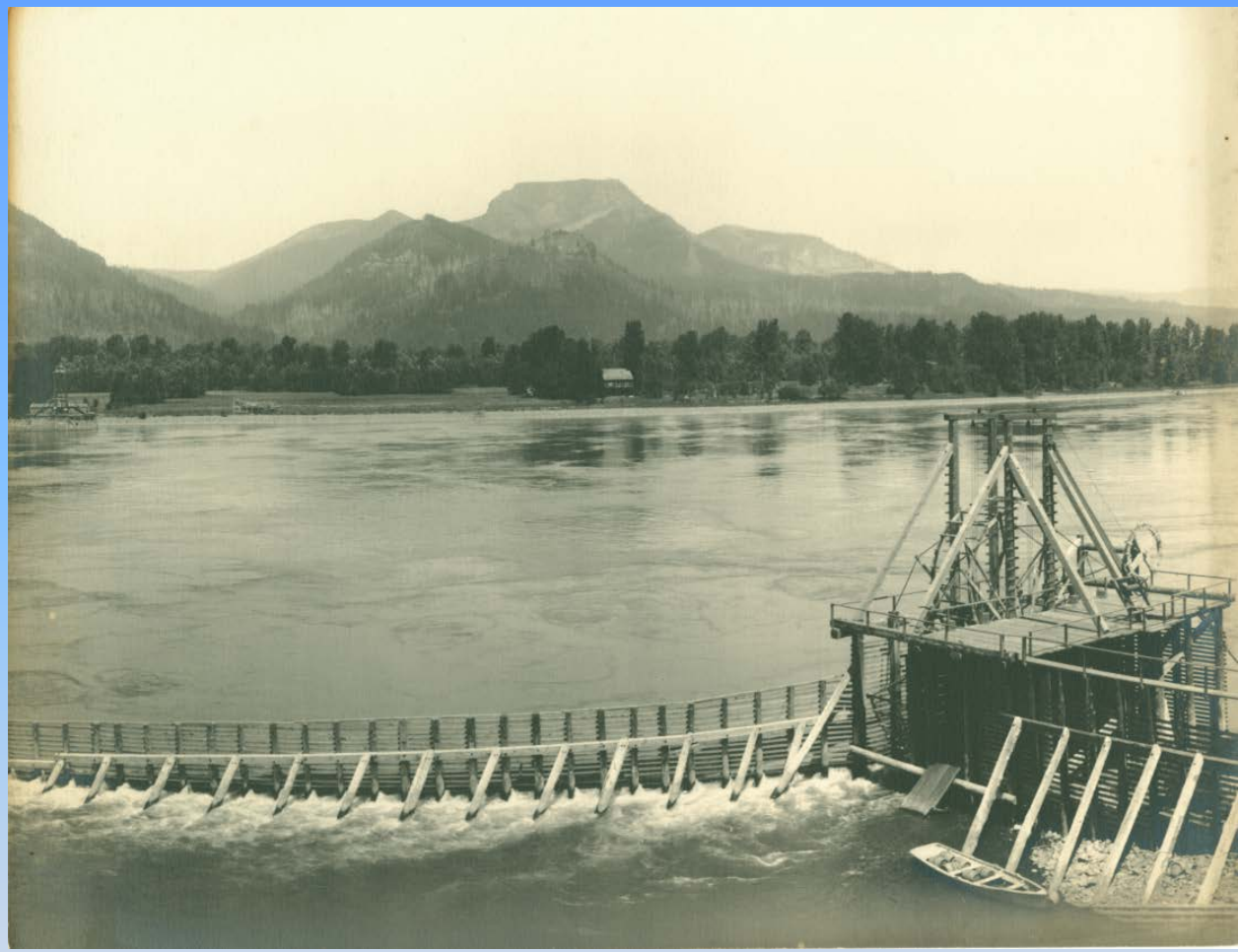
Over harvest could not be ignored

- Van Dusen (Master fish Warden) recognized the problem

- Canvassed for strict control of fish wheels and adoption of seasons (especially around Celilo Falls)

- By 1908 some actions taken but fish wheels not fully banned until 1934

- Undoubtedly much harm had been done, with harvest rates as high as 80%



Oregon Historical Society

Were hatcheries the Answer?.....

- "For a time I did think that the artificial propagation work would take the place of nature, and that thereby we would be able to keep the river stocked, and possibly increased, but the experience that I have had the past few years with the coast streams shows me that **nature, if given an opportunity, will do a great deal towards keeping up the supply, and that we should not yet a while count too much on our systems of artificial propagation work taking the place of nature**."

  - Van Dusen in his final year as Master Fish Warden (McAllister, 1909).

The Dam construction Era

Anthropogenic impacts accelerate

They're Dam near everywhere!

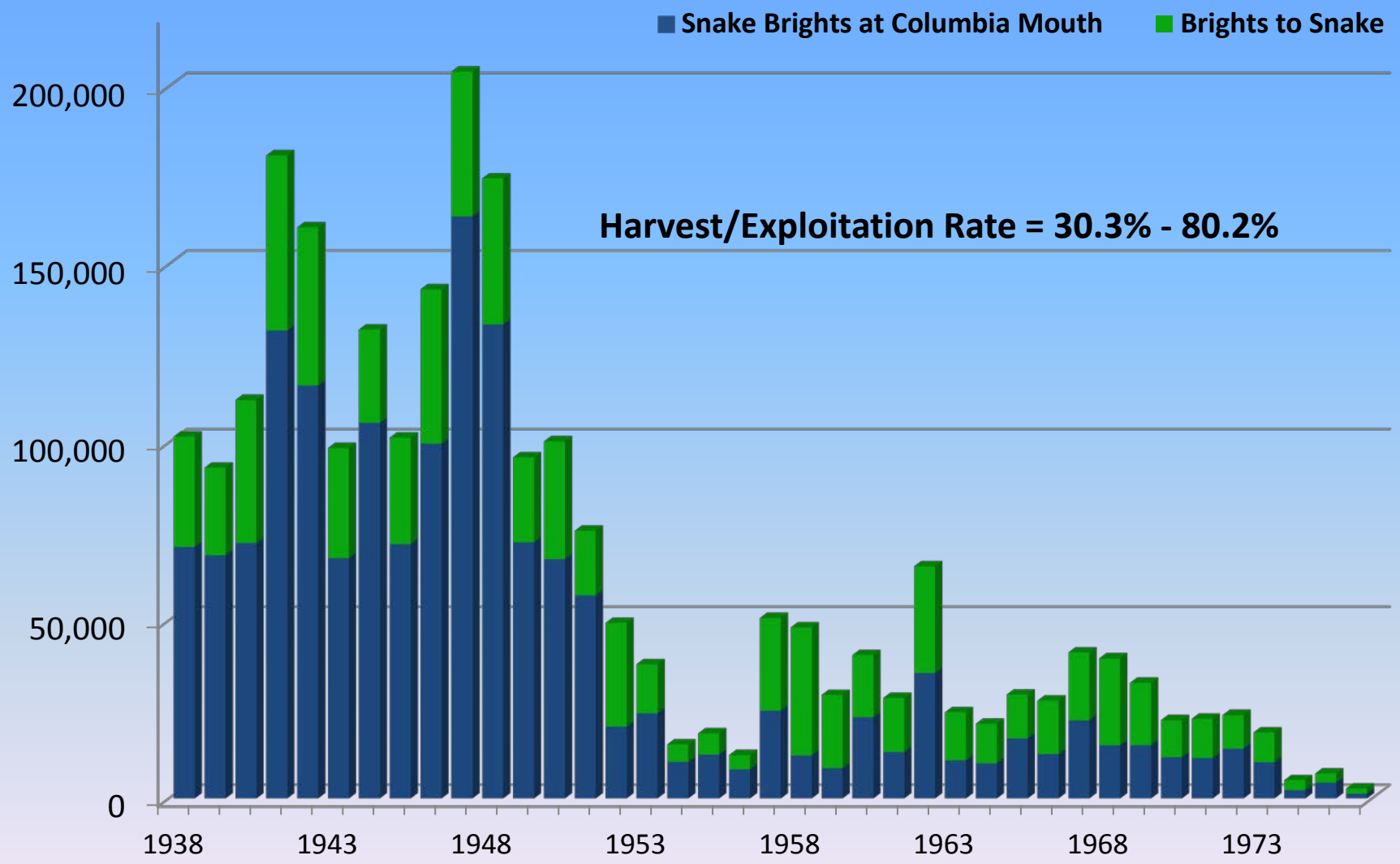
While over fishing continued down river – habitat problems and dam construction continued unabated within the basin with irrigation and small hydro dams constructed on the **Malheur, Boise, Burnt, Payette, Owyhee and Bruneau** rivers to name a few.

Direct and Indirect effects of Civilization

- Except for Bonneville (1938), dam construction was focused on tributary rivers throughout the middle Snake and access to most Snake River fall Chinook habitat remained – <u>except for that above Swan Falls and Lewiston Dams</u>
- But the Federal government and Idaho Power Company were about to get busy, and by the late 1940's planning for the Hells Canyon complex (IPC) of 3 dams, 4 lower Snake and more Columbia River dams (USACE) was well under way.

1938 marked a new age of enlightenment because counts of Chinook at the newly completed Bonneville Dam allowed a better, if not absolute, understanding of abundance.

Est. Snake River Fall Chinook Abundance



Based on Irving and Bjornn, 1981

Brownlee construction began in 1955 and closed in 1958

- Impounded 93 Km of former migration/rearing habitat.
- Provided with temporary trap w/ electric weir and collected 15,160 adults in 1957. Operated until 1961

Oxbow Dam (1961)

Impounded more habitat (the 20 Km upstream to Brownlee), but the adult trapping facility was an improvement over Brownlee and efforts to pass adults between 1957-1963 were deemed a modest success

Efforts to maintain Population

- Despite adult trapping success – juvenile collection and passage downstream was plagued with difficulties.
  - Poor collection efficiency of the collection boom

Juvenile capture facility in Brownlee Reservoir: efficiency 0.7 – 14.8%

Idaho Power Engineering Archive

Efforts to maintain Population

- Despite adult trapping success – juvenile collection and passage downstream was plagued with difficulties.
  - Poor collection efficiency of the collection boom
  - Delayed migration affected juvenile life history – encouraging adoption of yearling and subyearling life histories (Haas 1965; Durkin et al. 1970: Sims 1968)
  - Poor success with juvenile passage/survival through Brownlee Reservoir was generally attributed as cause of steady abundance decline.

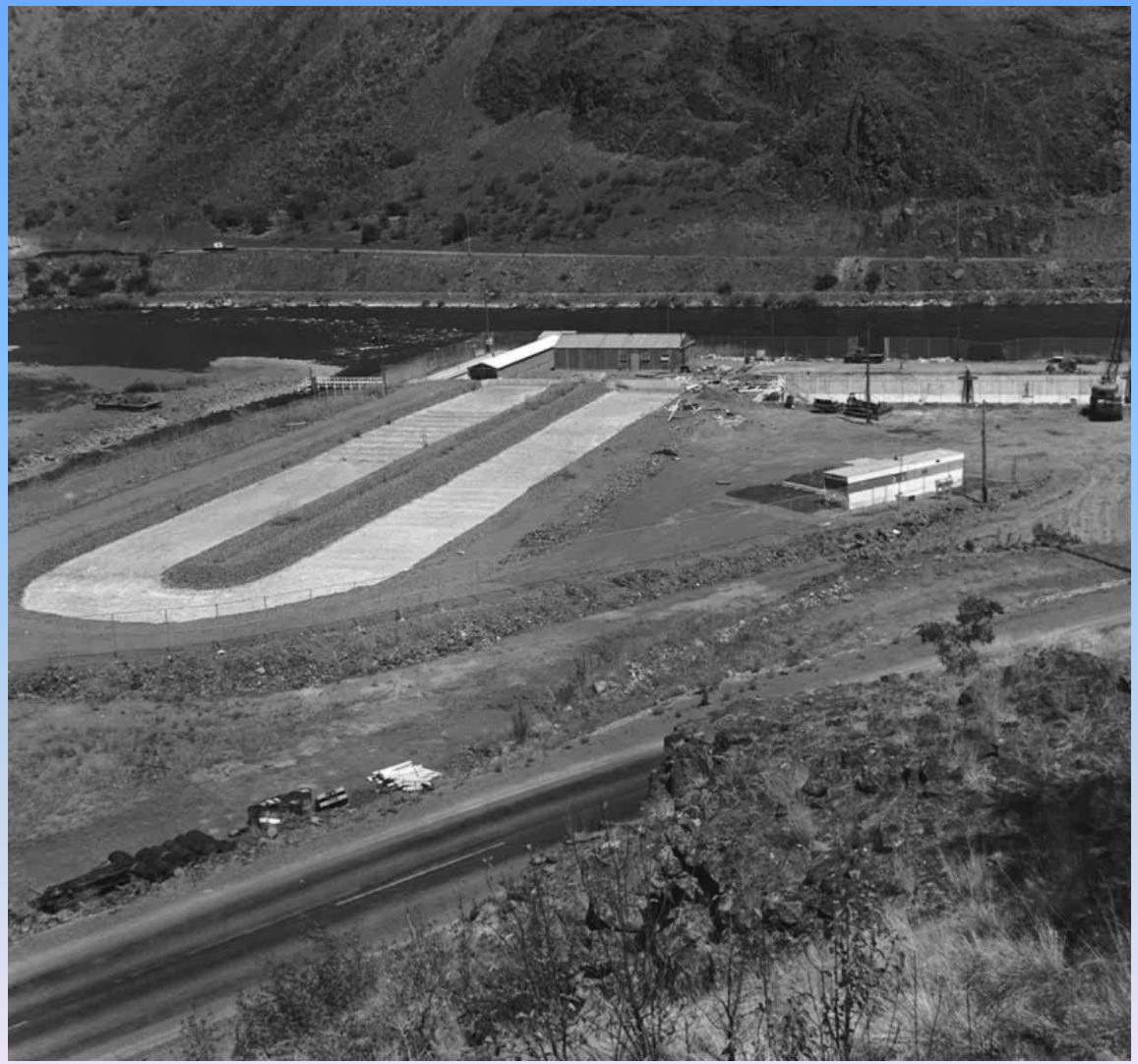
Salvaging the resource to prevent extinction.

THE MIDDLE ERA OF HATCHERY INTERVENTION

Oxbow Hatchery

Efforts to maintain Population

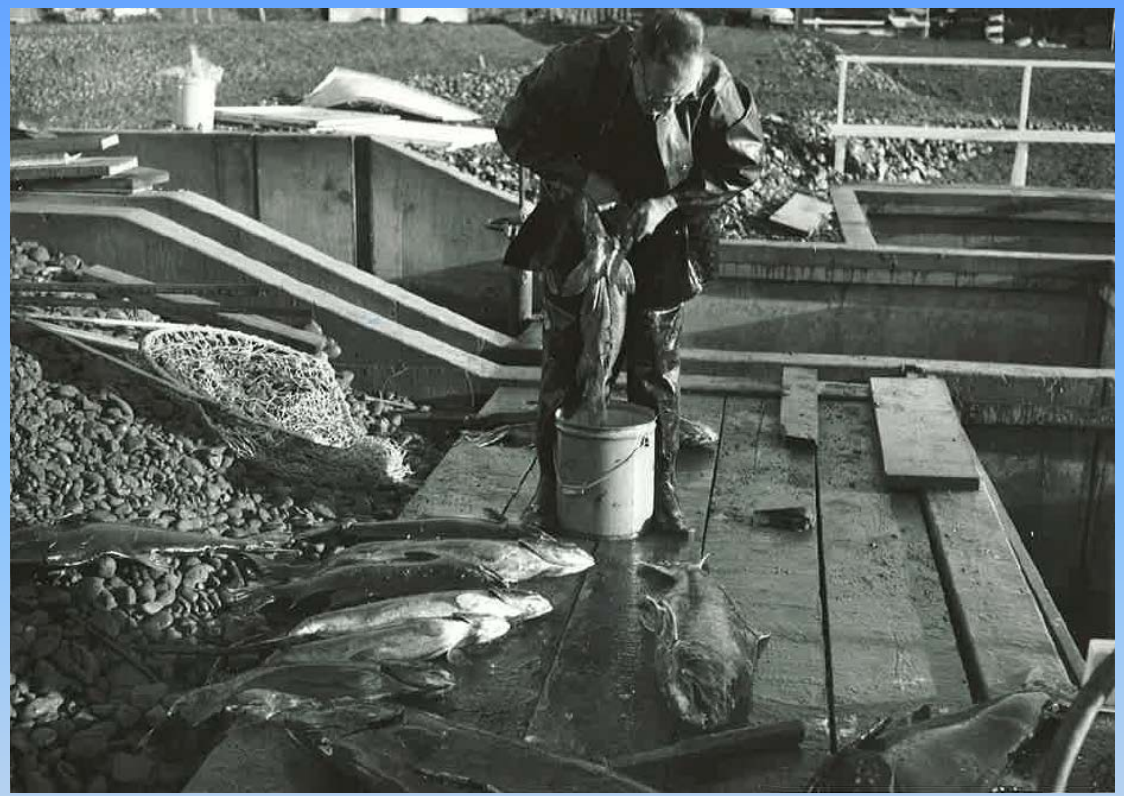
- With failure of juvenile efforts to maintain population in mid Snake – managers again turned to hatchery efforts to prevent extinction.
- A new experimental facility was built below Oxbow Dam – destined to become **Oxbow Hatchery**



Idaho Power Engineering Archive

Oxbow Problems - Adults

- Trapping increased steadily 1964-1967, effectively eliminating natural spawning in the Middle Snake River
- High hatchery water temperatures caused high mortality of adults (15.6 - 71.3%) 1960-67.
- By 1967 trapping moved downstream to the newly completed Hells Canyon Dam where 100% of adults were captured.



Fall Chinook spawning – 1960's

Idaho Power Engineering Archive

Hells Canyon (1967)

Oxbow Problems - Juvenile

- Low winter water temps delayed egg development and decreased size of fry at release.
- Coagulated yolk disease and gas bubble trauma along with unspecified bacterial diseases caused wide variance in egg-to-fry survivals.
- Size at release became a serious concern as hatchery fish much smaller than wild conspecifics.

Wild 66 mm in <u>May</u> (Bell 1957)

Hatchery 58 mm in <u>June</u> (Craig 1967)

Ineffectual Hatchery efforts.

- "Further concern has been expressed by fishery personnel over the relatively small size of fry released ….. at the Oxbow facility. **These fish have been small when compared to wild migrants which formerly used to pass through this same section of river** …. The **wild migrants** are known to have **reared for a period in the** more quiet environment of **Snake River near Swan Falls, attaining a possible critical increment in size prior to undertaking migration through the swifter river areas downstream**. Presumably the larger size …. could have made them more capable of coping with migration through highly turbulent sections of the river." *Haas (1965)*

Oxbow Problems - Juvenile

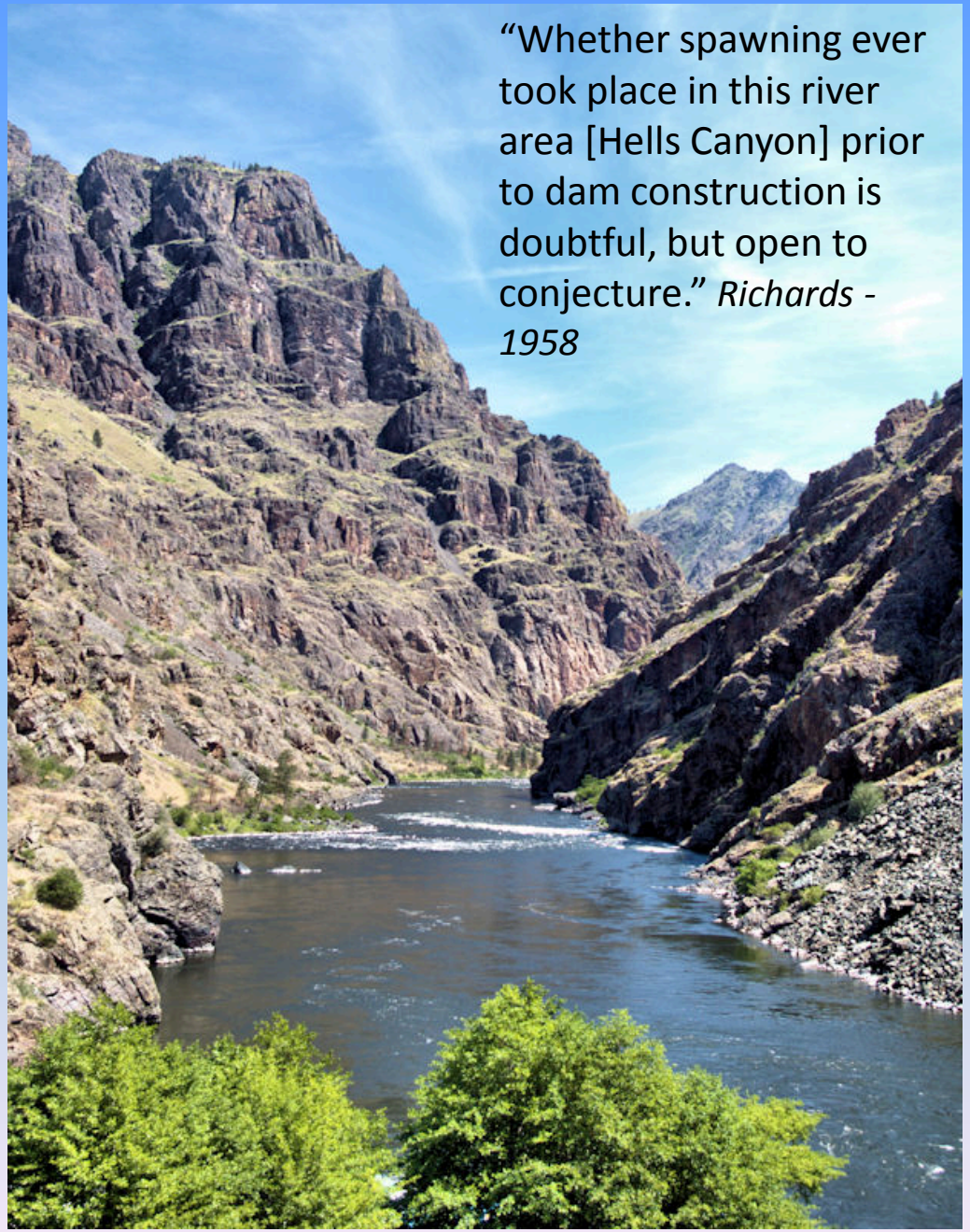
- Low winter water temps delayed egg development and decreased size of fry at release
- Coagulated yolk disease and gas bubble trauma along with unspecified bacterial diseases caused wide variance in egg – fry survivals..
- Size at release became a serious concern as hatchery fish much smaller than wild conspecifics.
- **Poor performance: P:P < 1.0 resulted in the fall Chinook program being discontinued c. 1972.**

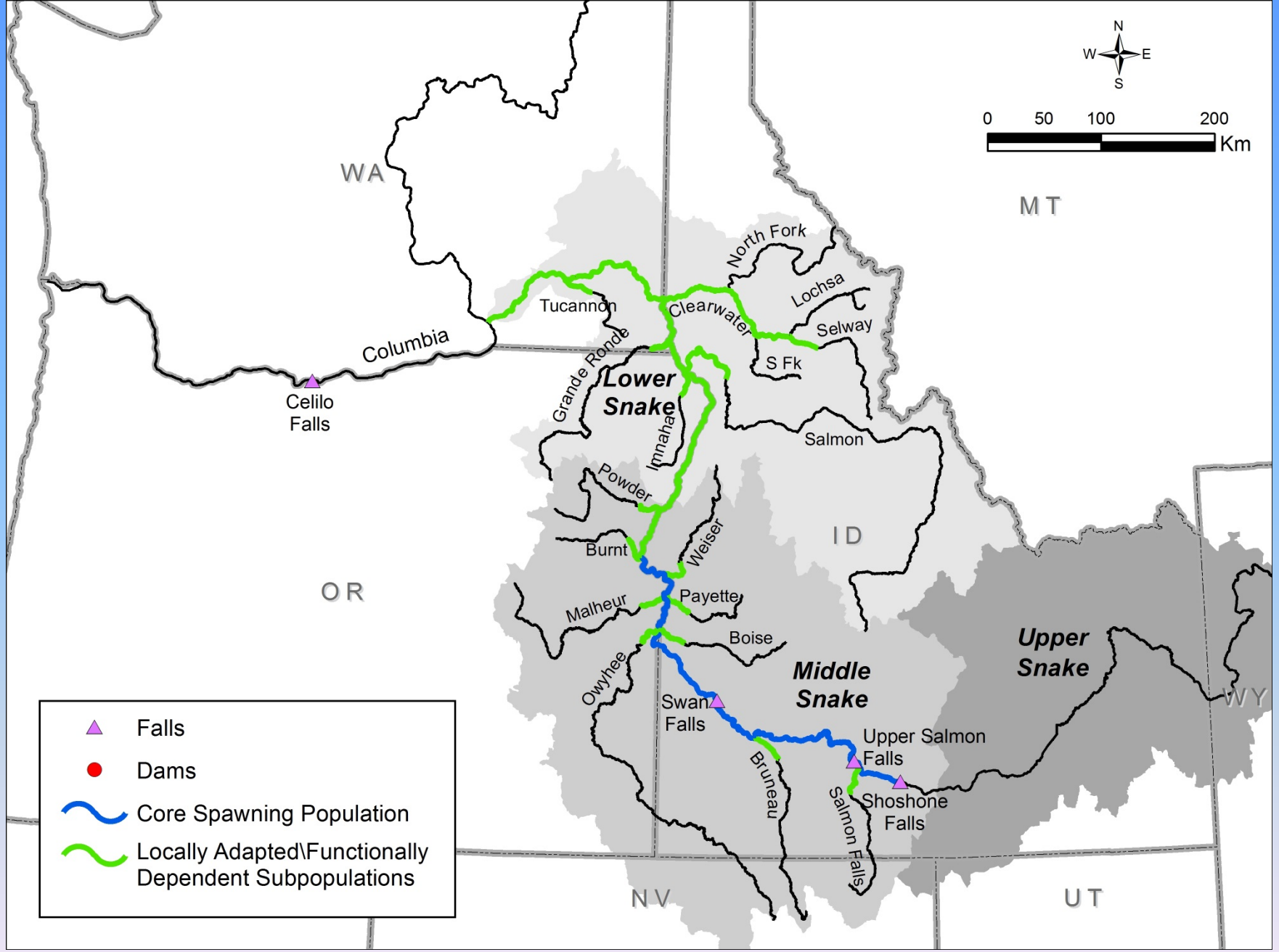
Wild 66 mm in <u>May</u> (Bell 1957)

Hatchery 58 mm in <u>June</u> (Craig 1967)

Post Oxbow Hatchery Situation

- Core Fall Chinook habitat now inaccessible
- Less desirable Hells Canyon habitat now needed to support the population





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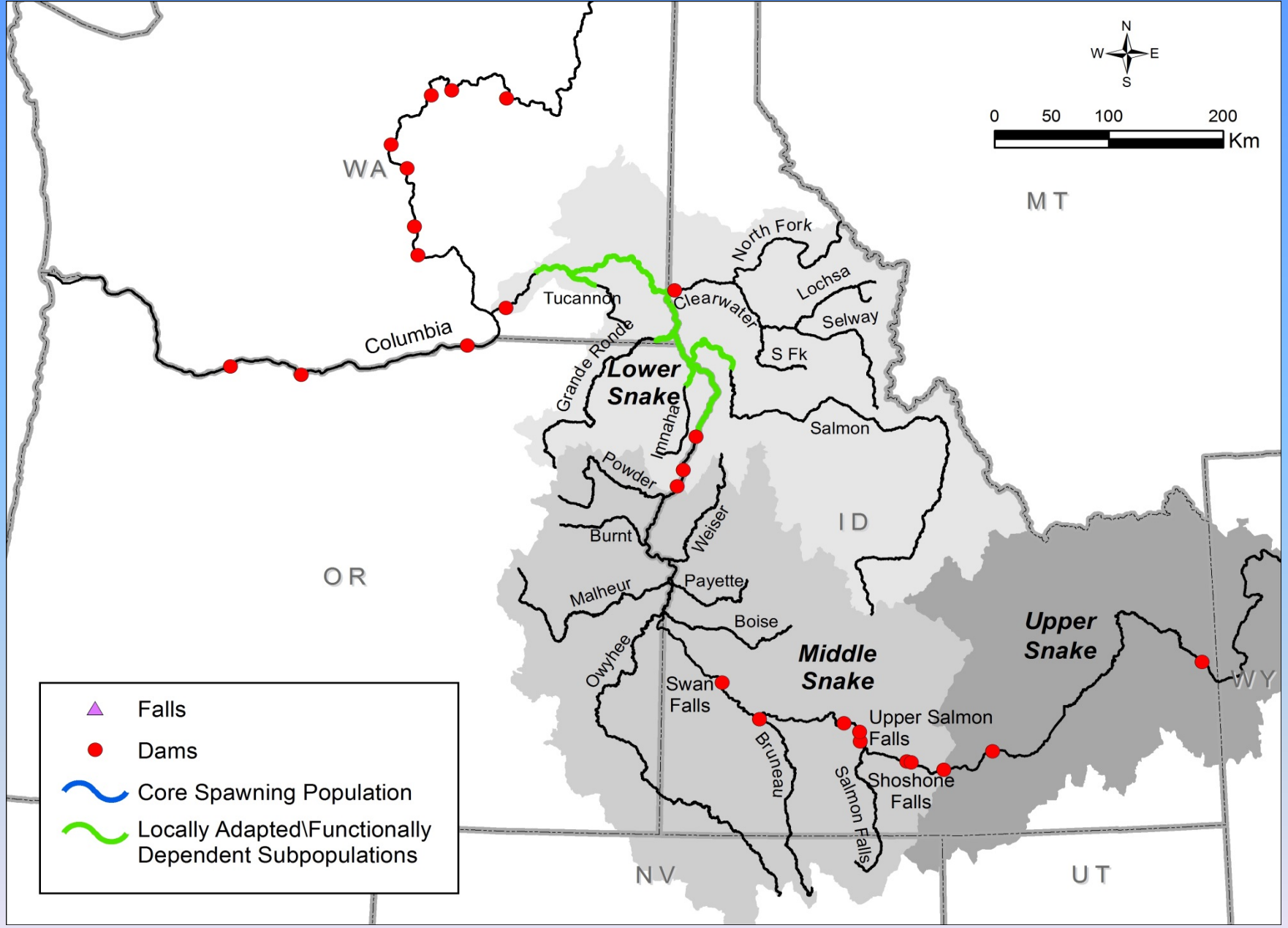


After Hells Canyon – fall Chinook were limited to above Ice Harbor pool to HC Dam + some tributary spawning.

Where were Fall Chinook producing?

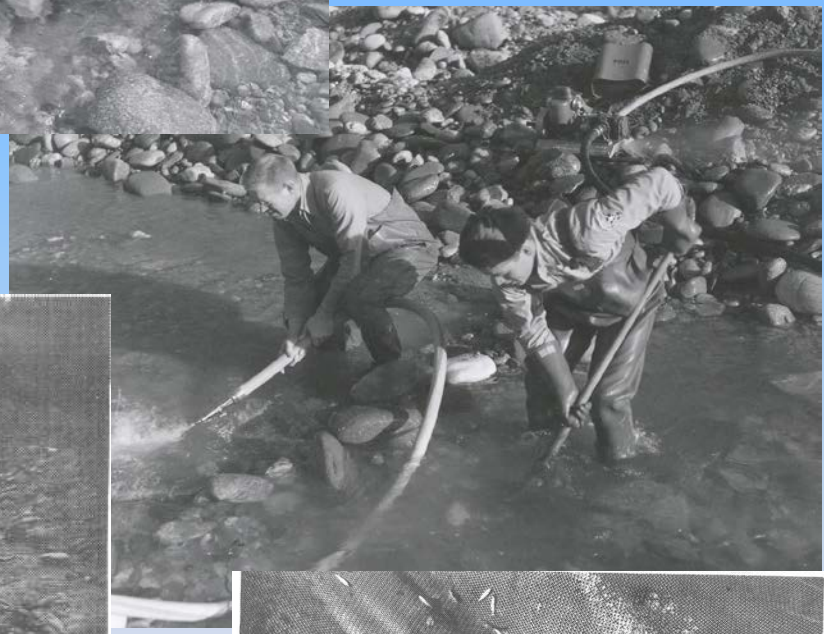
- Derived abundance estimates at the Snake River mouth exceeded those counted at Oxbow or Hells Canyon by 8,500 – 27,600.
- Redd surveys confirmed spawning in lower Snake to the mouth and mainstem areas above Ice Harbor Dam pool but no records of that usage could be found.
- Also some reference to redds in lower Imnaha

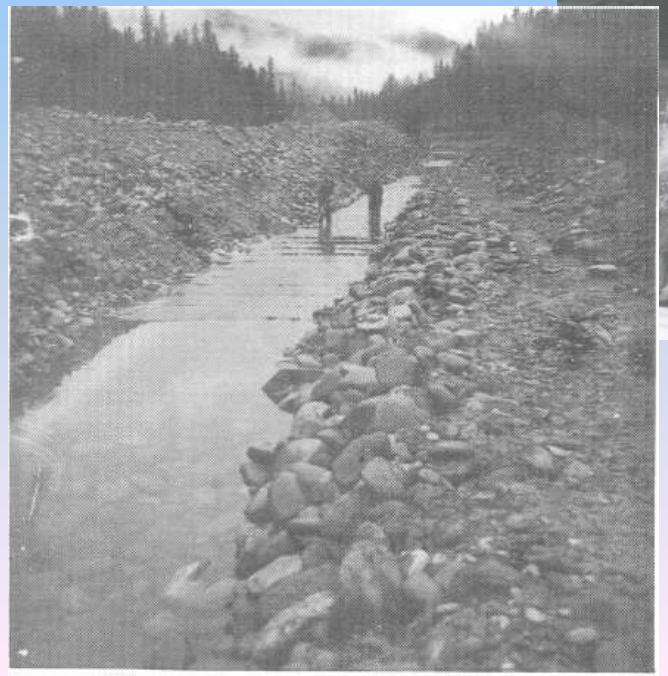
Some additional recovery efforts

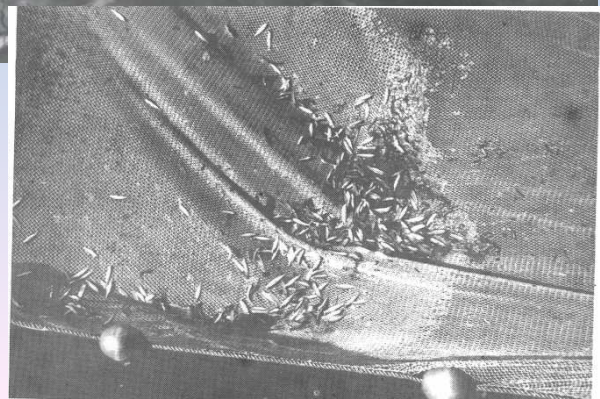
- Egg collection and artificial redd construction in the Clearwater and Selway rivers (1960-68)

- Notably unsuccessful) resulting in only 9 adults at Lewiston Dam in 1972 and the program was discontinued

Selway Hatching Channel, 1962-63
(Bell 1964)







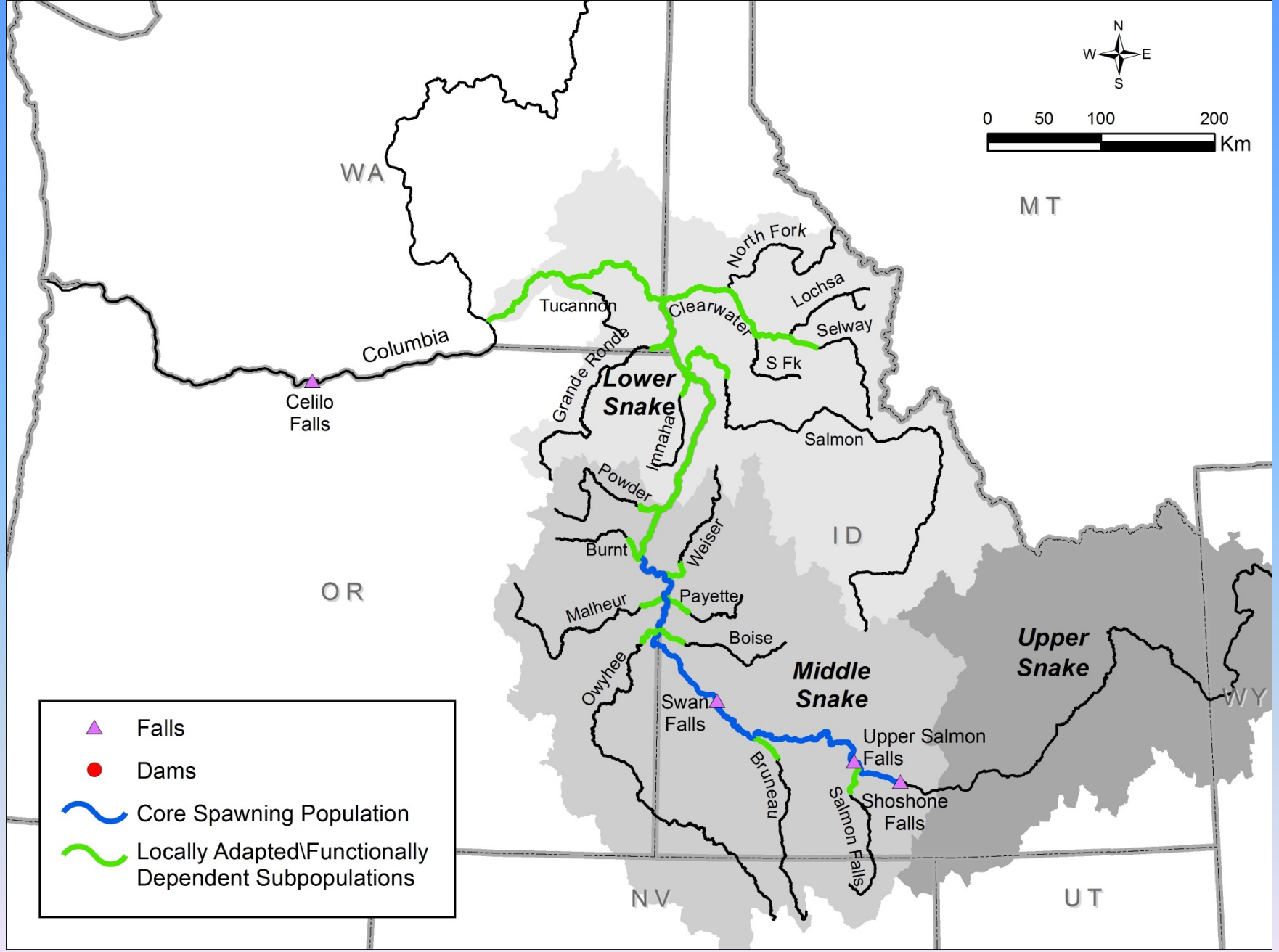
Some additional recovery efforts

- Habitat Conservation and Flow Management (1964-1974)
  - Studies surrounding the proposed construction of several new large dams, including,
    - **High Mountain Sheep (204 m tall)**
    - **Nez Perce (213 m tall)**
- Results were flow recommendations to promote redd building and protect eggs and juveniles during growth and development.
- Eventually Protected by Hells Canyon Wilderness

The final Straw

- Sequentially the last three lower Snake dams were completed by the USACE,
  - Lower Monumental (1969)
  - Little Goose (1970)
  - Lower Granite (1975)
- Snake River Fall Chinook numbers fell
  - 1938-47 high of **47,600**
  - 1975 low of **2,558**

Lewiston Dam is Removed – 1973



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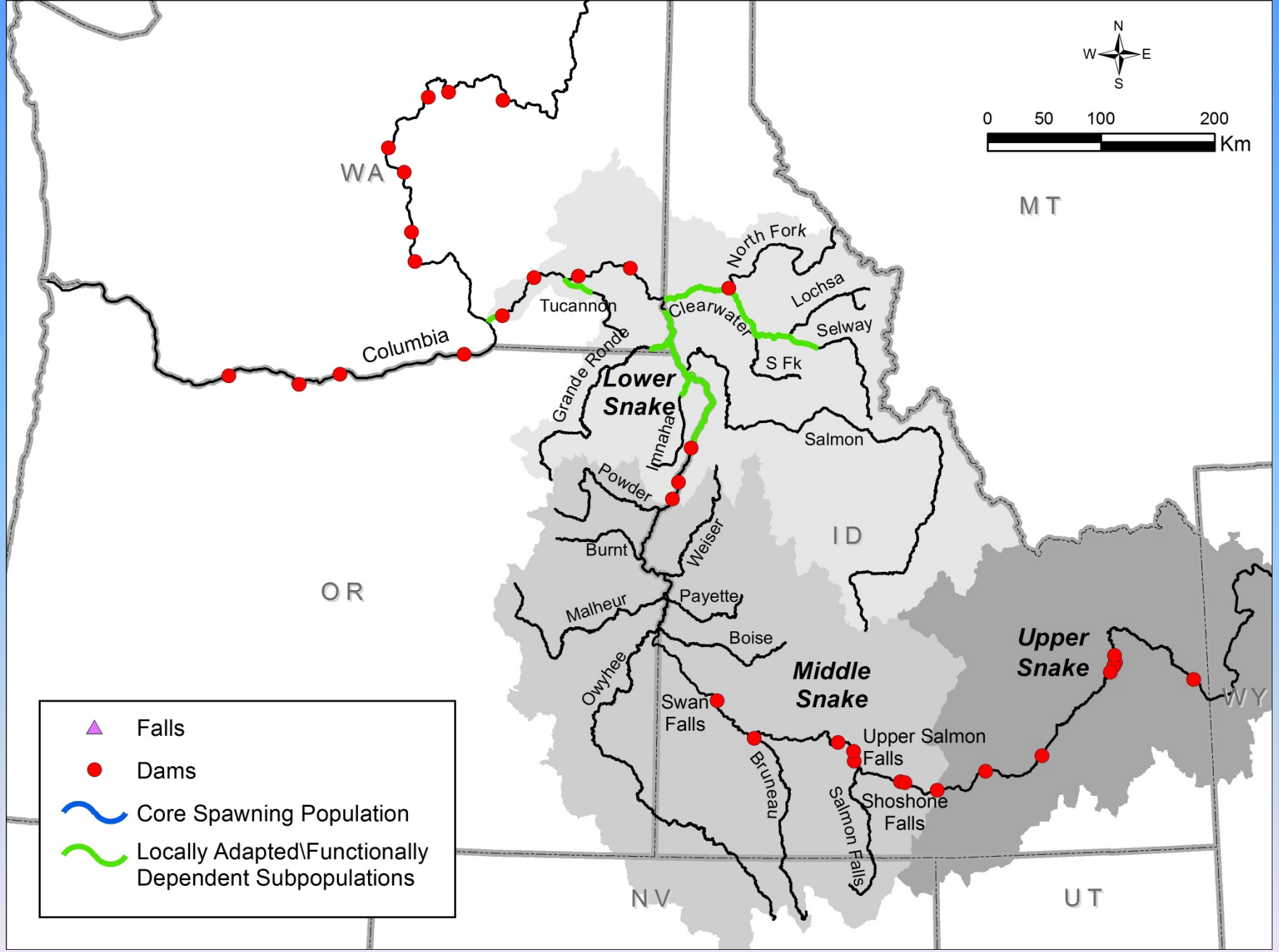
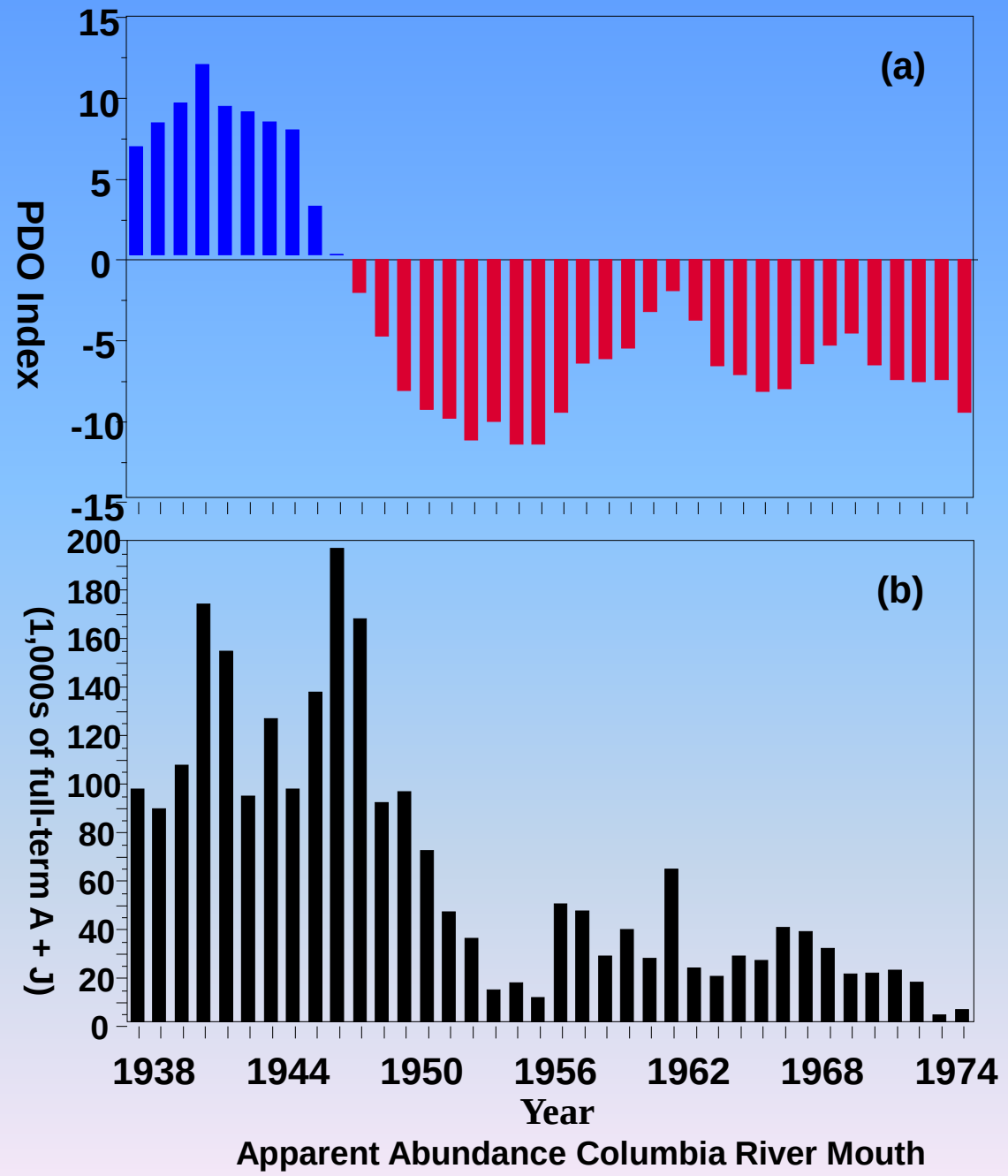


Remaining accessible habitat for fall Chinook, 1975.

Pacific Decadal Oscillation – part of the perfect storm on fall Chinook.

The PDO index*, which was directly proportional to and explained 53.2% (*N* = 38 years; *P* < 0.0001) of the annual variation in apparent abundance of Snake River basin fall Chinook salmon at the Columbia River mouth, **<u>was negative each year from 1948 to 1975</u>**.



* From Mantua, NOAA Science Center

Summary

- Over fishing
- Dewatering, sedimentation and juvenile entrainment
- Dam construction:
  - habitat loss
  - altered ecology
  - direct mortality (adults + juveniles)
  - super saturation of gasses

Summary (con't)

- Predation by indigenous and introduced species
- Poor Ocean conditions (-PDO)
- Poor hatchery efforts
- **Bottom line – by 1975 the entire Snake River Basin was a dramatically altered ecosystem, within which there was an expectation that fall Chinook remain viable!?**

The Rest of the Story……

The remainder of our two days will take up the history of Snake River fall Chinook with implementation of the LSRCP effort, and other recovery actions that have affected this population.

Image courtesy of Portland District
US Army Corps Of Engineers

Questions?