Investigating passage of ESA-listed juvenile fall Chinook salmon at Lower Granite Dam during winter when the fish bypass system is not operated

Kenneth Tiffan
U.S. Geological Survey

William Connor
U.S. Fish & Wildlife Service

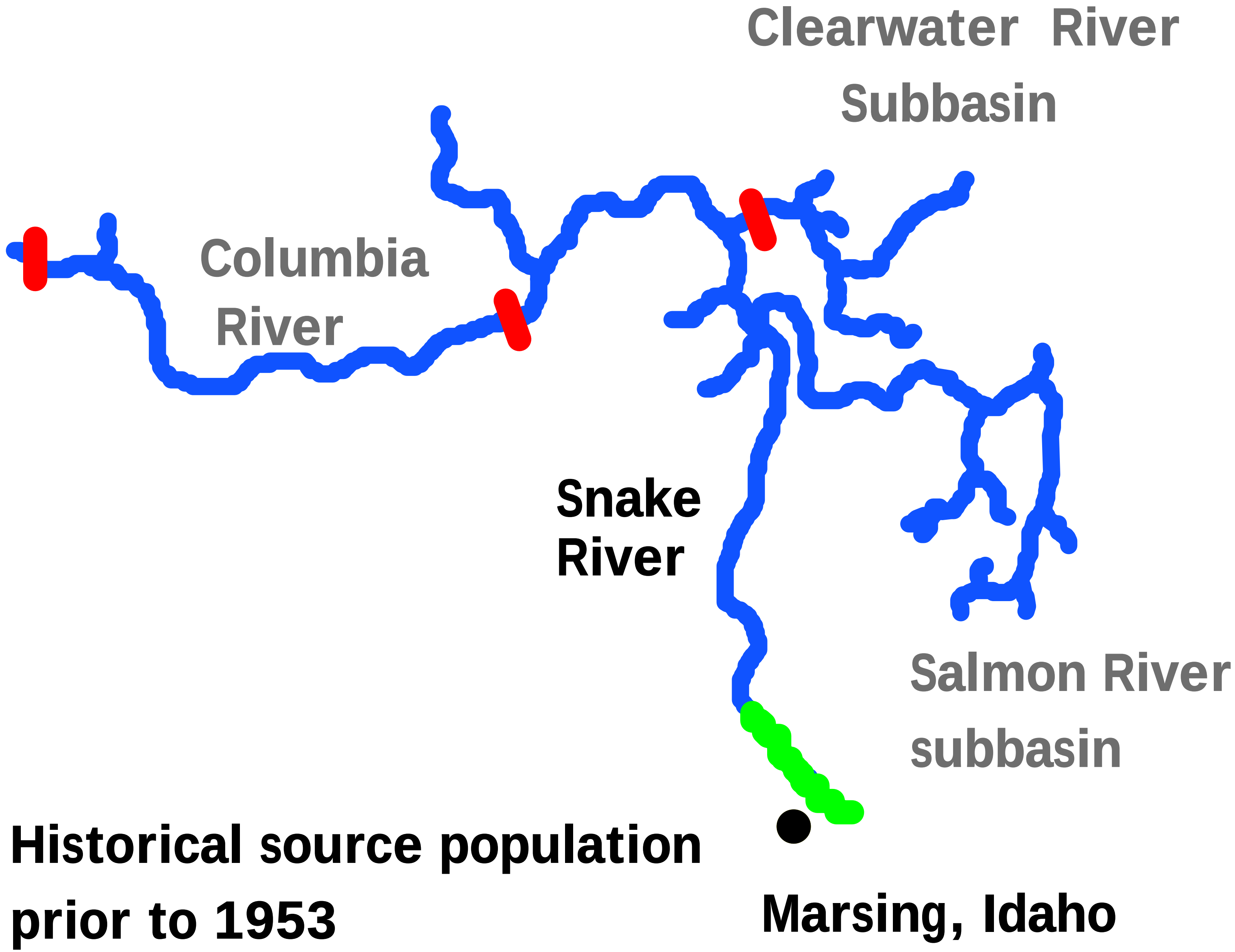
Project 200203200

U.S. FISH & WILDLIFE SERVICE

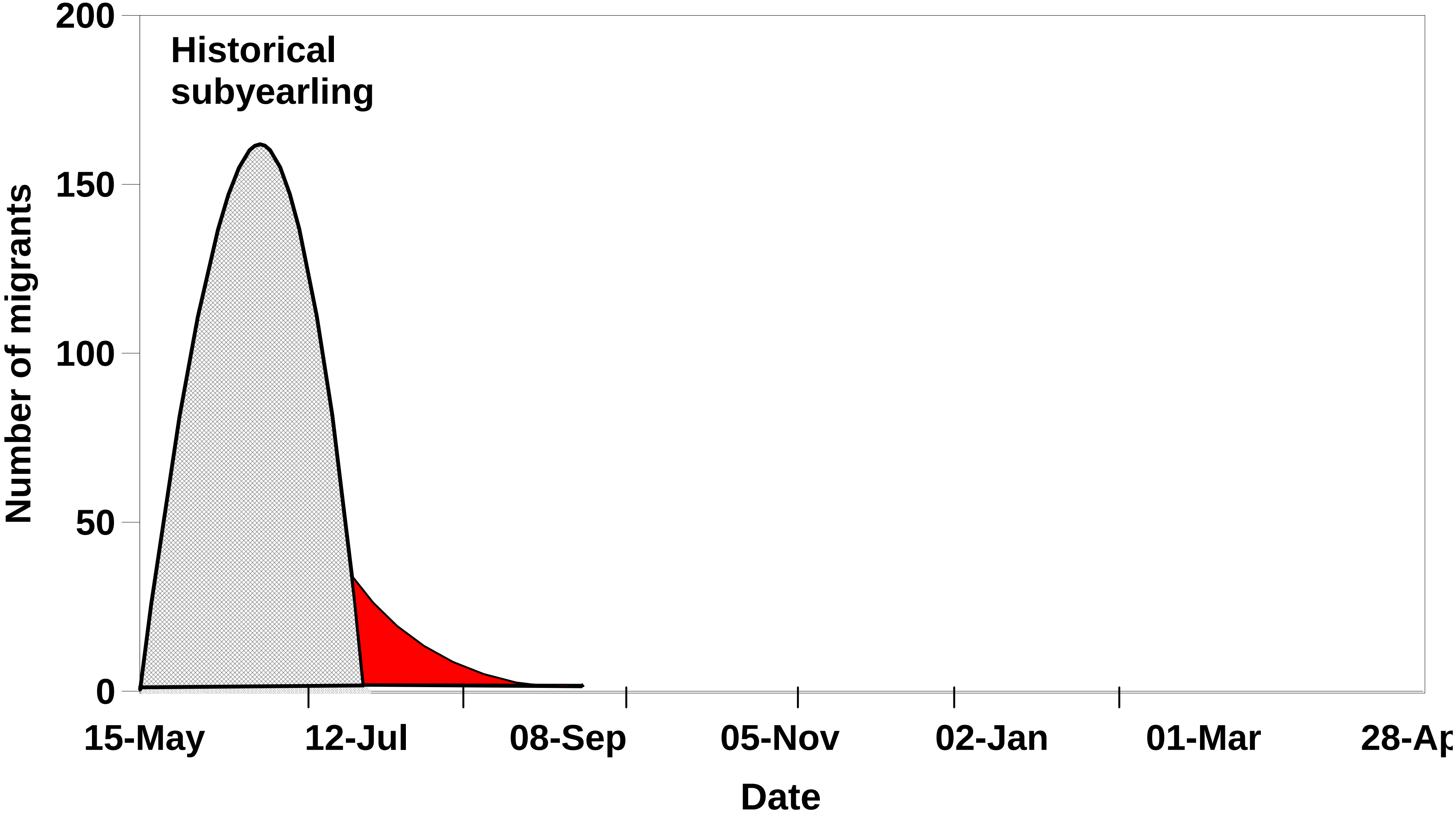
Washington Department of FISH and WILDLIFE

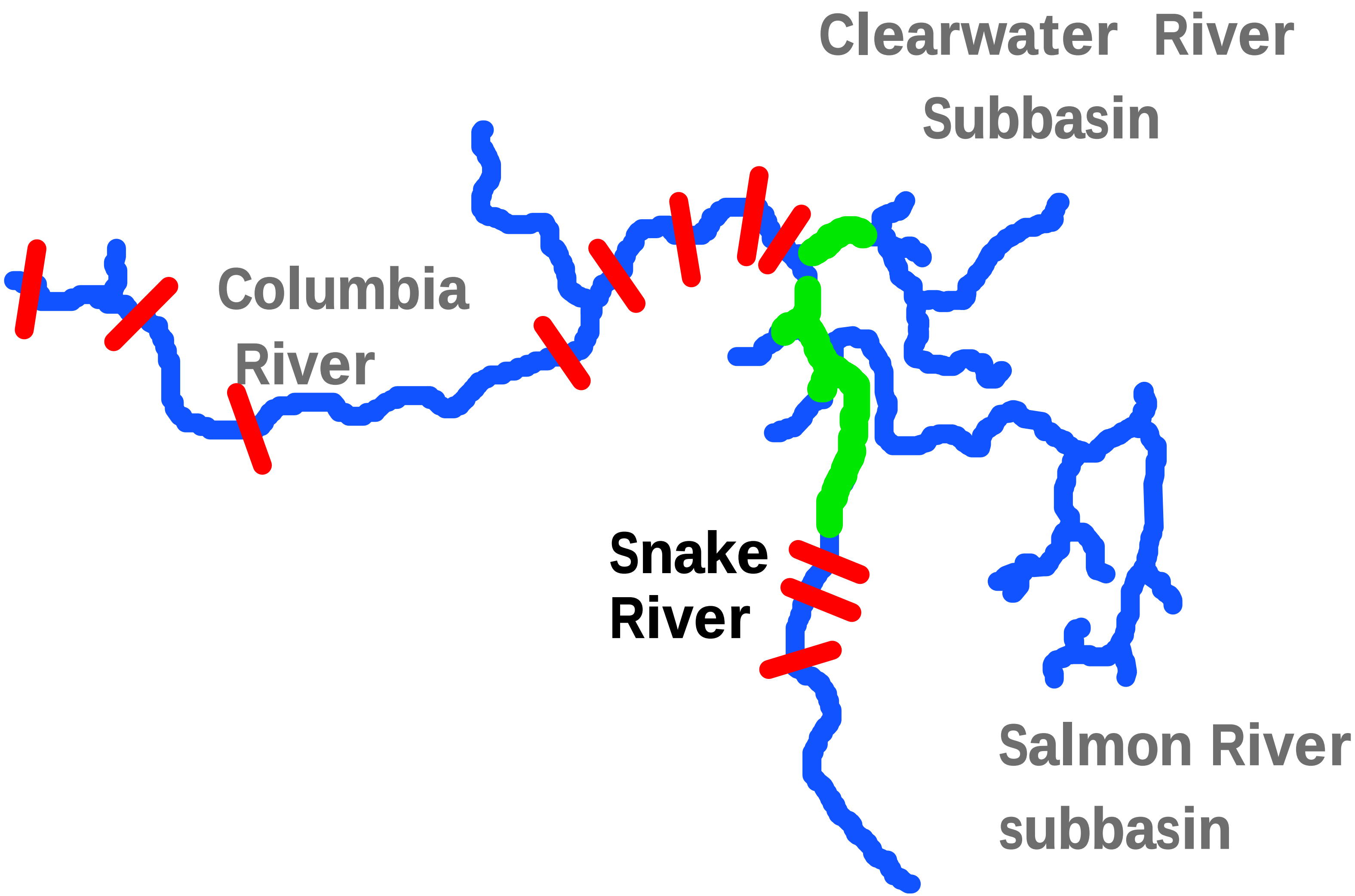
USGS science for a changing world

Bonneville Power Administration


Clearwater River
Subbasin
Columbia
River
Snake
River
Salmon River
subbasin
Historical source population
prior to 1953
Marsing, Idaho

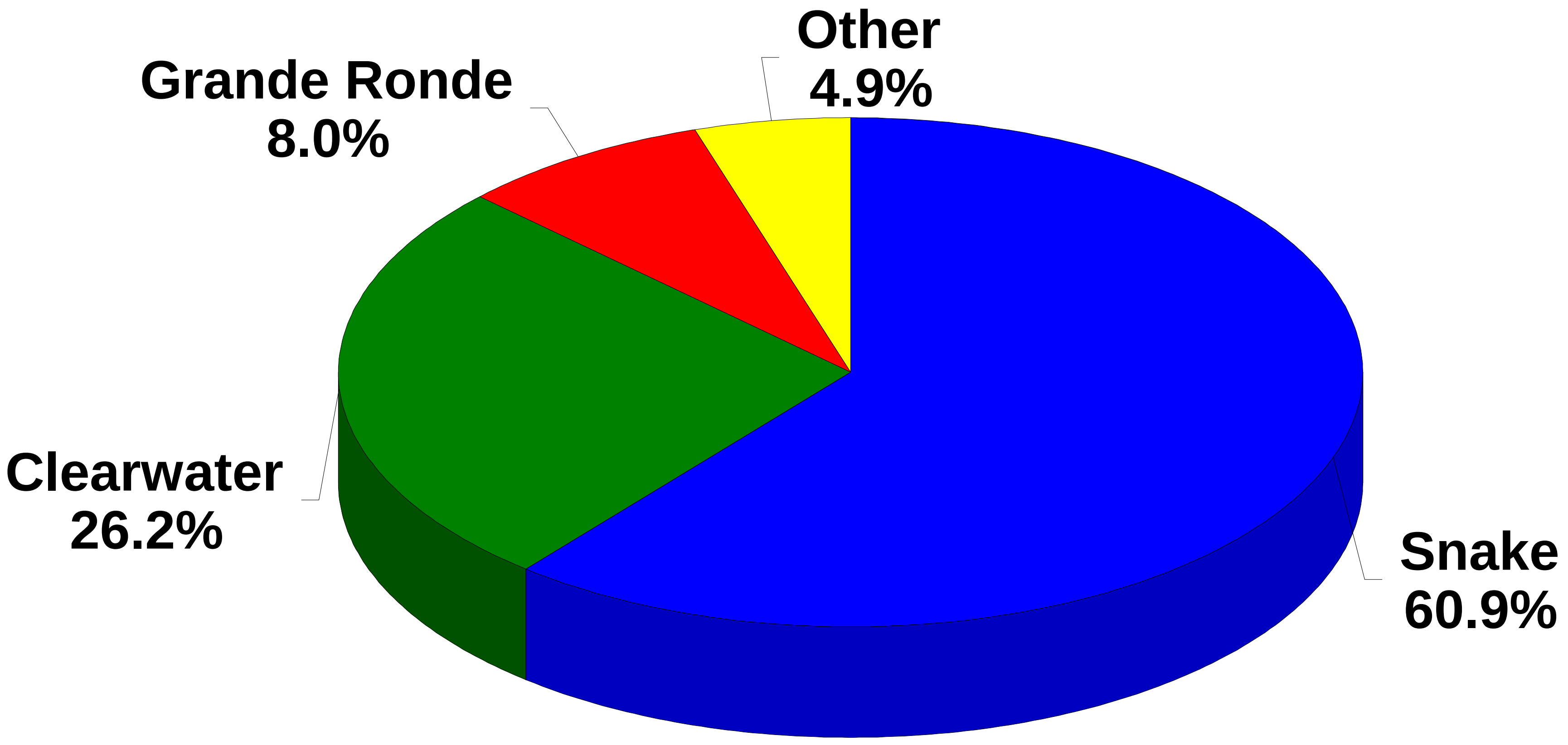
A depiction of fall Chinook salmon smolt migration timing from the Snake River



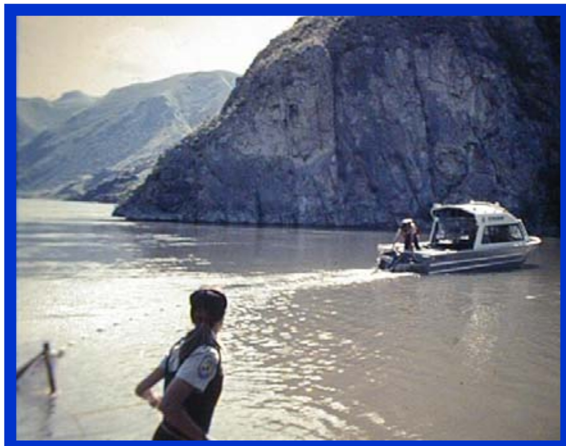


Known documented
spawning areas 1991-2003.

Overall distribution of redds upstream of Lower Granite Reservoir

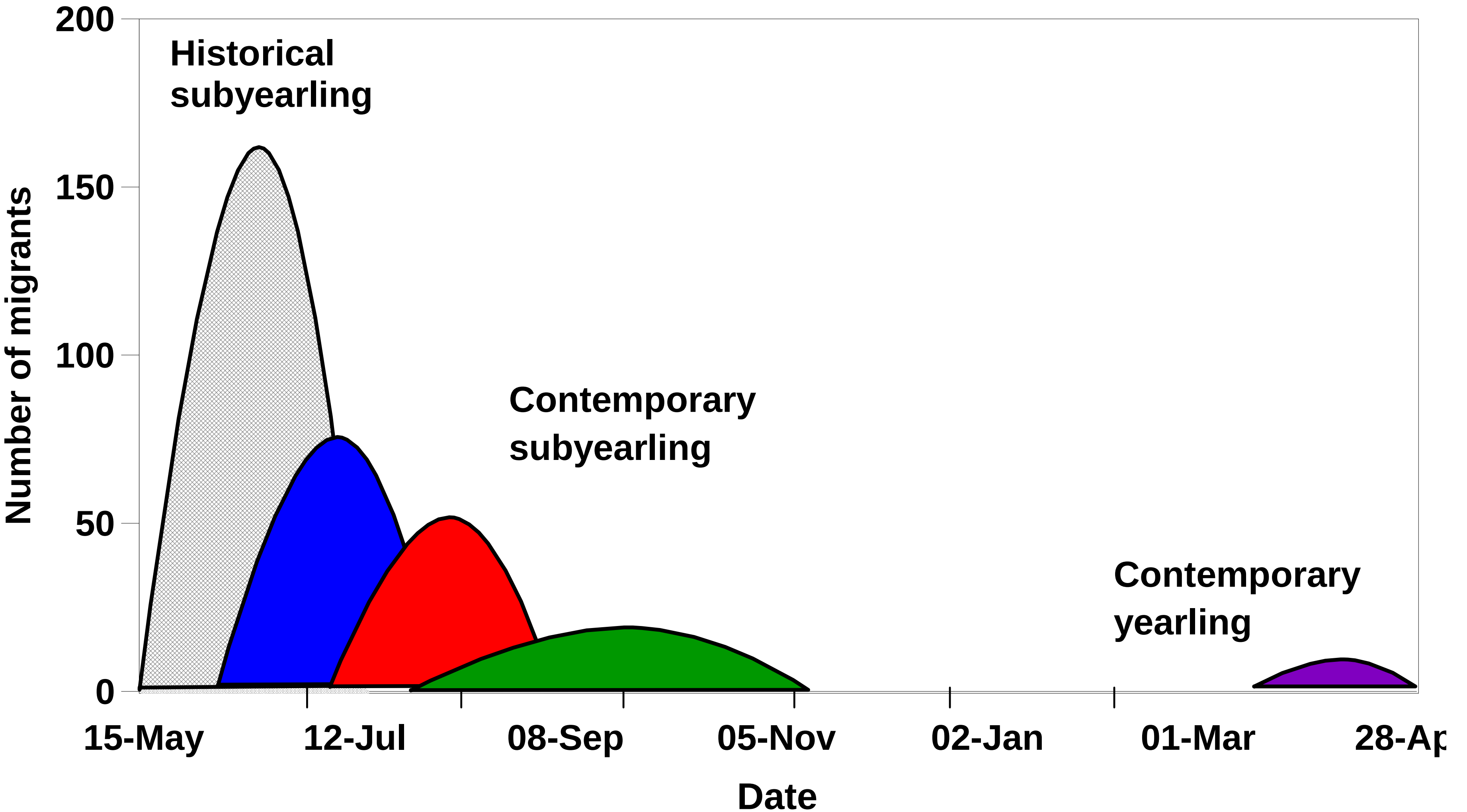


Use of PIT tags and radio tags to understand contemporary juvenile life histories



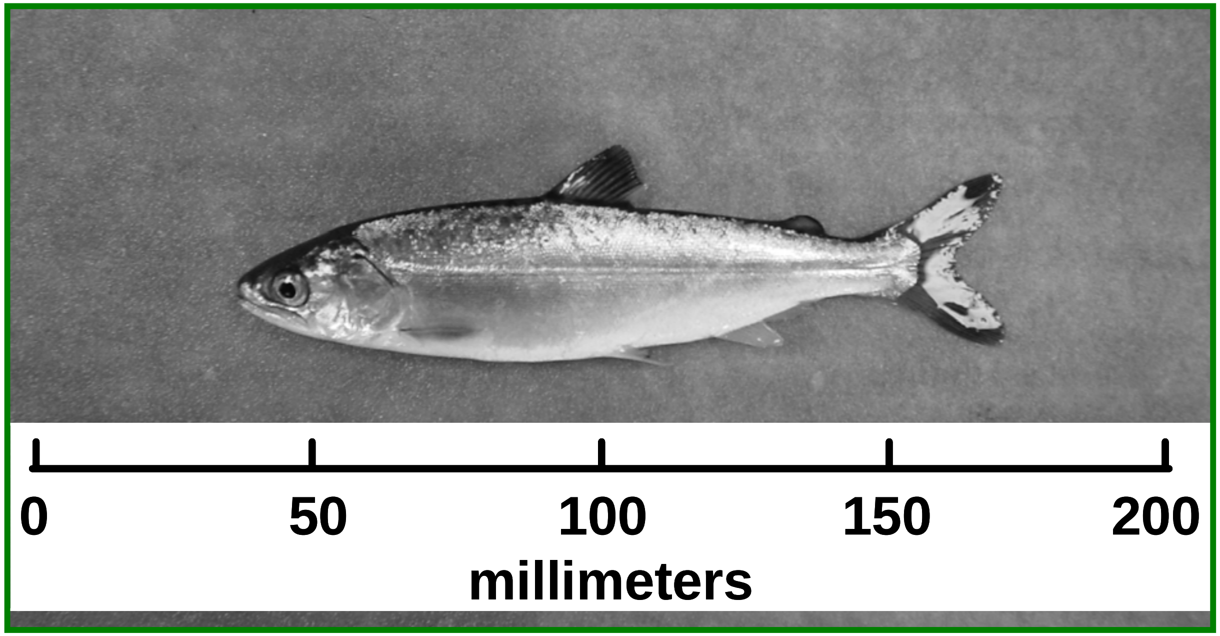


A depiction of fall Chinook salmon smolt migration timing from the Snake River

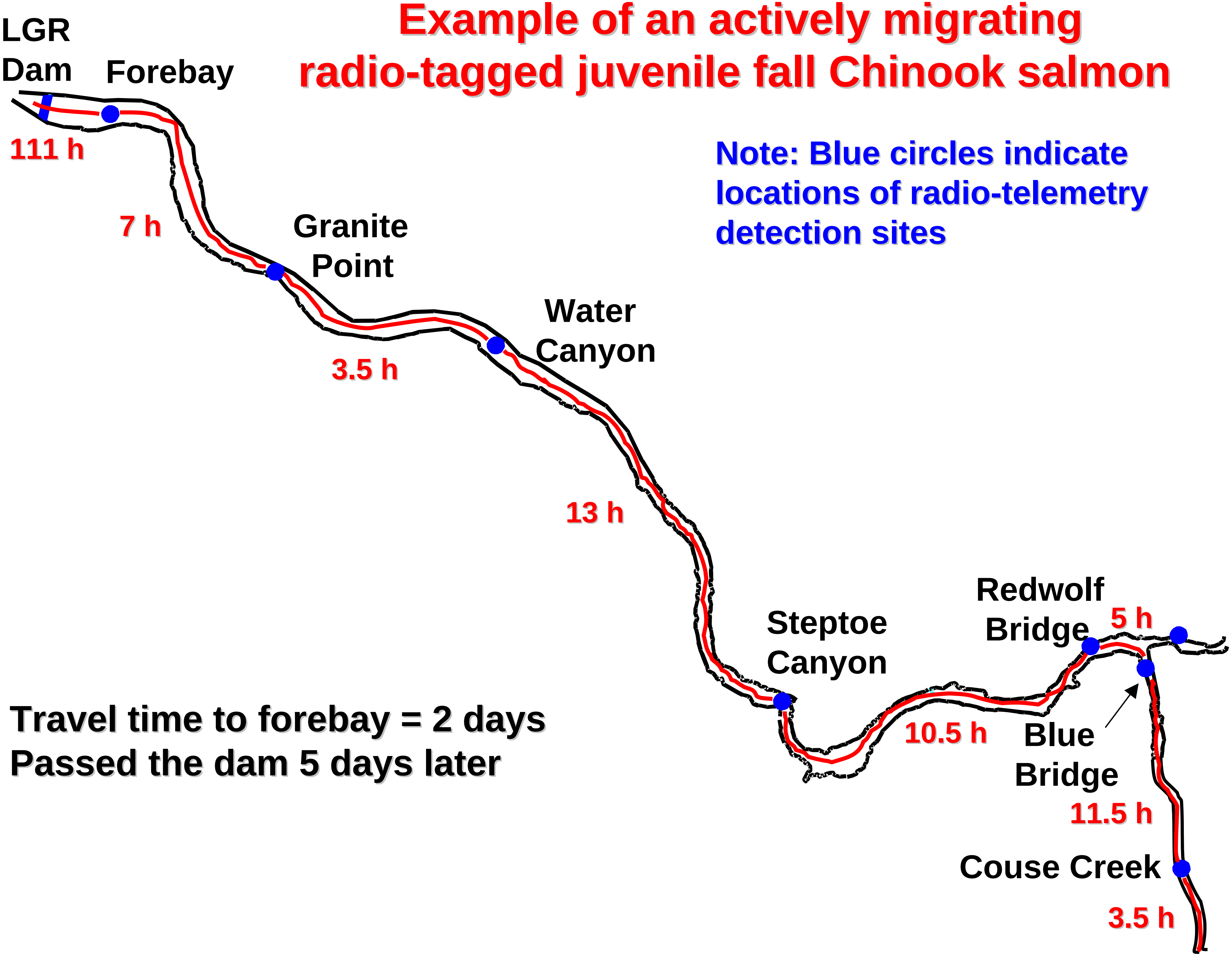


Details on ocean-type juveniles

1) Discontinuous shoreline rearing
2) Rapid dispersal into LGR reservoir
3) Discontinuous downstream dispersal
4) Active seaward movement



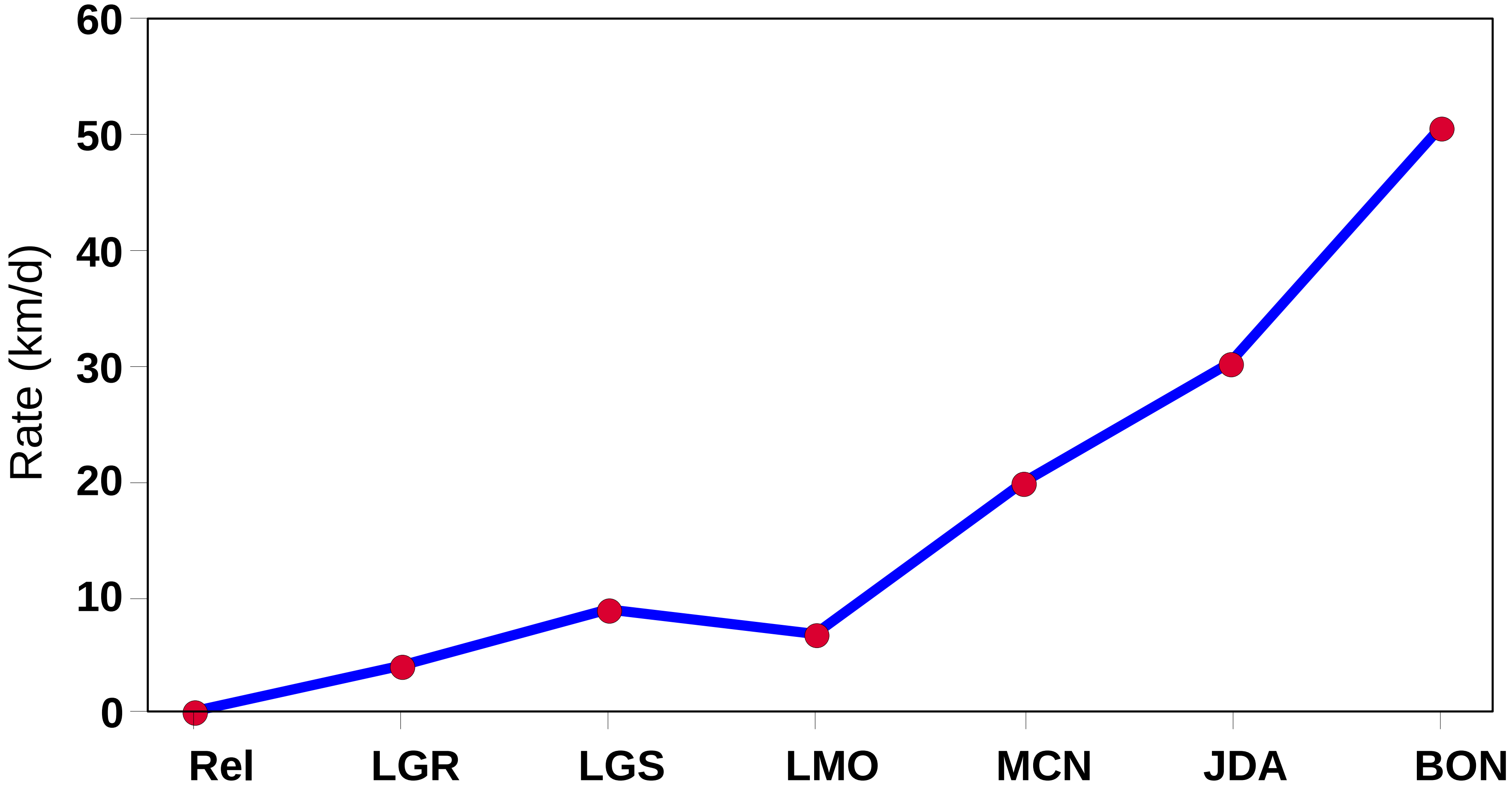
Example of an actively migrating radio-tagged juvenile fall Chinook salmon



Note: Blue circles indicate locations of radio-telemetry detection sites

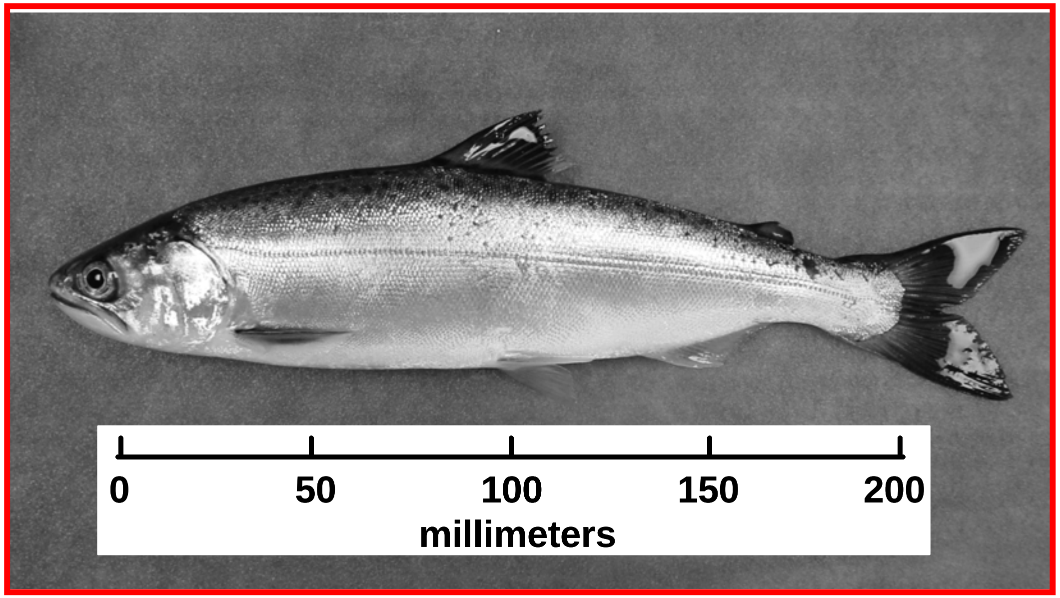
Travel time to forebay = 2 days
Passed the dam 5 days later

Observed rates of seaward movement for wild ocean-type subyearlings PIT tagged in the Snake River in 2003

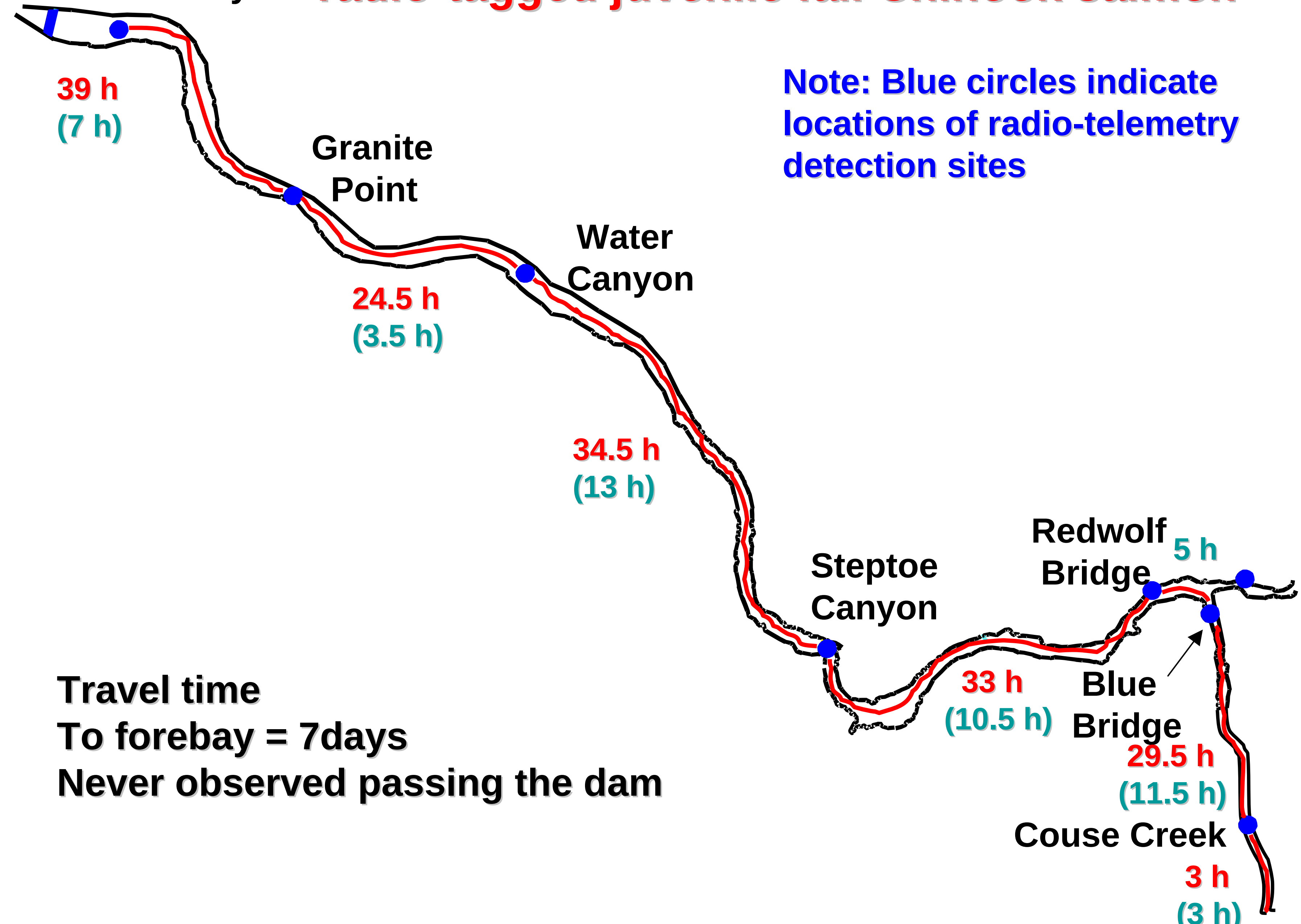


Speculative details on reservoir-type juveniles

1) Discontinuous shoreline rearing
2) Rapid dispersal into LGR reservoir
3) Discontinuous downstream dispersal
4) Disrupted/delayed seaward movement
5) Discontinuous downstream dispersal
6) Active seaward movement as yearlings



Example of an inactively migrating radio-tagged juvenile fall Chinook salmon

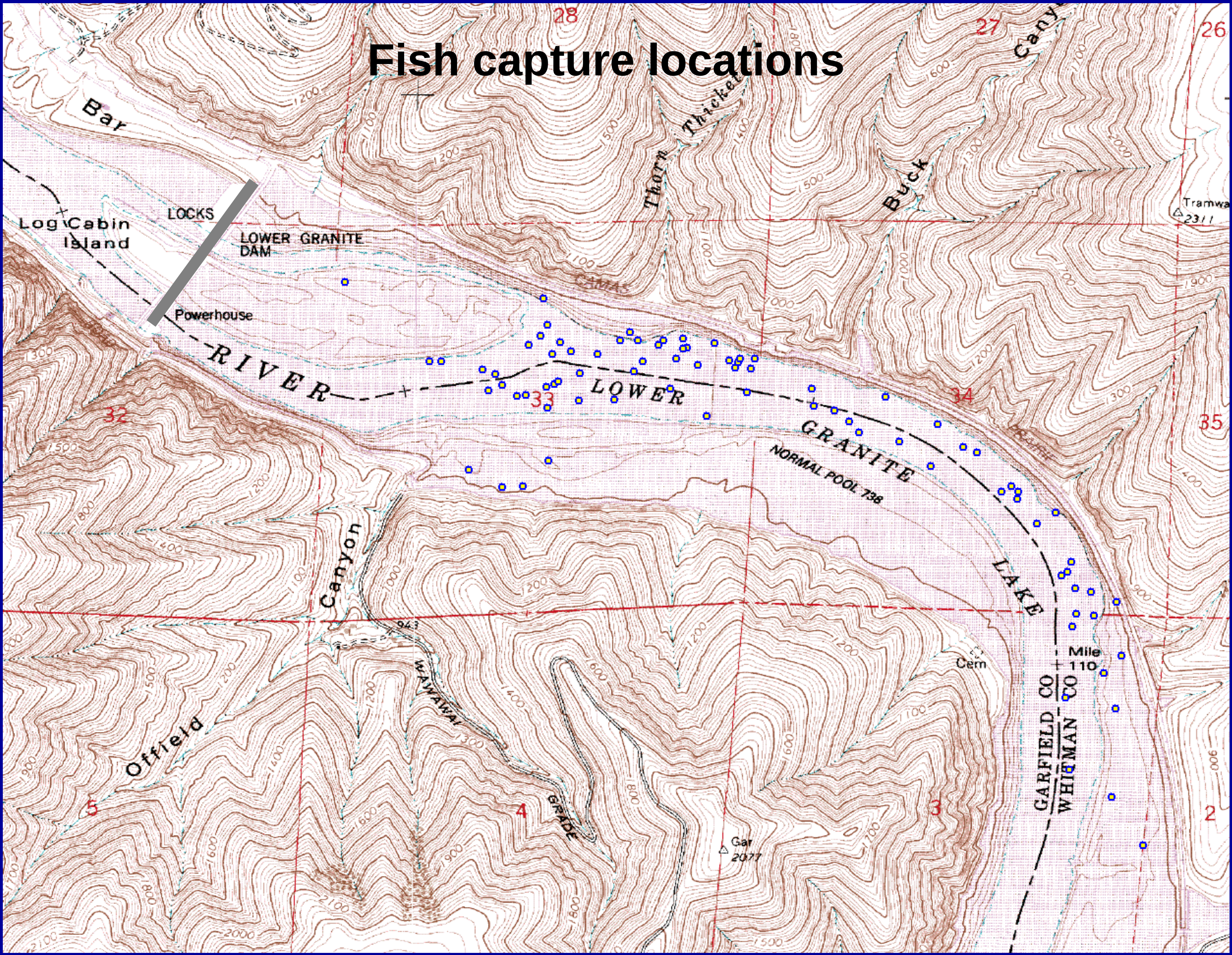


Note: Blue circles indicate locations of radio-telemetry detection sites

Travel time
To forebay = 7days
Never observed passing the dam

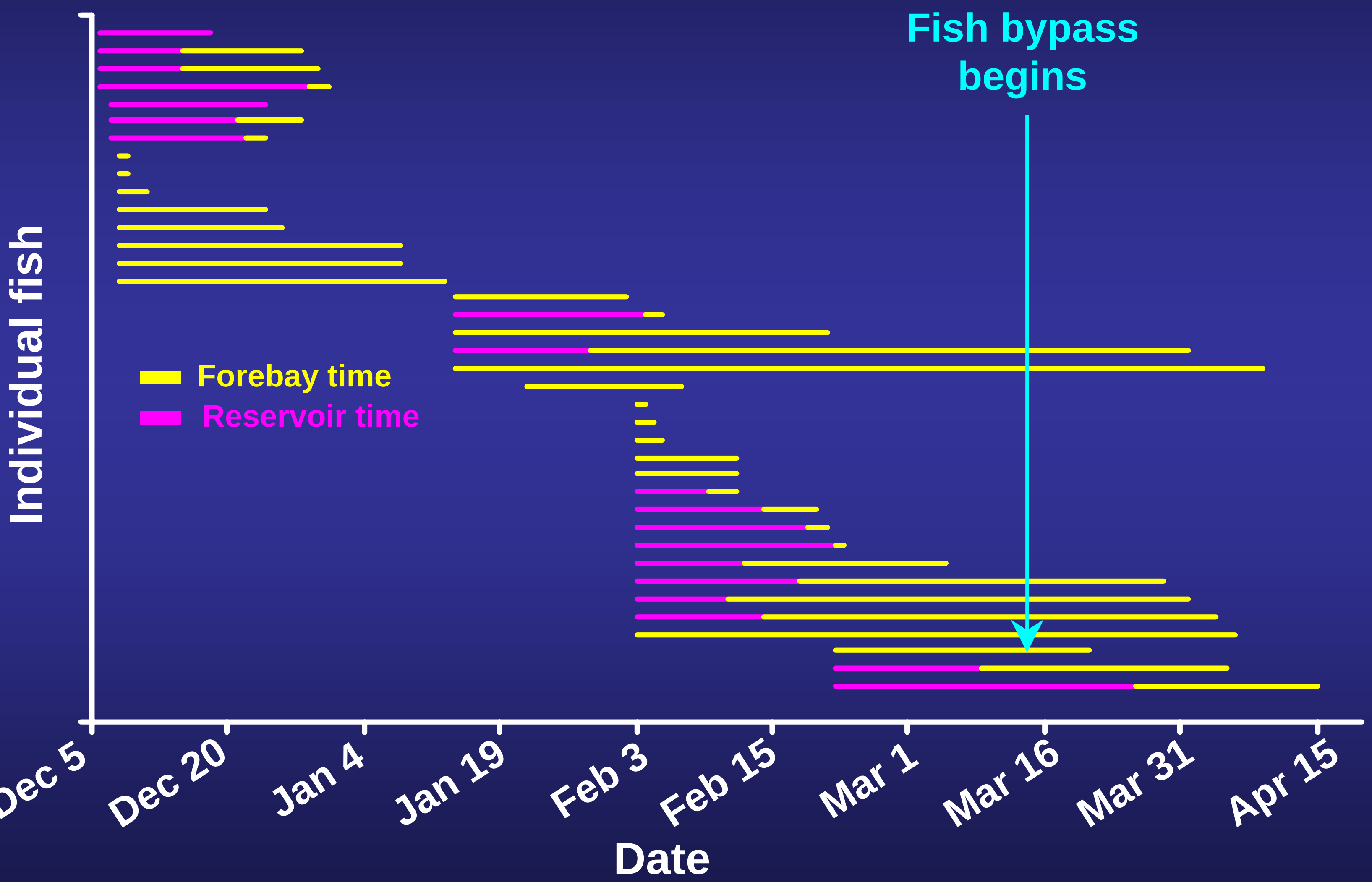
When do reservoir-type juveniles pass dams?

Fish capture locations



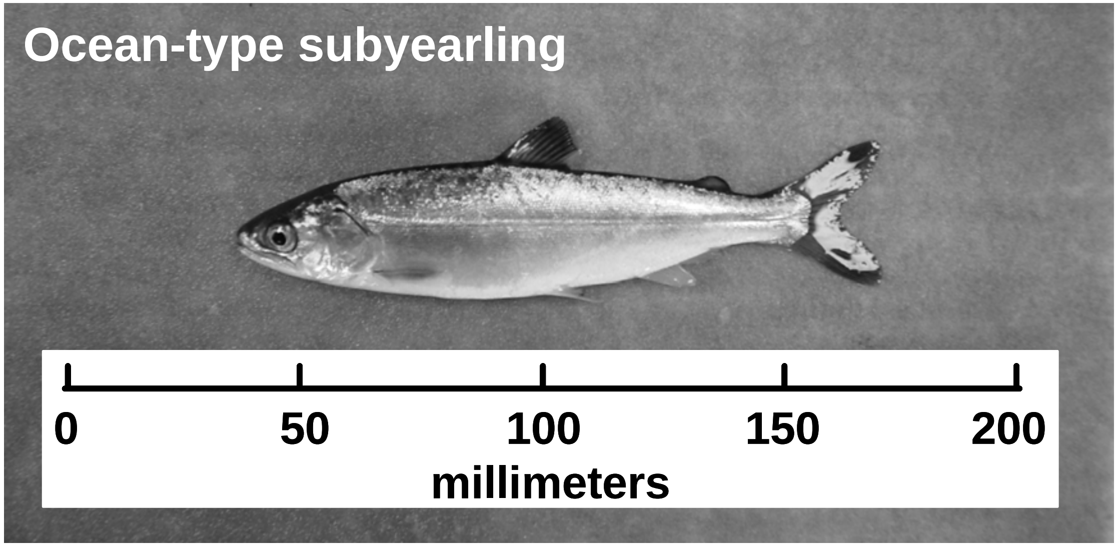
2003-2004

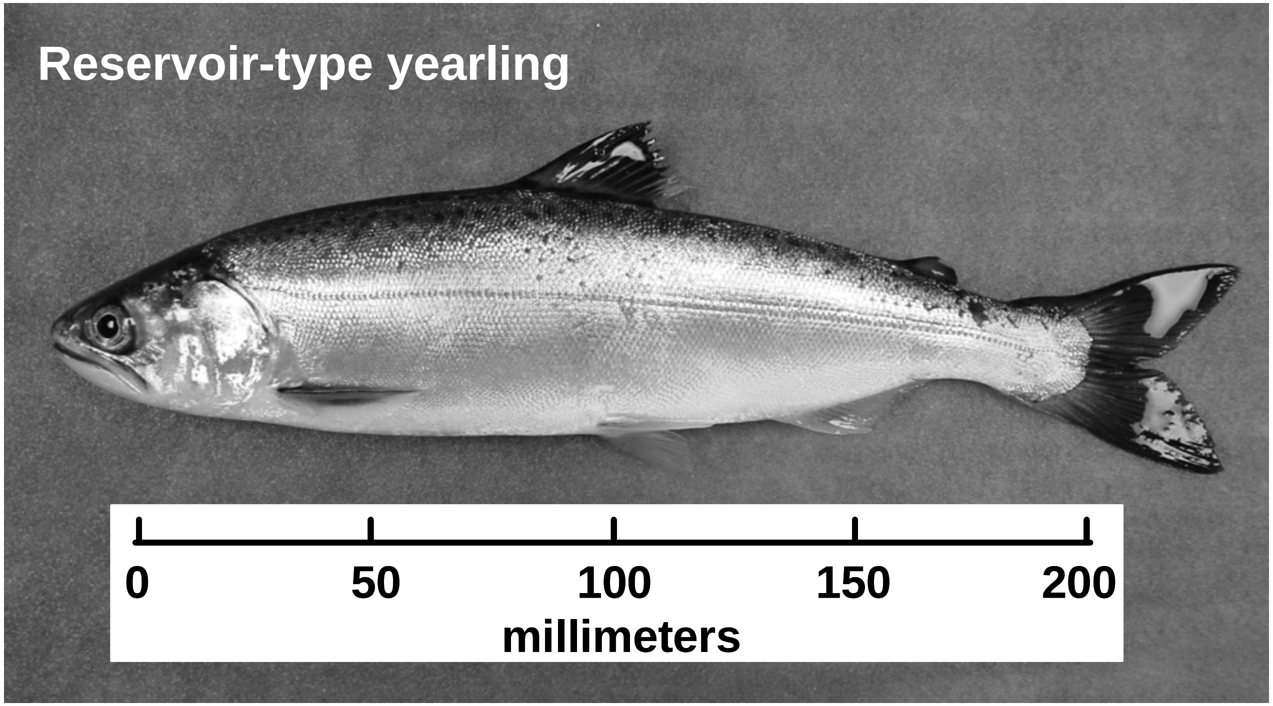
Mean length = 198 mm (169-247), mean weight = 85.9 g (51.2-137.6)
62% (38/61) of tagged fish passed Lower Granite Dam
76% (29/38) of fish that passed, did so before bypass began



2004-2005 Winter Passage Data as of 3-15-05

Location	Number	Percent
Released above Lower Granite	140	
Lower Granite tailrace	52	37%
Little Goose forebay	15	11%
Little Goose tailrace	8	6%
Lower Monumental forebay	6	4%
Lower Monumental tailrace	3	2%
Ice Harbor forebay	1	0.7%


Ocean-type subyearling
0
50
100
150
200
millimeters


Reservoir-type yearling
0
50
100
150
200
millimeters

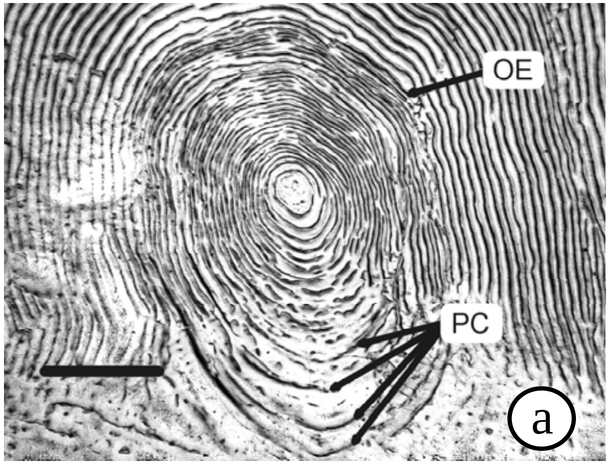
Adult collection

Collected adults at Lower Granite Dam 1998—2003.

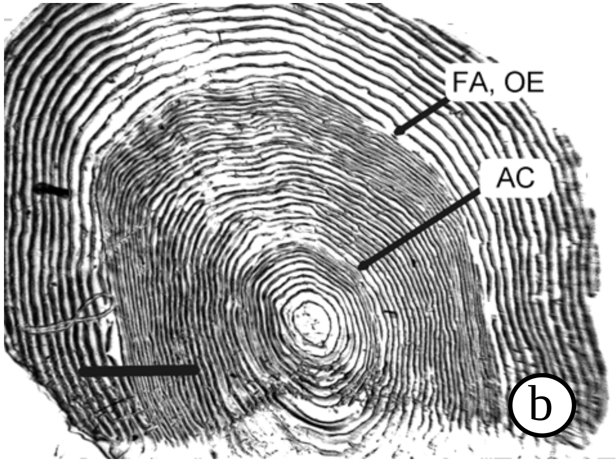
Sampled scales, measured fork length and estimated gender.

Scale pattern analysis

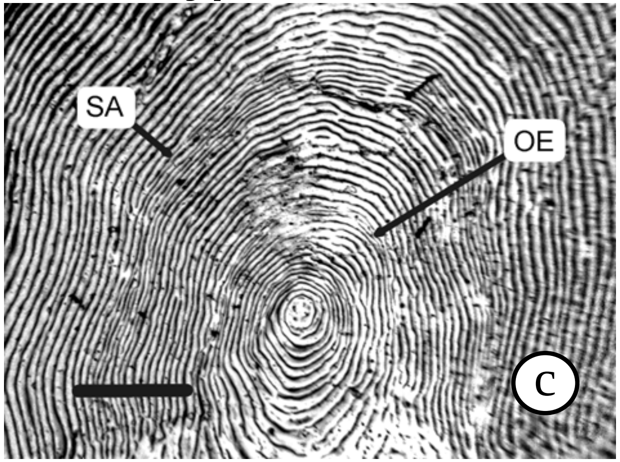
LFH Yearling



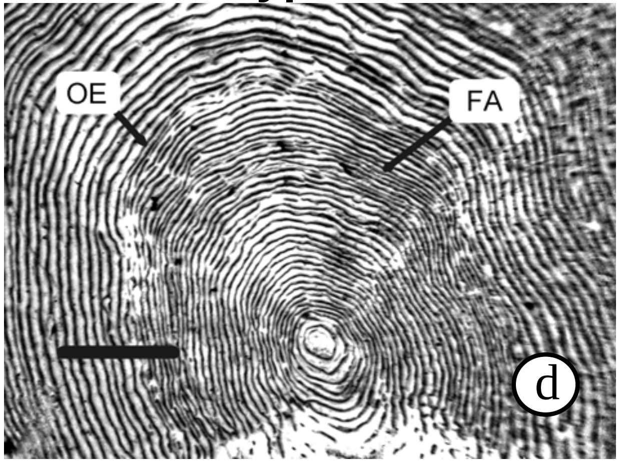
Hatchery subyearling



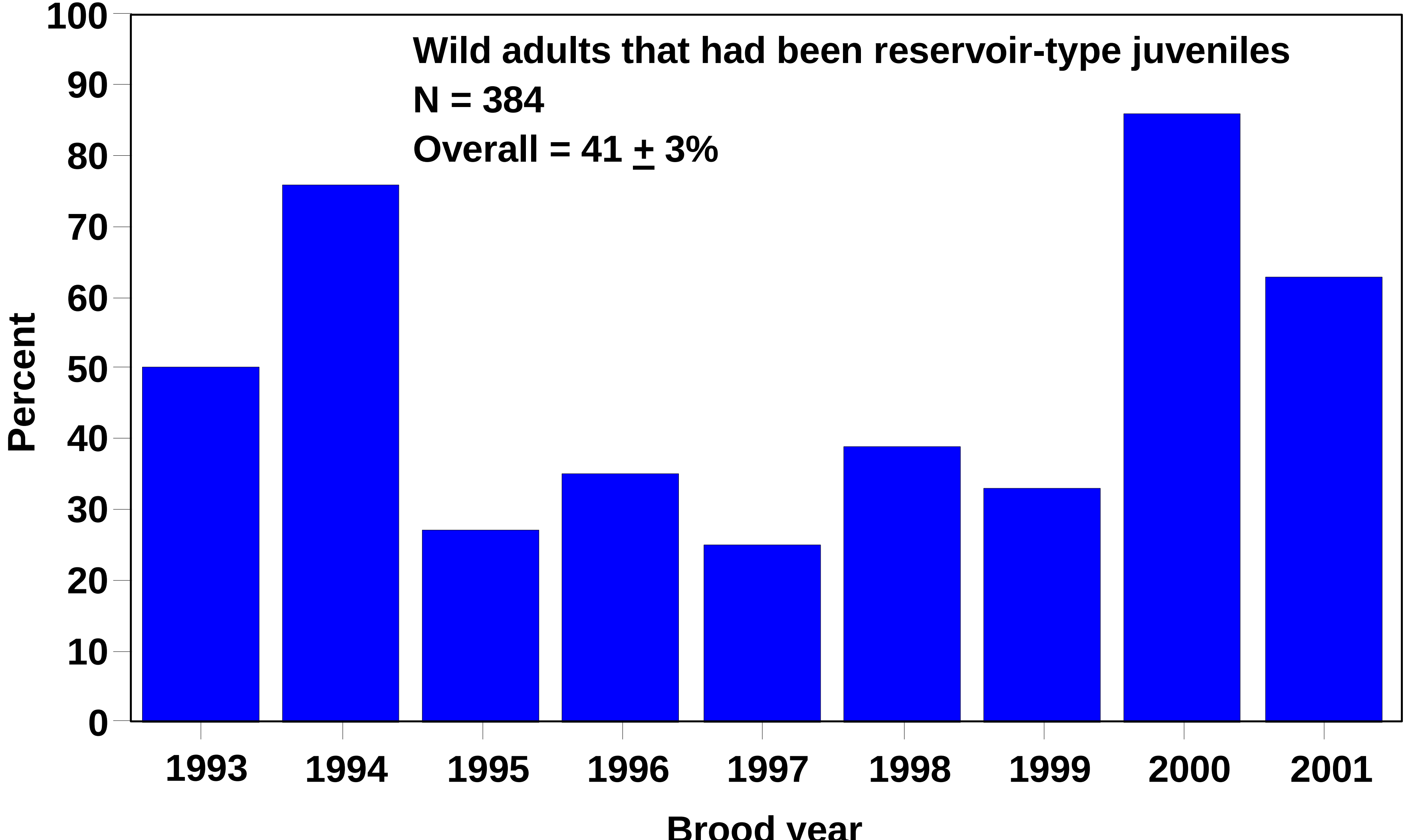
Ocean-type



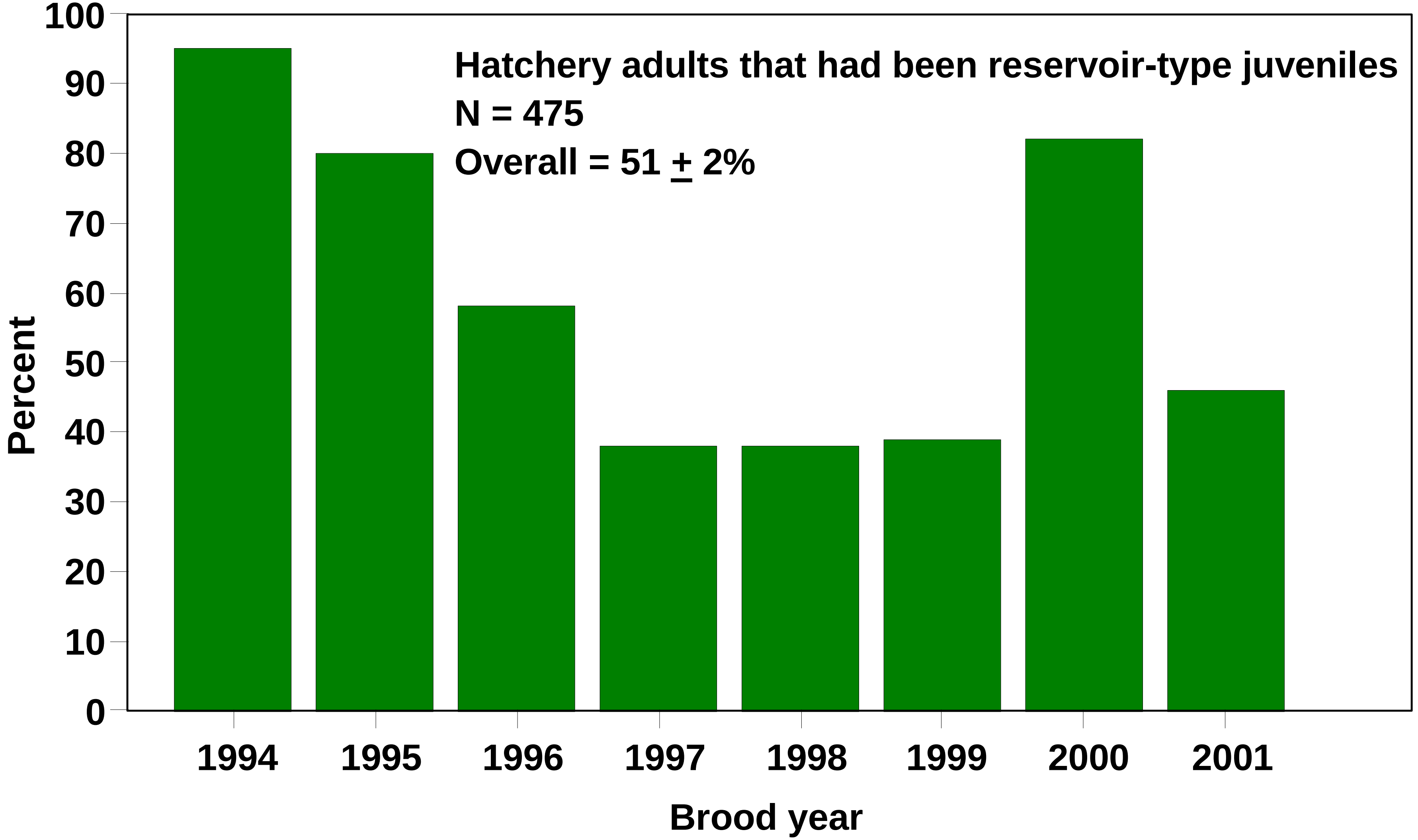
Reservoir-type



Results of analyses on wild adults
(6 return years representing 11 brood years)



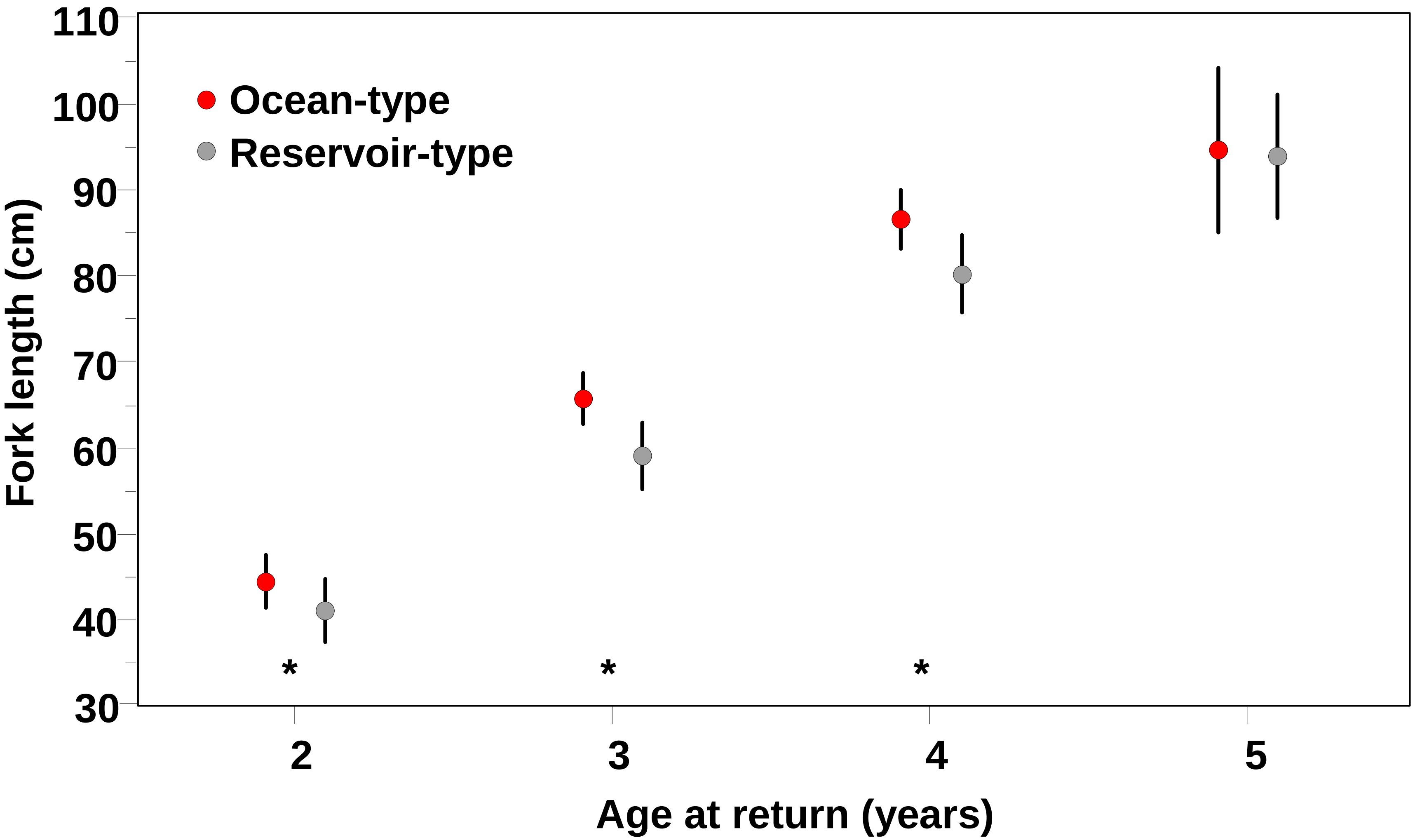
Results of analyses on hatchery adults
(6 return years representing 10 brood years)



Gender composition was independent of juvenile life history type, whereas age composition was dependent on juvenile life history type (e.g., wild males).

Juvenile life history type	Number collected	Percentage by age class 2	3	4	5	6	X^2	*P*
Ocean	135	16.3	29.6	46.7*	6.7	0.7	15.9	0.003
Reservoir	87	16.1	28.7	31.0	24.2*			

Size composition was dependent on juvenile life history type (e.g., wild males).



Connor, W. P., J. G. Sneva, K. F. Tiffan, R. K. Steinhorst, and D. Ross. In press. Two alternative life history types for fall Chinook salmon in the Snake River basin. Accepted for publication in Transactions of the American on 9 August, 2004.

-There is no typical juvenile life history type for fall Chinook salmon in the Snake River basin, rather two alternatives, namely, ocean-type and reservoir-type.

-Both of these alternative juvenile life histories are important to the recovery of fall Chinook salmon in the Snake River basin.

- There is very little known about reservoir-type juveniles.

Management and Research Questions

Which are the primary reservoirs used by reservoir-type juvenile fall Chinook salmon?

What is the passage timing of reservoir-type juvenile fall Chinook salmon in reservoirs?

How abundant are reservoir-type juvenile fall Chinook salmon?

How much turbine mortality occurs during winter passage at dams?

How does flow augmentation, spill, in-river migration, etc. influence the prevalence of reservoir-type juveniles?