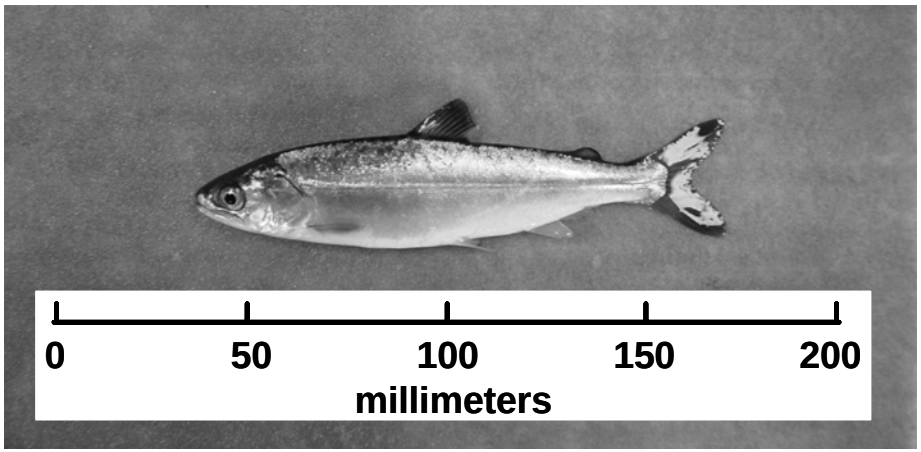
Investigating passage of ESA-listed juvenile fall Chinook salmon at Lower Granite Dam during winter when the fish bypass system is not operated

Project 200203200

U.S. Fish & Wildlife Service · Washington Department of Fish and Wildlife · USGS science for a changing world · Bonneville Power Administration

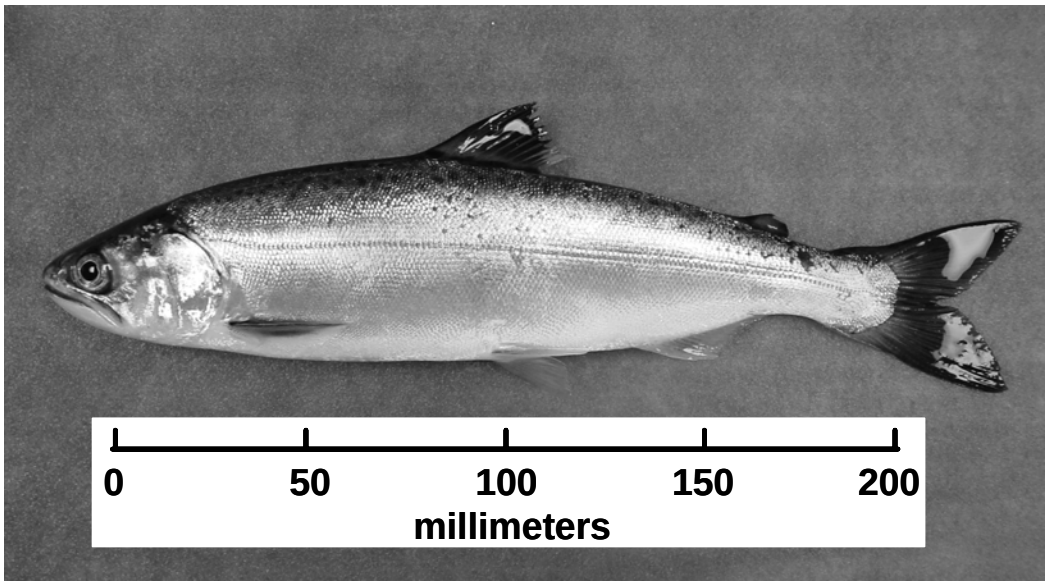
Results of analyses on juveniles



Ocean-type

Wild, N = 47, FL = 139, K = 1.2

Hatchery, N = 1,162, Fl = 112, K = 1.2



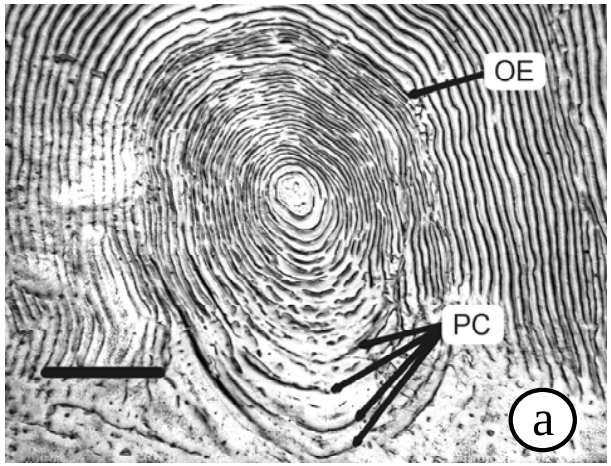
Reservoir-type

Wild, N = 38, FL = 222, K = 1.1

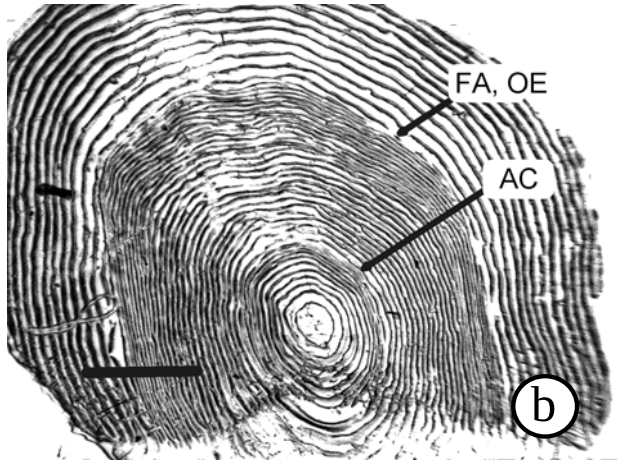
Hatchery, N = 42, Fl = 224, K = 1.1

Scale pattern analysis

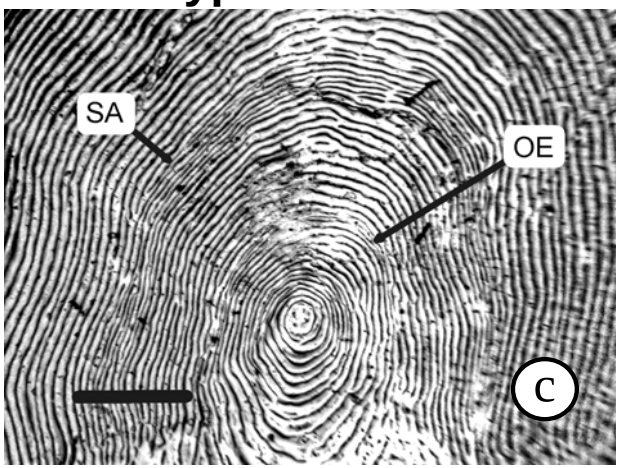
LFH Yearling



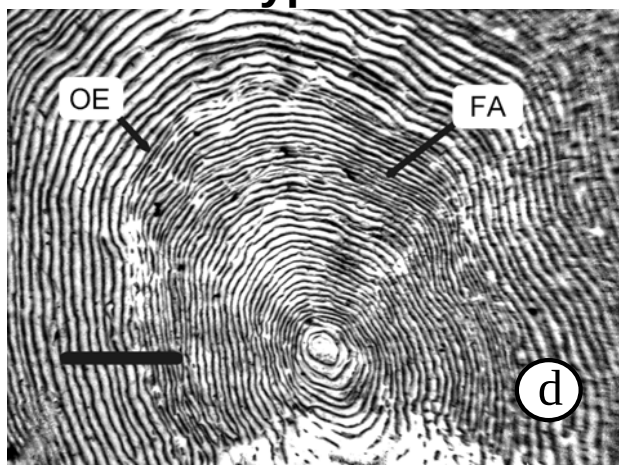
Hatchery subyearling



Ocean-type



Reservoir-type

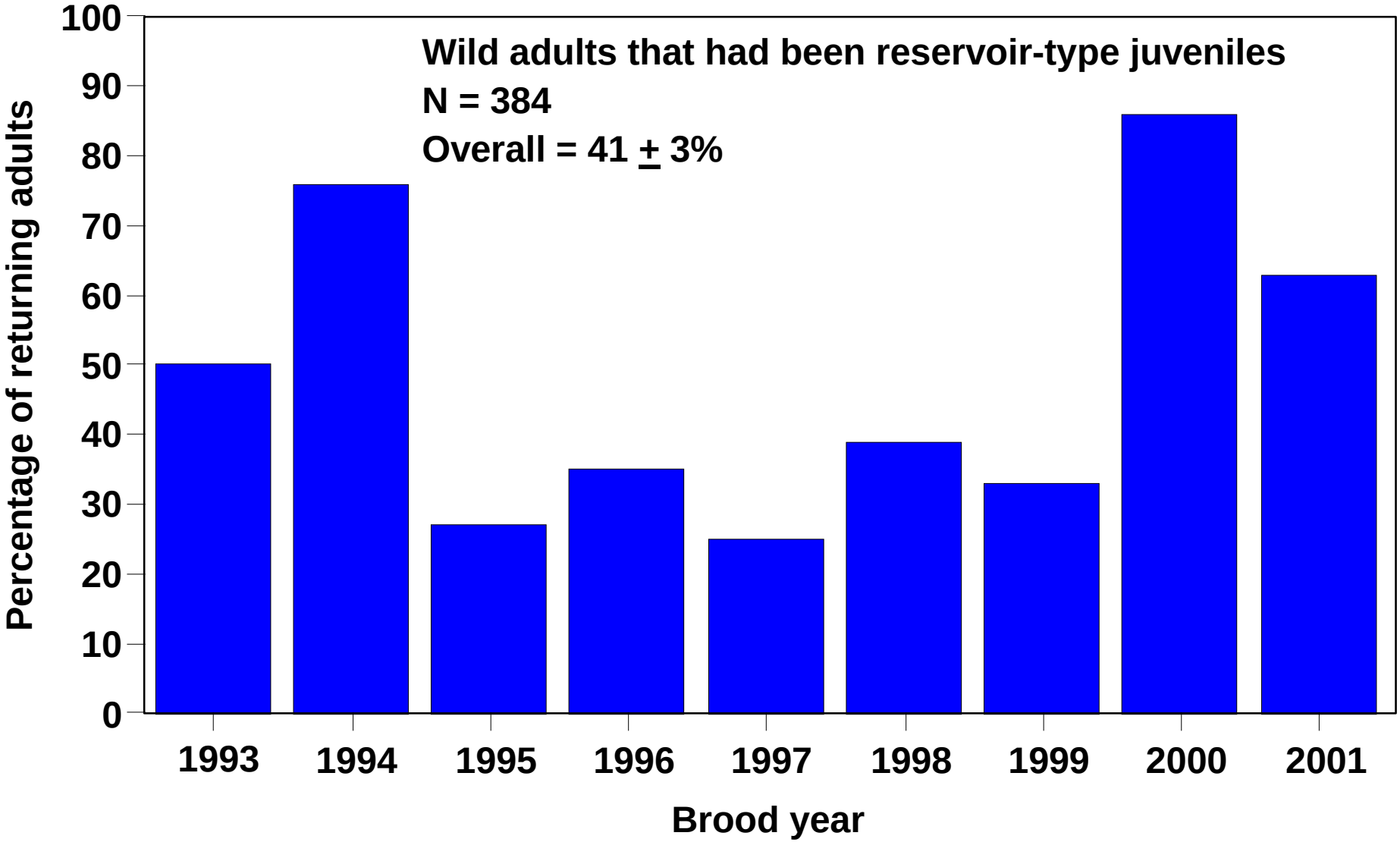


Adult collection

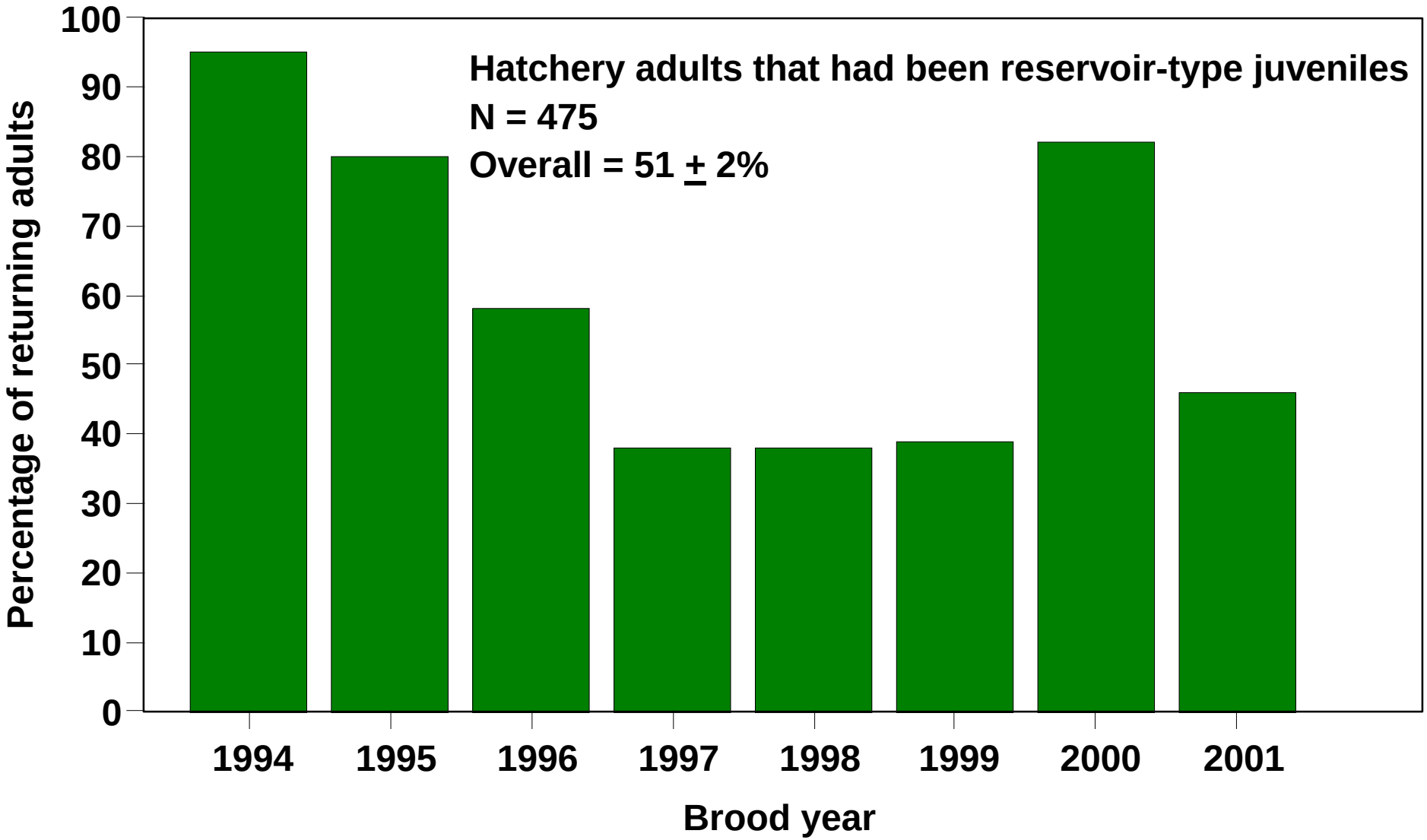
Collected adults at Lower Granite Dam 1998—2003.

Sampled scales, measured fork length and estimated gender.

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



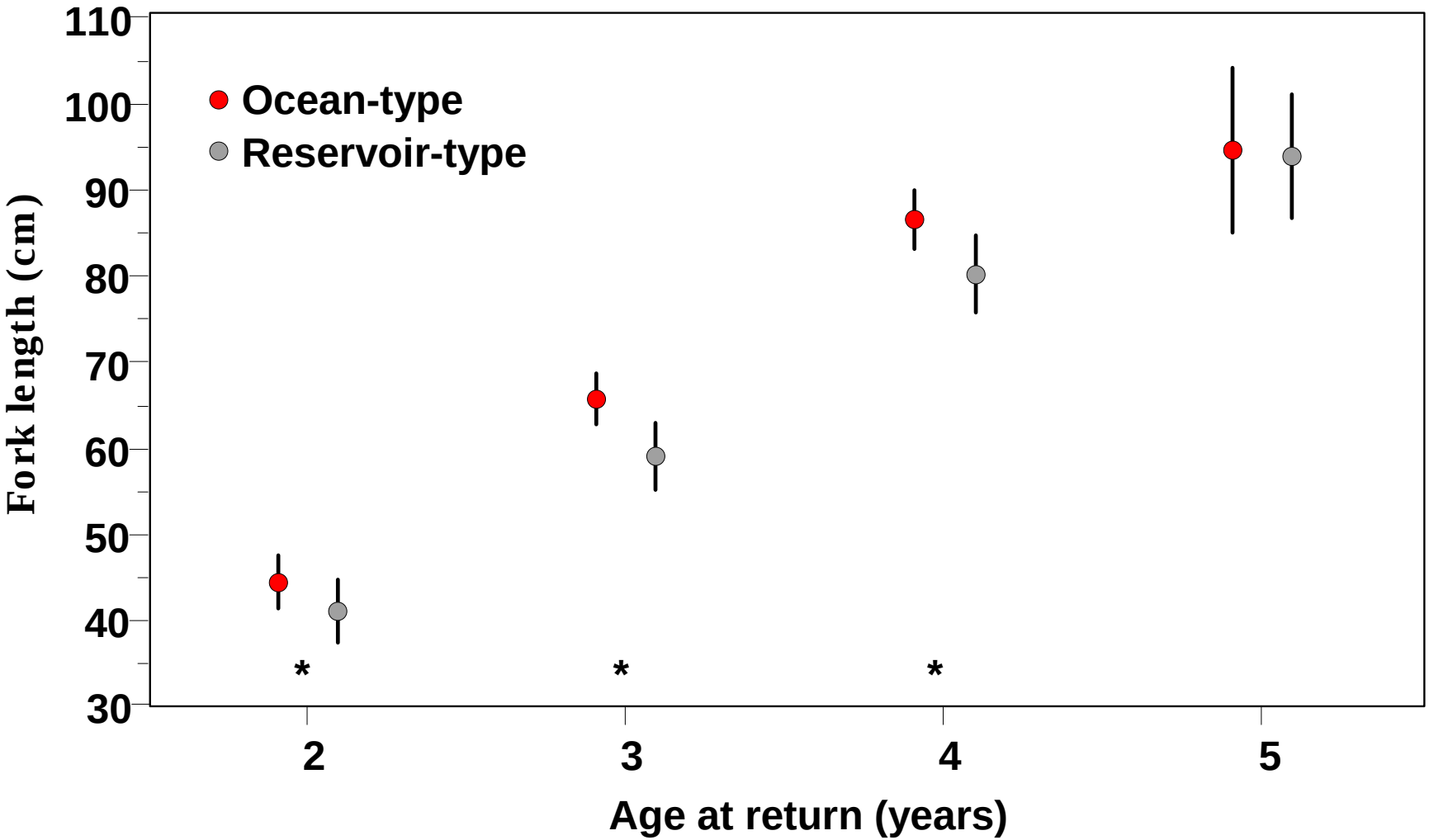
Results of analyses on hatchery adults
(6 return years representing 10 brood years)



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					X^2	P
		2	3	4	5	6		
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.

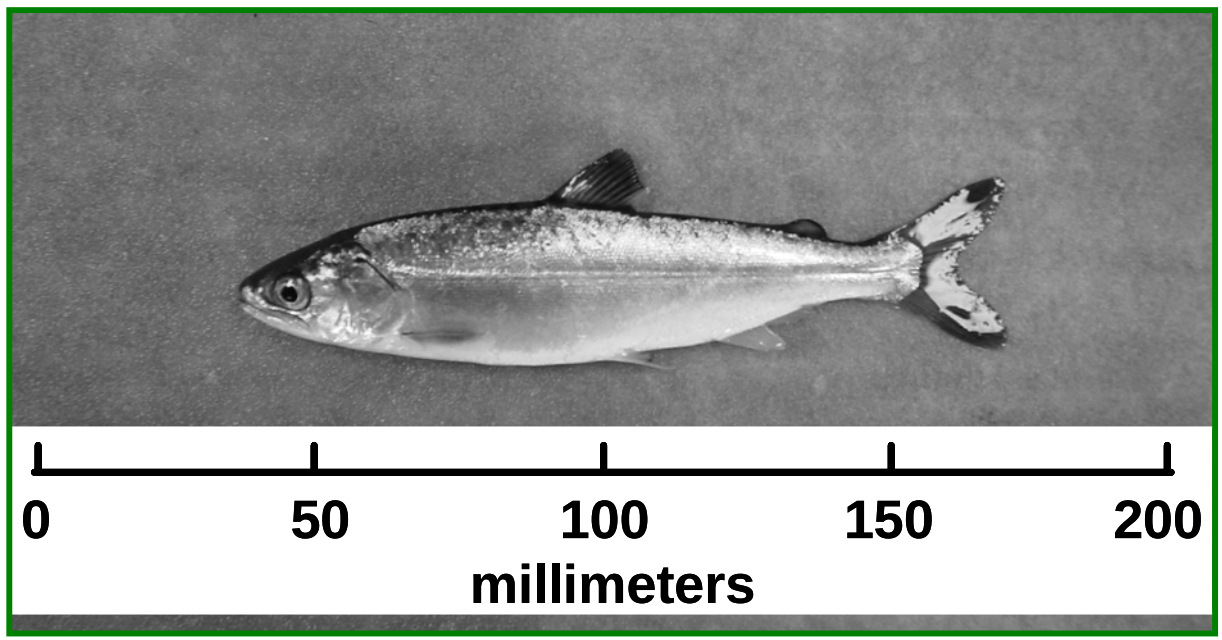
-There is no typical juvenile life history type for fall Chinook salmon in the Snake River basin, rather two alternatives, namely, ocean-type and reservoir-type.

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

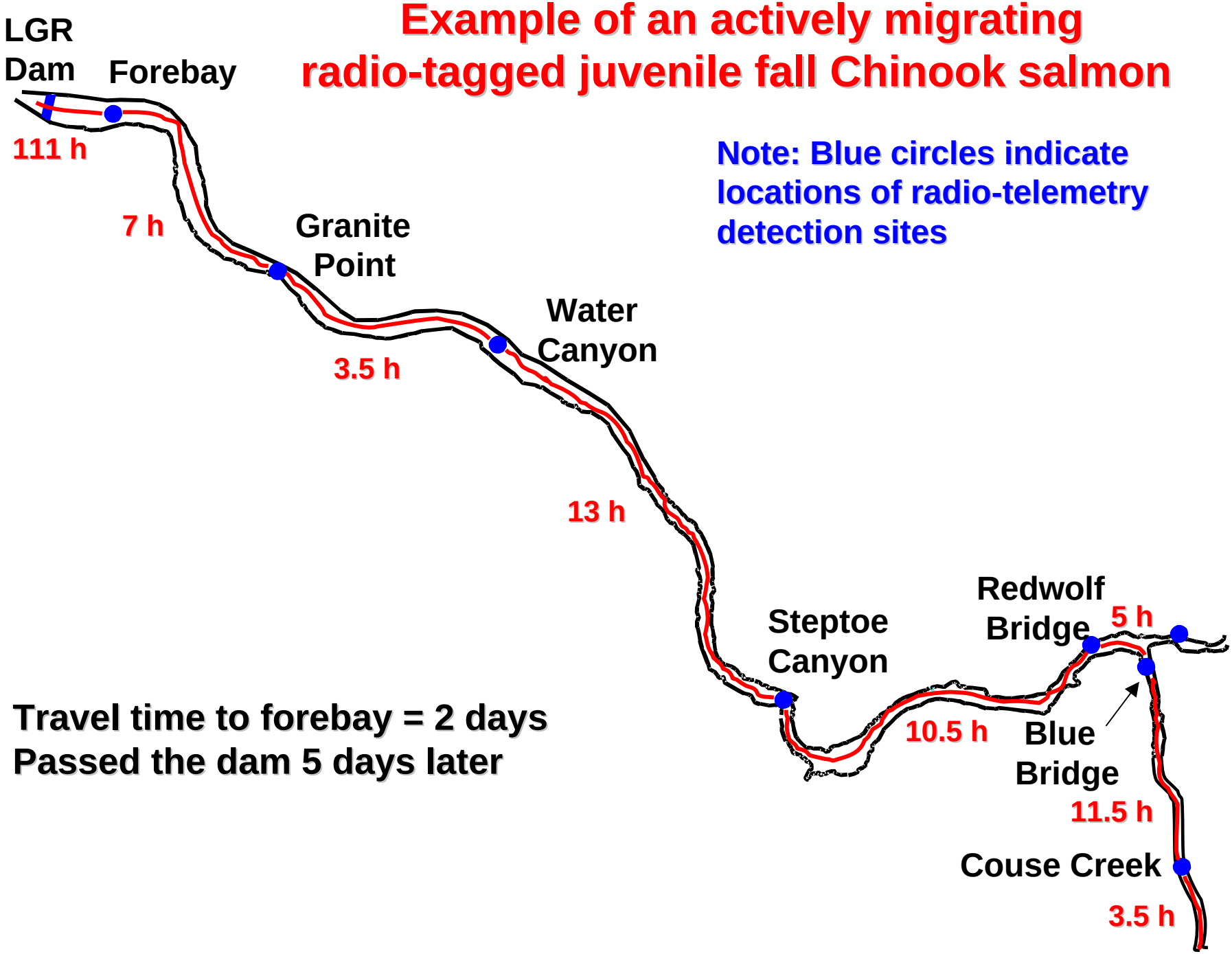
- There is very little known about reservoir-type juveniles.

Details on ocean-type juveniles

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



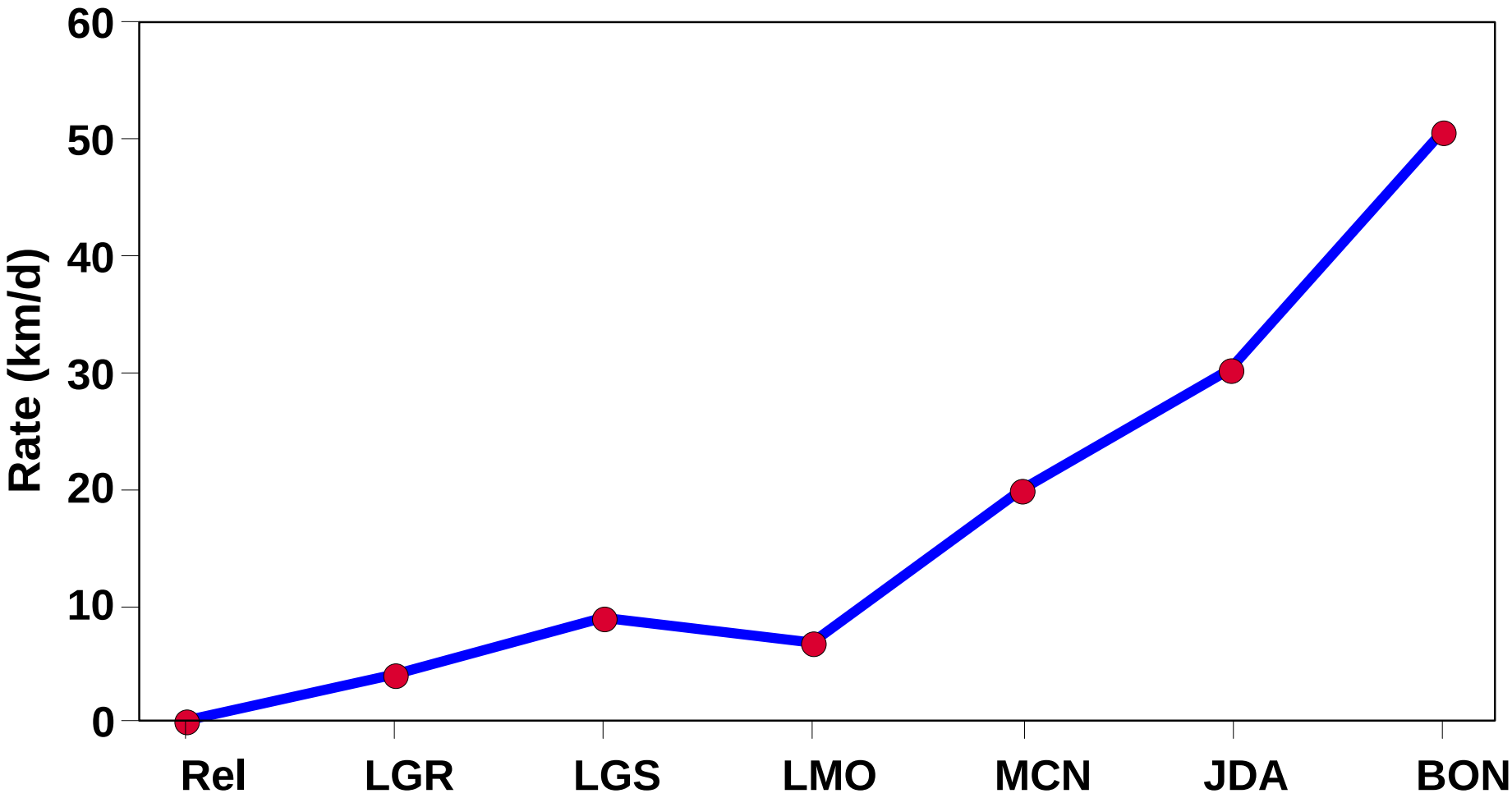
Example of an actively migrating radio-tagged juvenile fall Chinook salmon



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

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

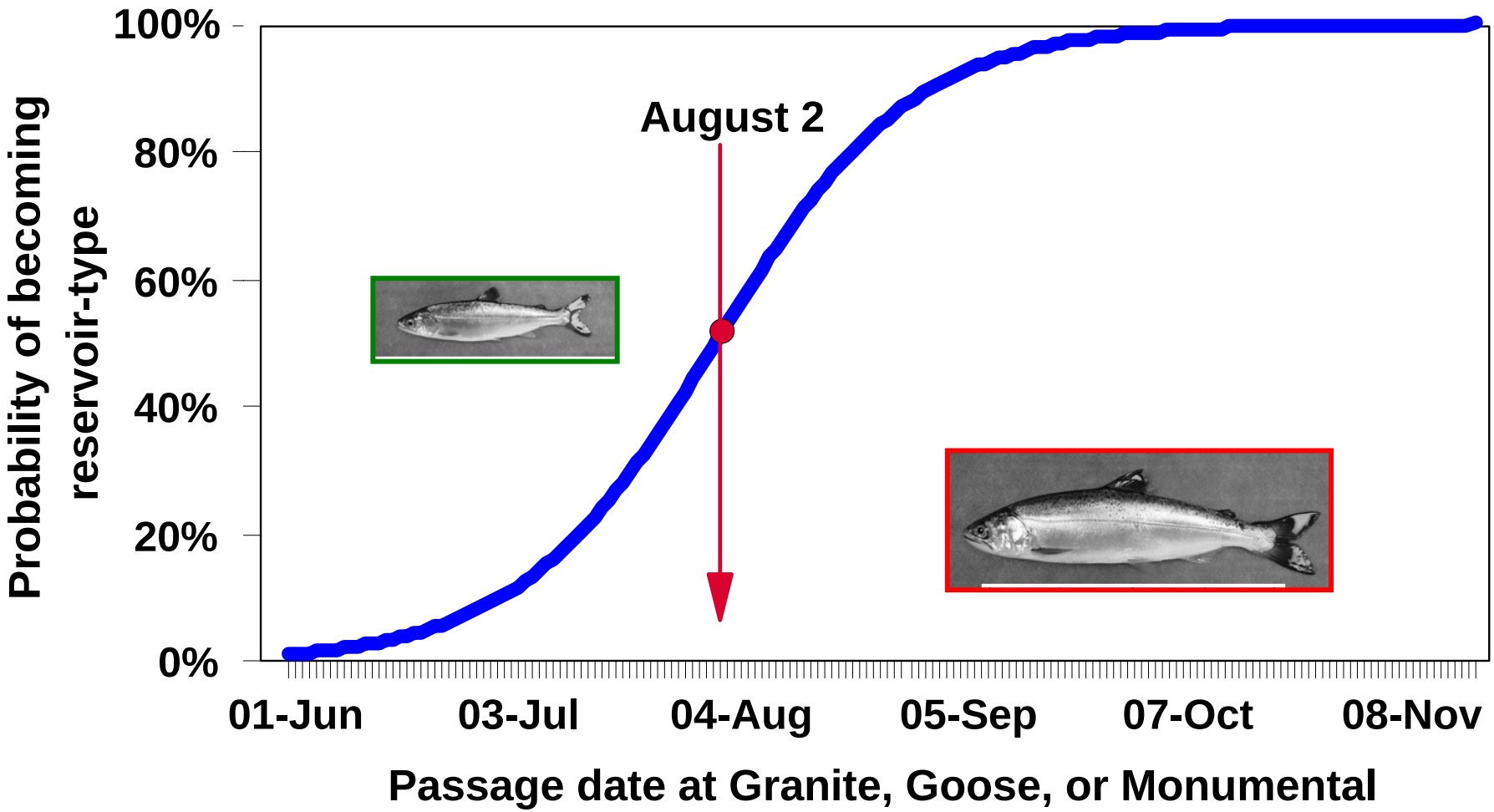
Observed rates of seaward movement for wild ocean-type subyearlings PIT tagged in the Snake River in 2003



What determines life history-type?

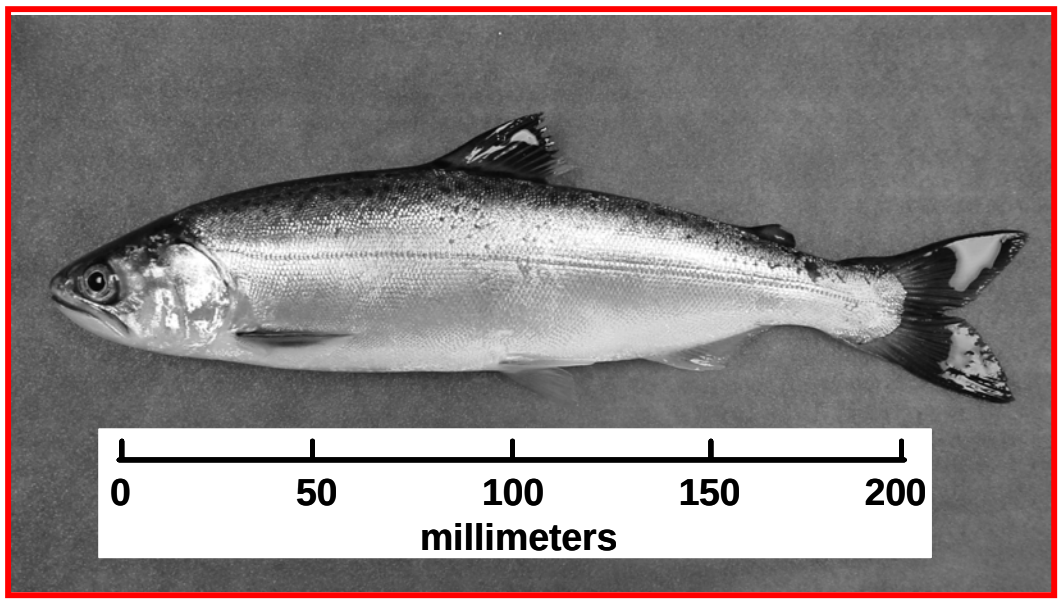
Logistic regression (*N* = 52; wild and hatchery combined)

Accuracy 85%

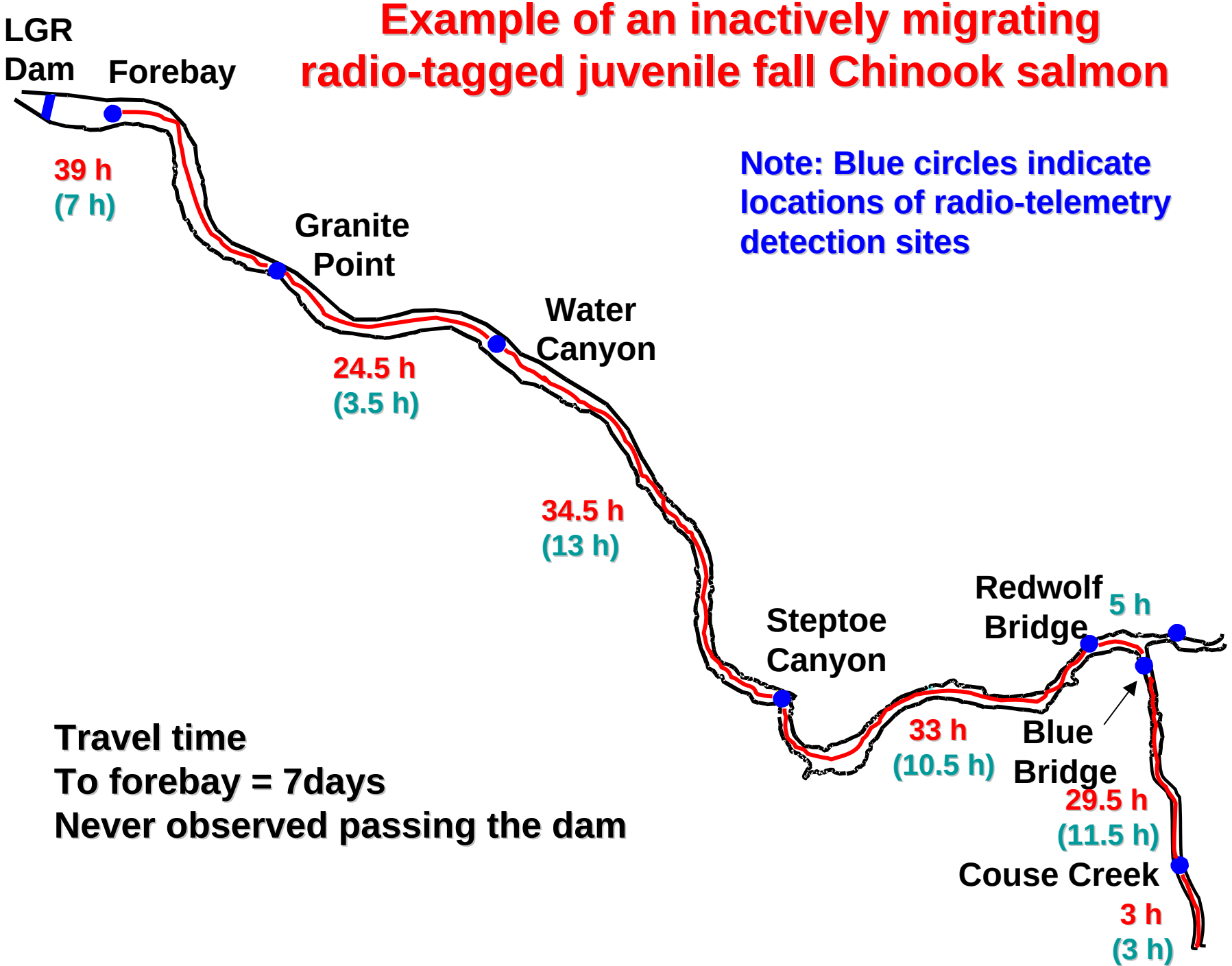


Speculative details on reservoir-type juveniles

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

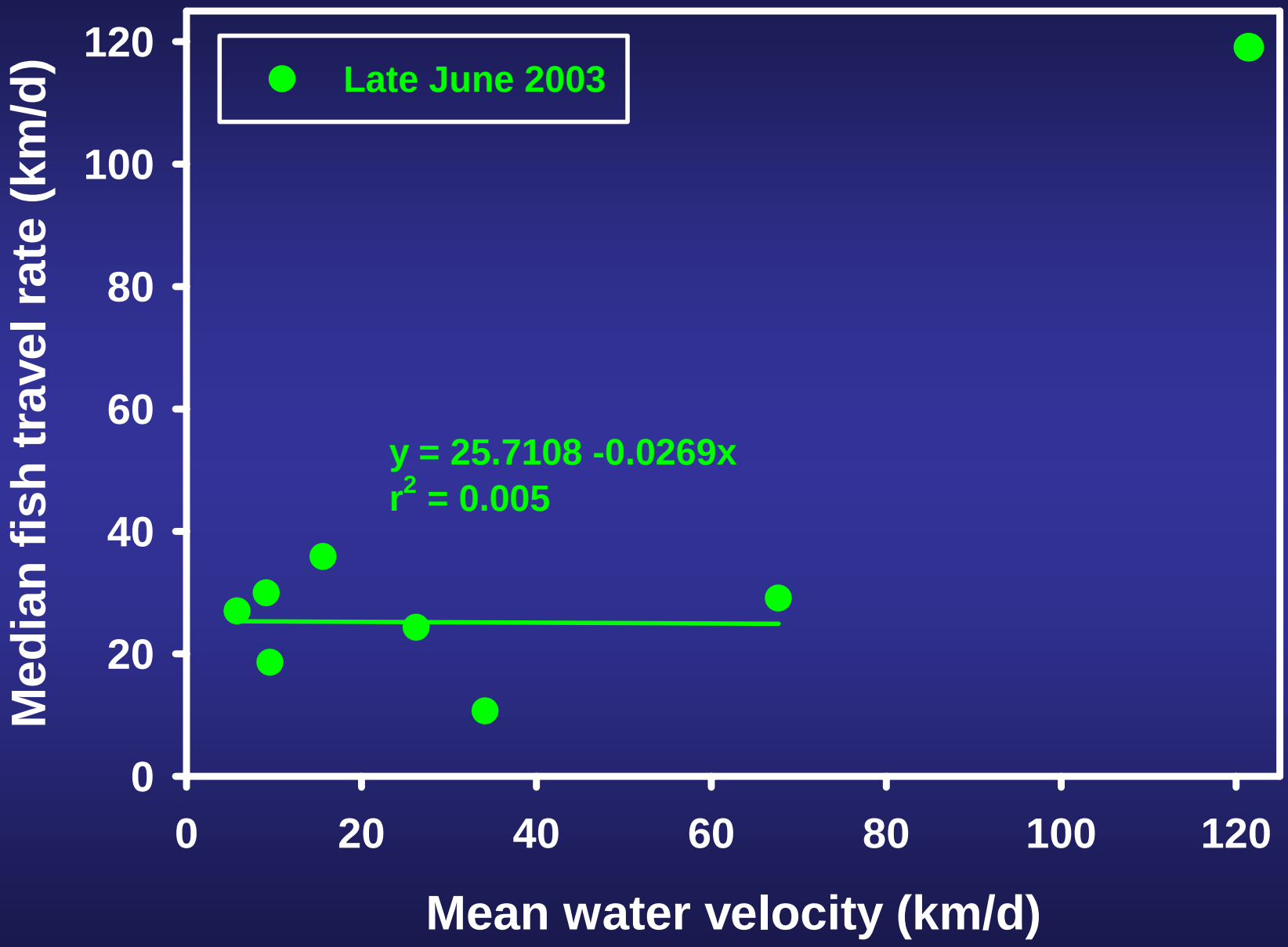


Example of an inactively migrating radio-tagged juvenile fall Chinook salmon

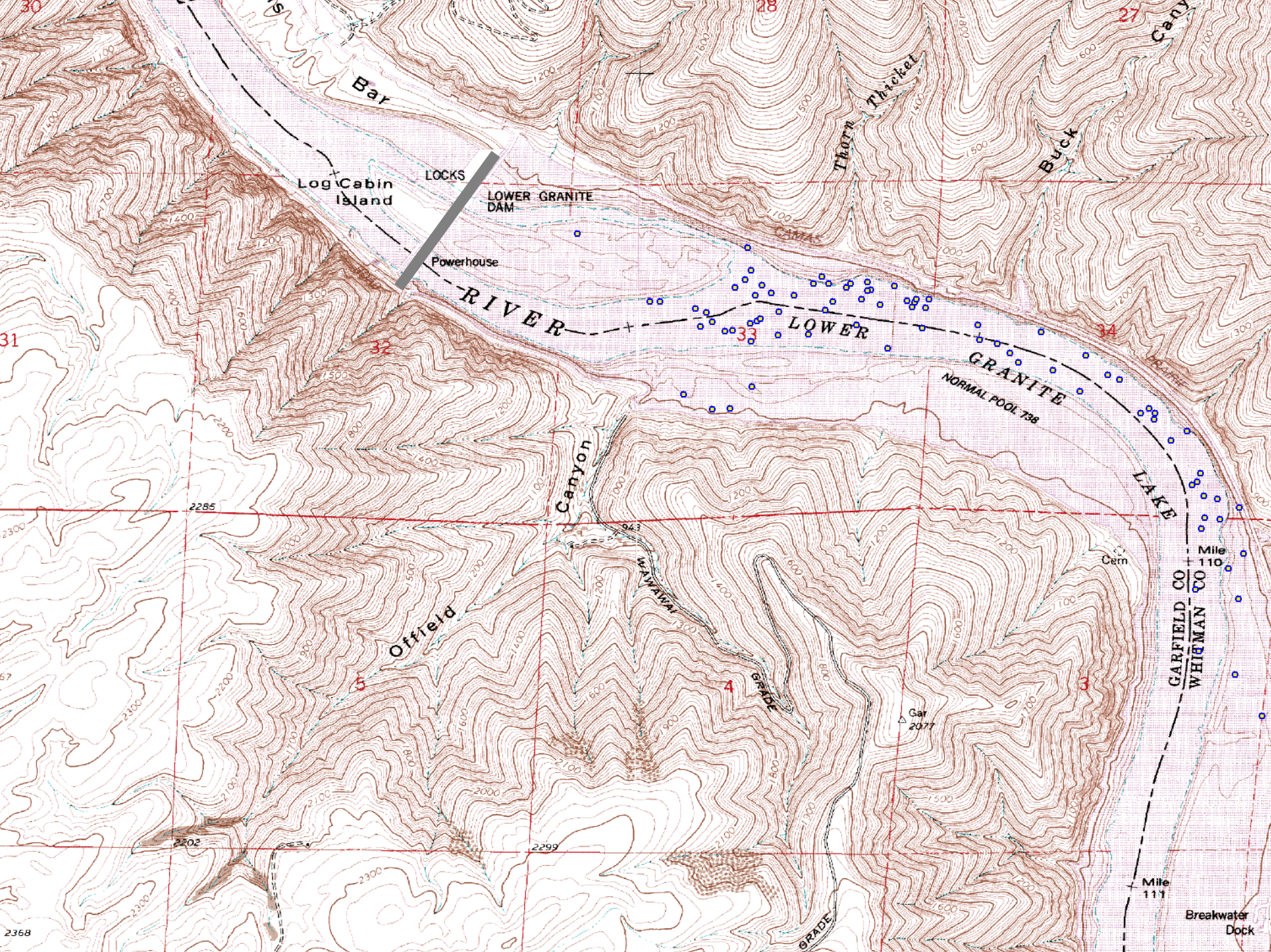


Note: Blue circles indicate locations of radio-telemetry detection sites

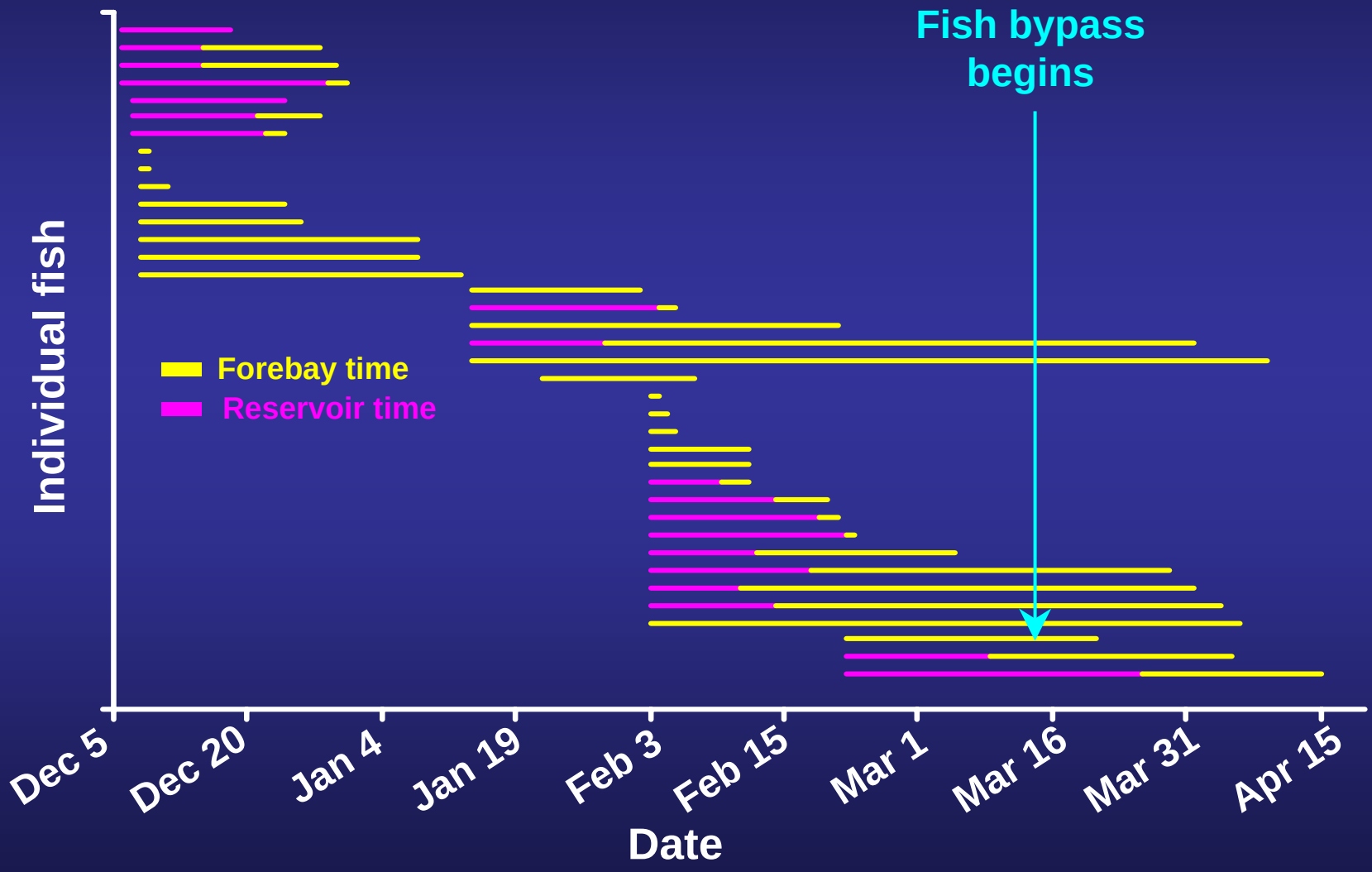
Travel time
To forebay = 7days
Never observed passing the dam


Late June 2003
y = 25.7108 -0.0269x
r2 = 0.005
Median fish travel rate (km/d)
Mean water velocity (km/d)
0
20
40
60
80
100
120

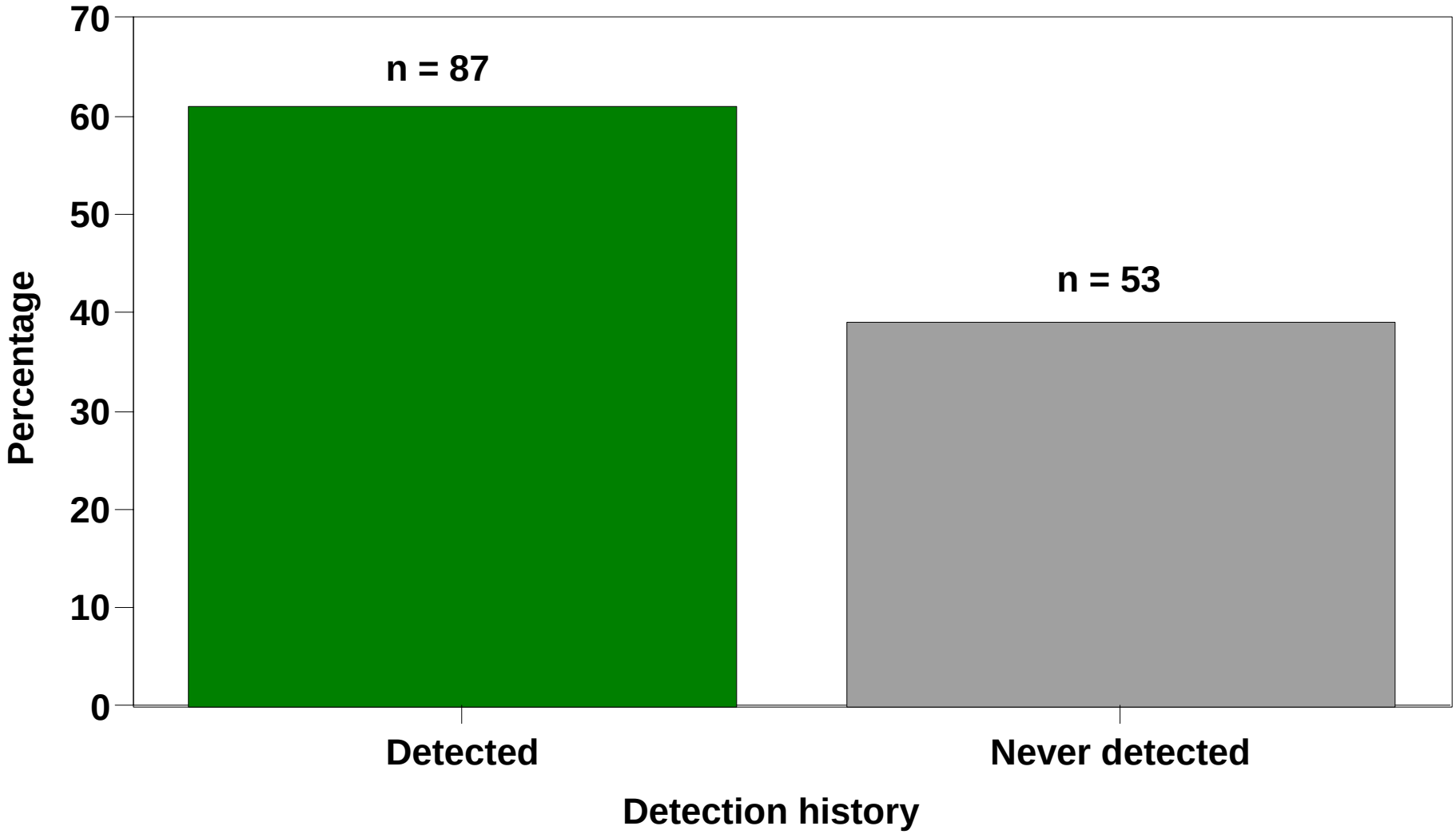
When do reservoir-type juveniles pass dams?

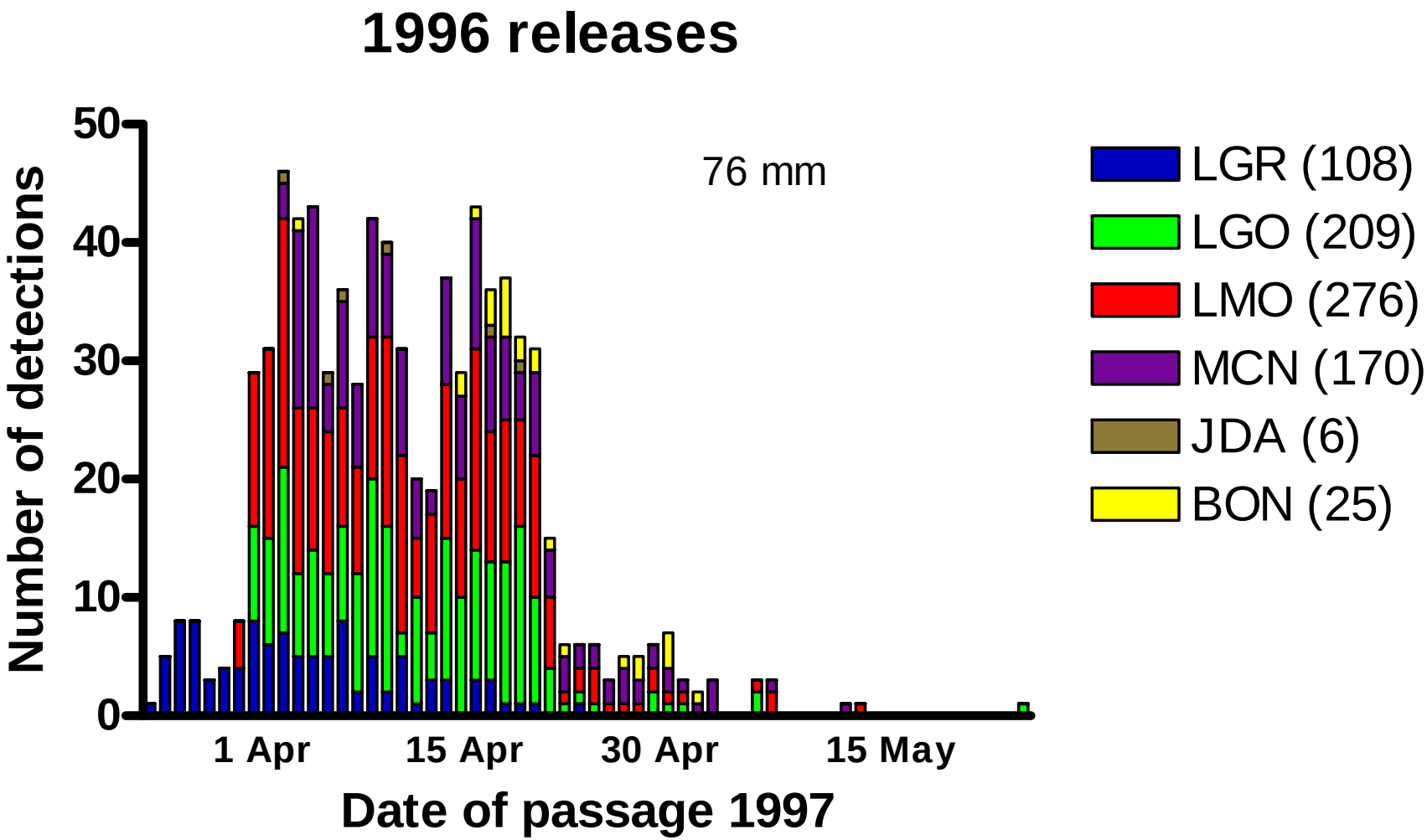

Bar
Log Cabin Island
LOCKS
LOWER GRANITE DAM
Powerhouse
RIVER
LOWER GRANITE
NORMAL POOL 738
LAKE
Thorn Thicket
Buck
Canyon
Offield
WAWAWAI
GRADE
Cem
Gar
2077
Mile 110
Mile 111
GARFIELD CO
WHITMAN CO
Breakwater Dock
2285
2202
2299
2368
30
31
32
33
34
28
27
5
4
3

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



Juvenile detection histories of adults that were PIT tagged as juveniles




1996 releases
76 mm
Number of detections
50
40
30
20
10
0
1 Apr
15 Apr
30 Apr
15 May
Date of passage 1997
LGR (108)
LGO (209)
LMO (276)
MCN (170)
JDA (6)
BON (25)

Observations on releases of PIT-tagged hatchery fall Chinook salmon subyearlings

- Released 175,443 PIT tagged fish
- 4,932 smolts were transported
- 53,324 smolts were bypassed
- 3,386 smolts were known to have migrated the following year
- 369 adults have returned

*** 1995-2000, 1999 releases excluded because of tag frequency change**

SARs Estimated LGR to LGR

Disposition	# Adults	SAR*
Transported	22	0.51
Bypassed	183	0.56
Known reservoir-types	51	1.35
Never detected	113	??

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?
(Preliminary estimates: 13% to 39% for the Snake River 1998-2003)

How much turbine mortality occurs during winter passage at dams?

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