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# Comparison of early marine migratory behaviour of sockeye salmon and kokanee

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Lyse Godbout<sup>1</sup>, and Jim Cameron**

## Acknowledgements:

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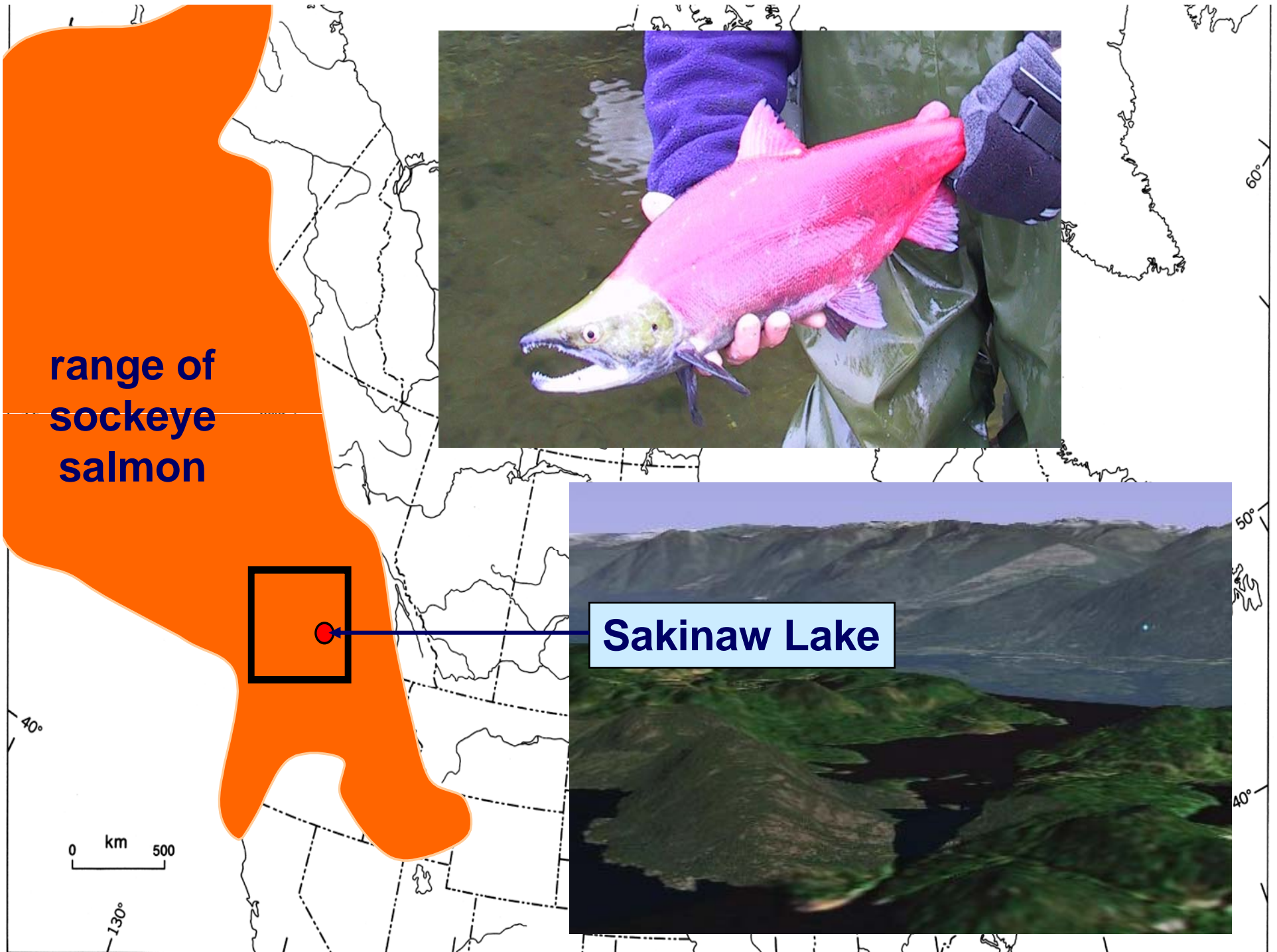
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<sup>2</sup> Kintama Research Corporation, Nanaimo, B.C.

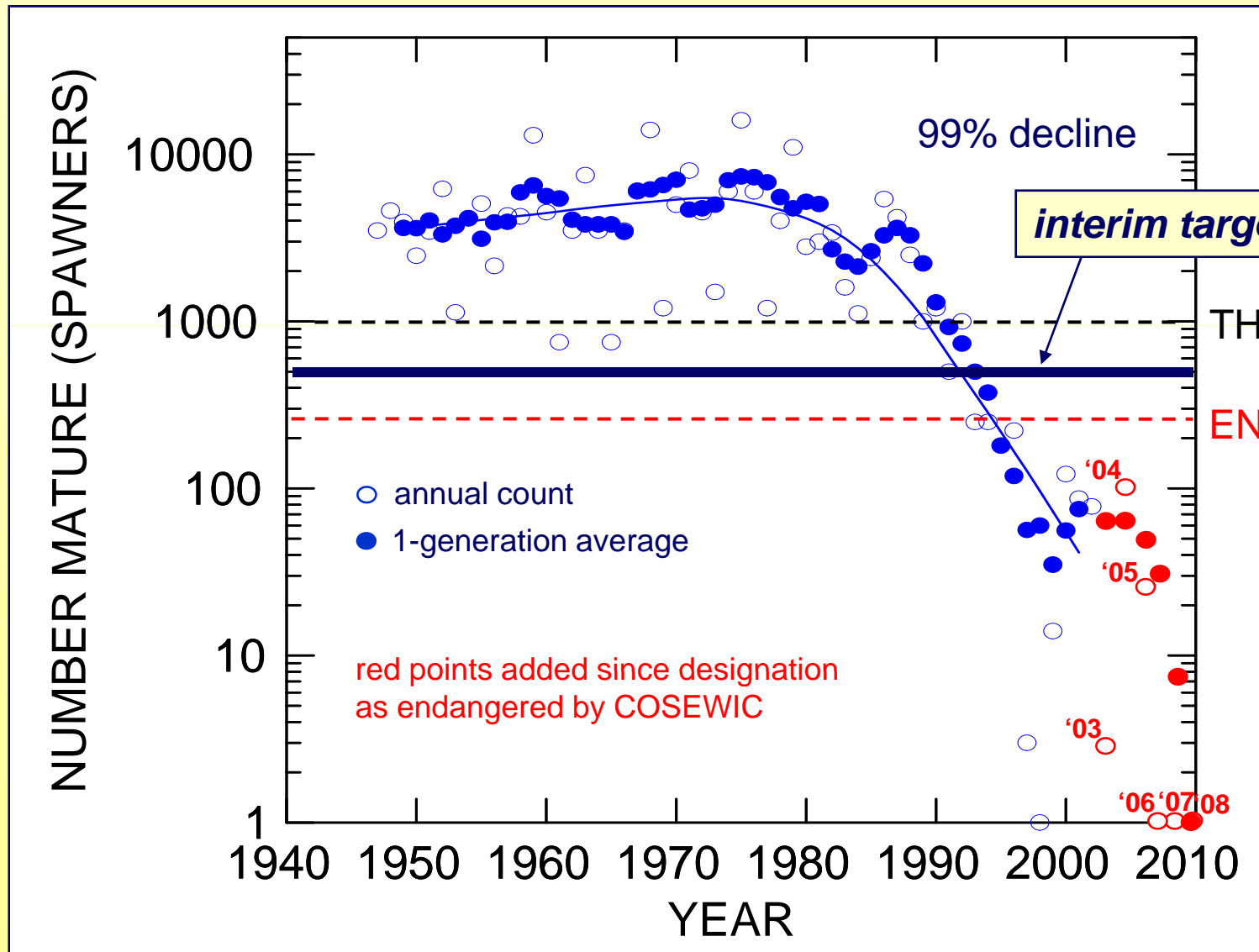
**range of  
sockeye  
salmon**

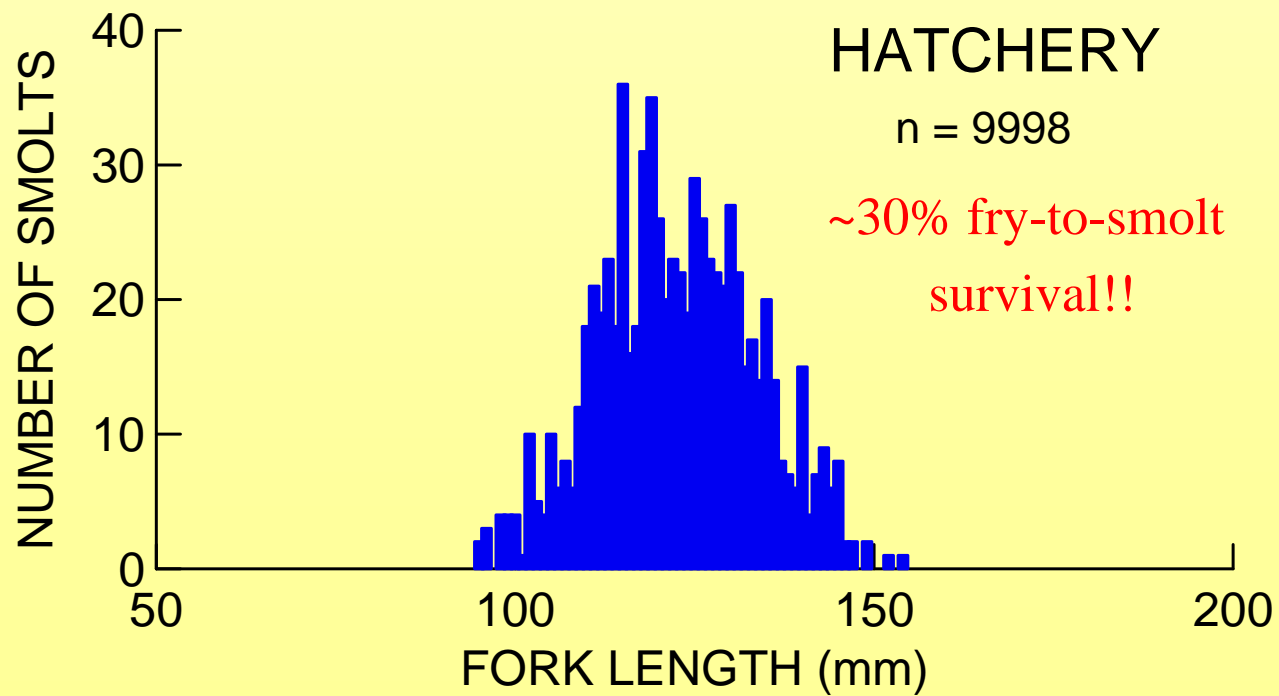
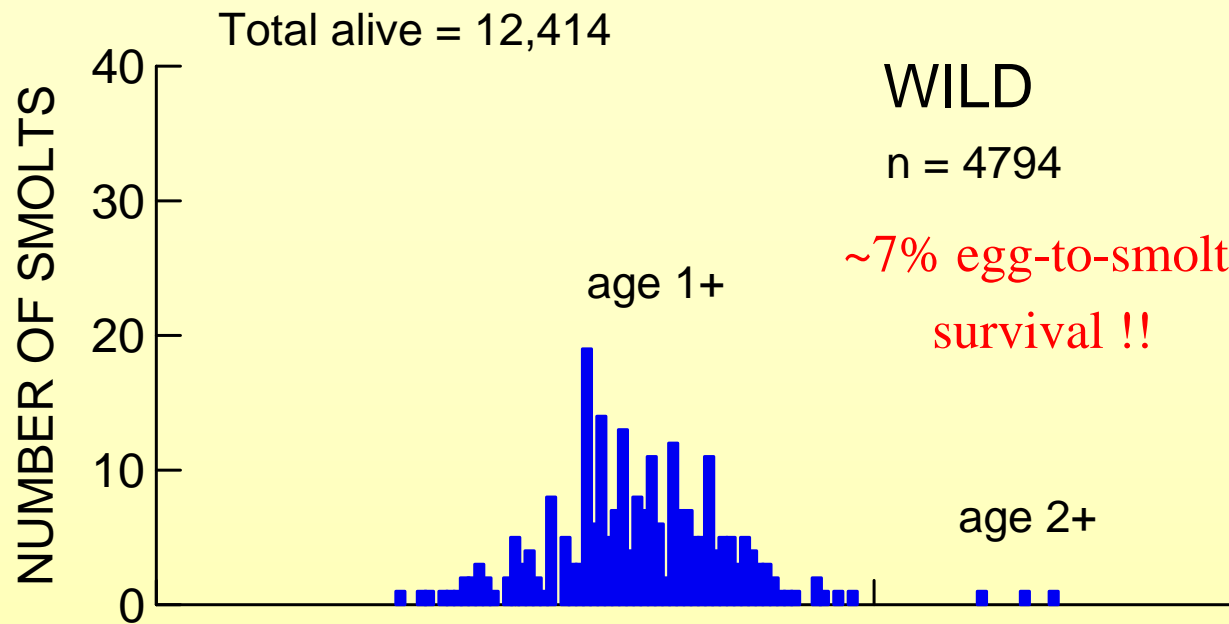


**Sakinaw Lake**



# SAKINAW SOCKEYE: TREND IN ABUNDANCE





## Hatchery supplementation of Sakinaw Lake sockeye

| brood year | hatchery fry release |                | survival rate   |                |
|------------|----------------------|----------------|-----------------|----------------|
|            | type                 | number (x1000) | fry-to-smolt    | smolt-to-adult |
| 2001       | F1                   | 32             | 30%             |                |
| 2002       | F1                   | 3              | 1% <sup>a</sup> |                |
| 2003       | F1                   | 0              | --              |                |
| 2004       | F1                   | 26             | 32%             |                |
| 2005       | F2                   | 97             | 4%              |                |
| 2006       | F2                   | 74             | 16%             |                |
| 2007       | F2                   | 420            | 15%             |                |

<sup>a</sup> unusually hot and dry during smolt emigration; high residualism suspected

# How can marine survival be so much worse for Sakinaw than Fraser sockeye?

 **acoustic tagging (2004-2006)**

- seaward route and timing?

*(maybe they emigrate via Juan de Fuca or spend more time in Georgia Strait)*

- return route and timing?

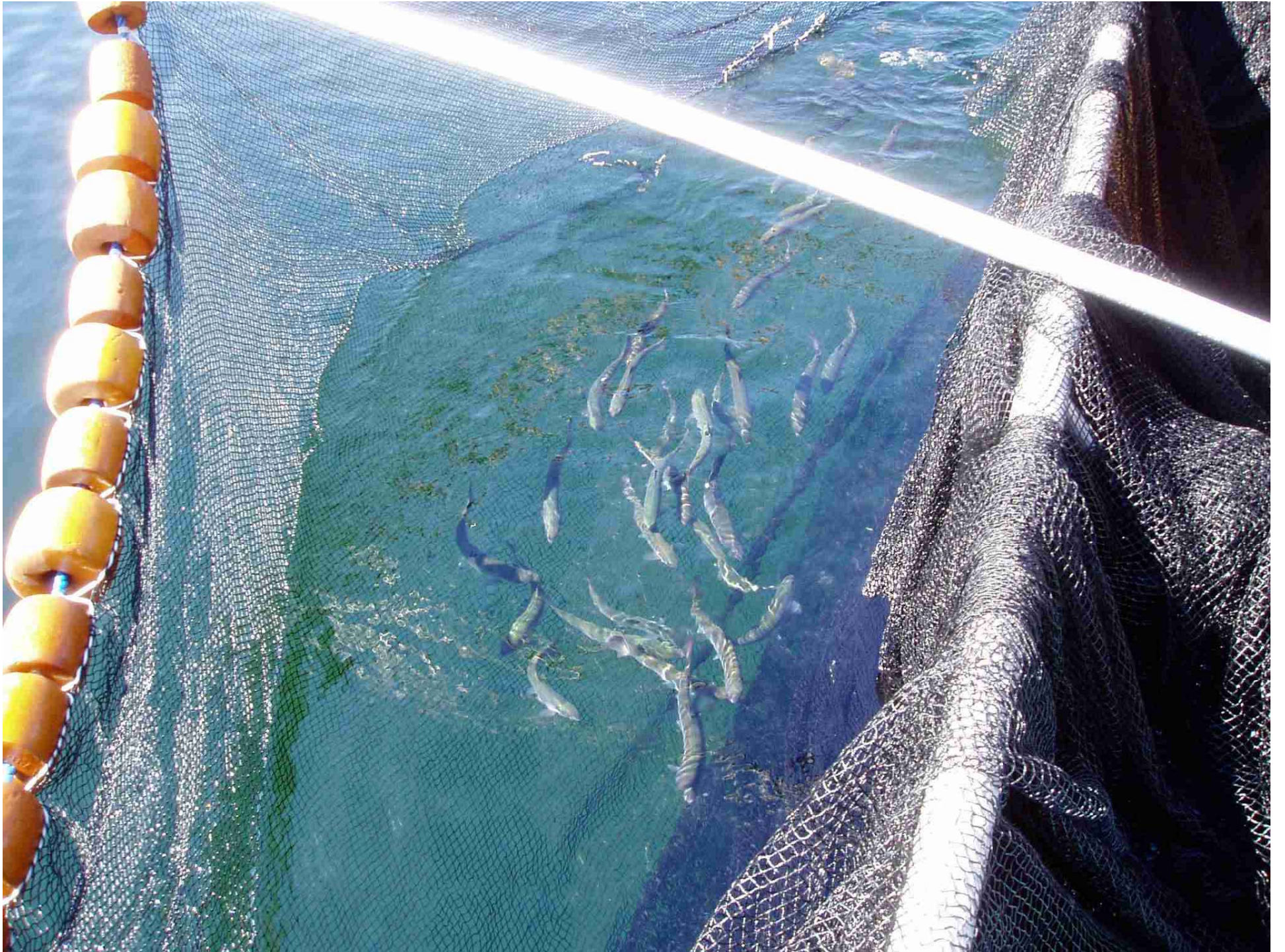
*(to minimize incidental fishing mortality)*

Vemco V9-1L tags were implanted in 158 hatchery smolts (age 1+) and 96 residents (mostly age 2+)

“Sleeper” programming:  
ON 4 mo./OFF 20 mo./ON



Flown to sea cage in  
a small cove 1 km  
from Sakinaw outlet



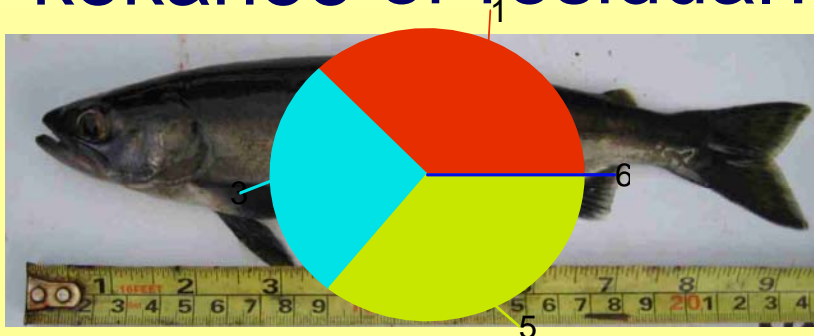
# Sympatric Ecotypes

anadromous

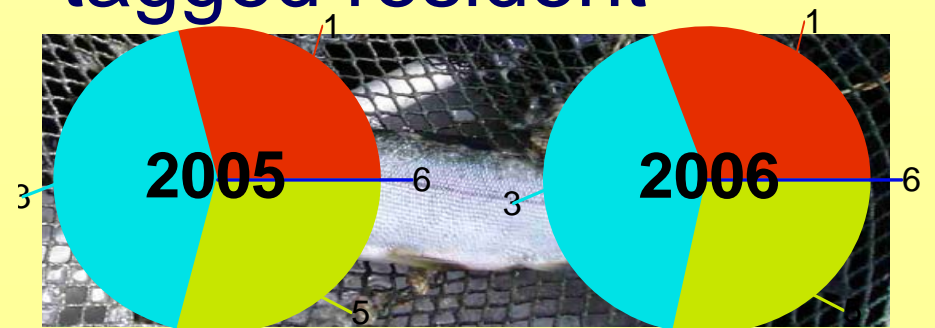
*mtDNA haplotype frequencies*

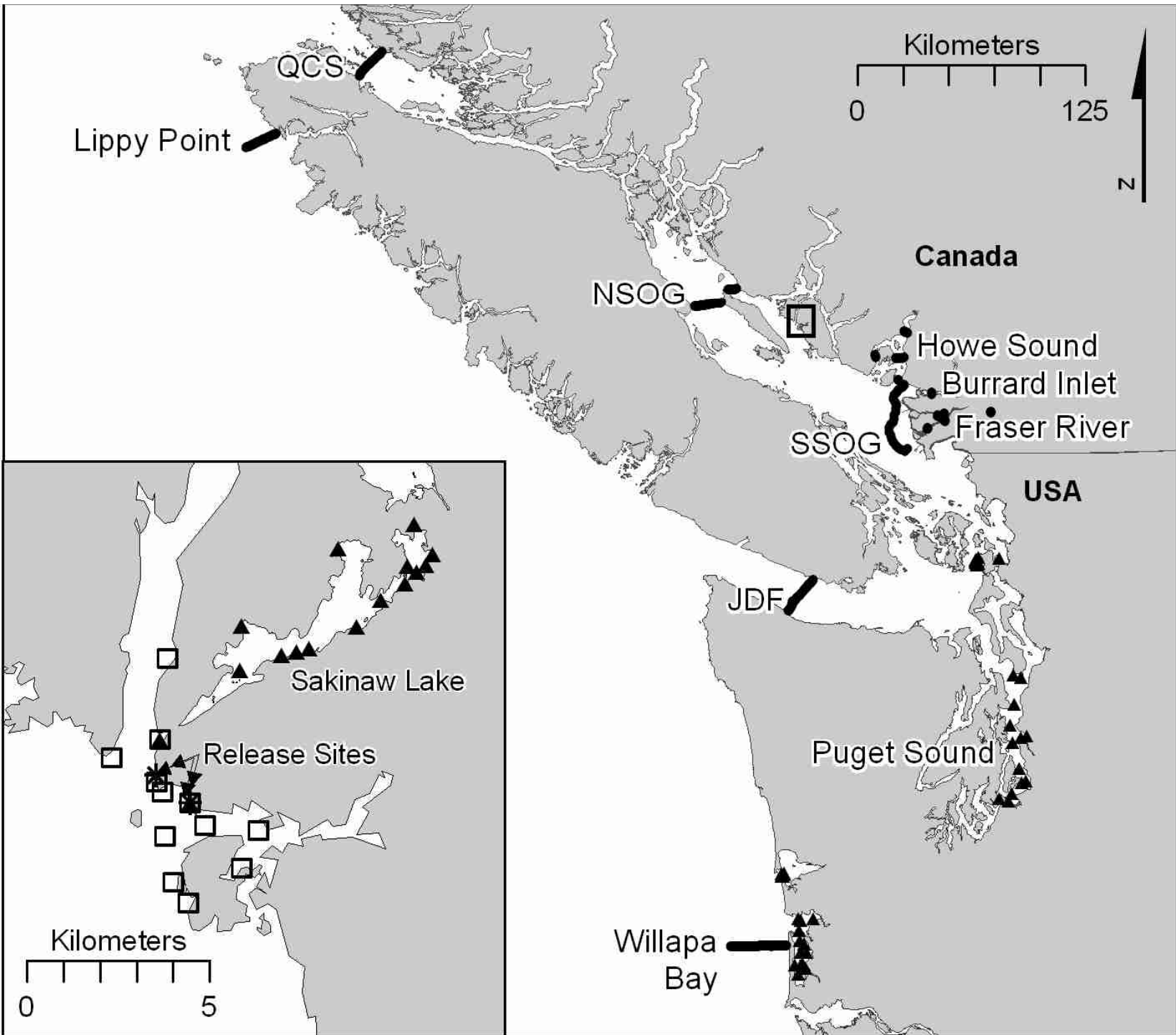


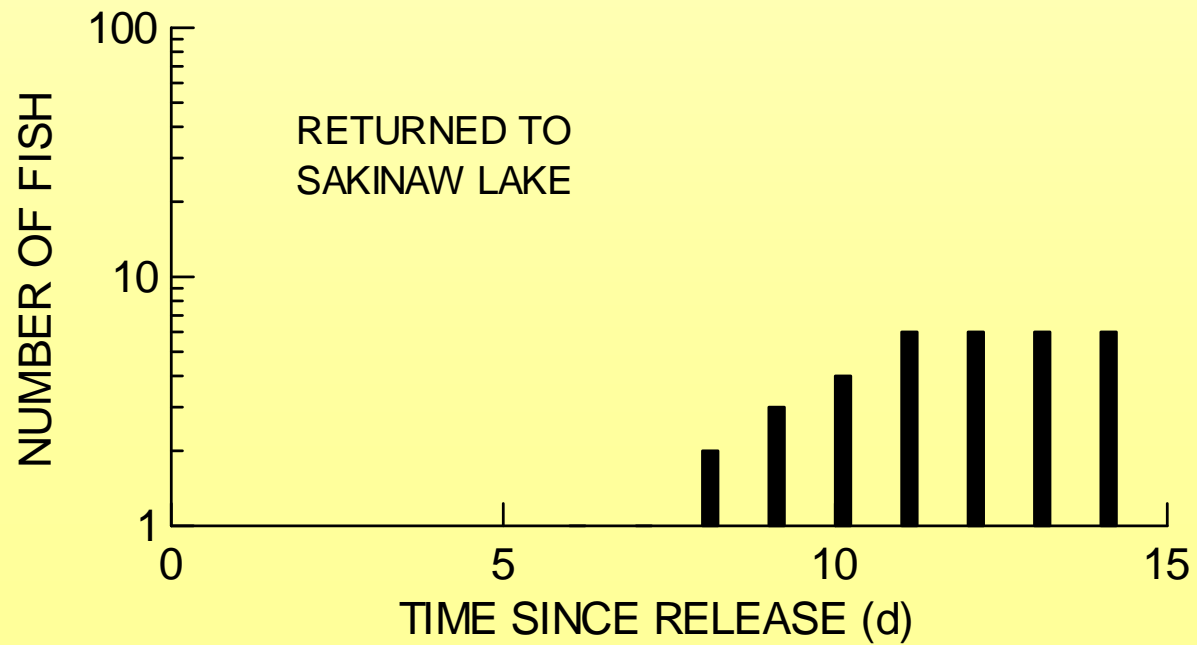
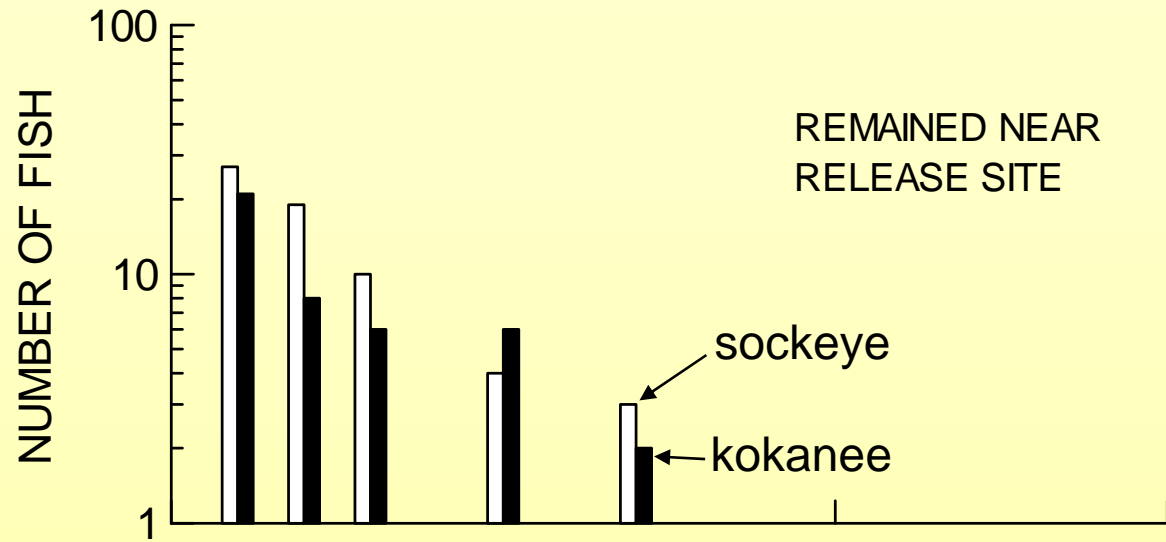
kokanee or residual?

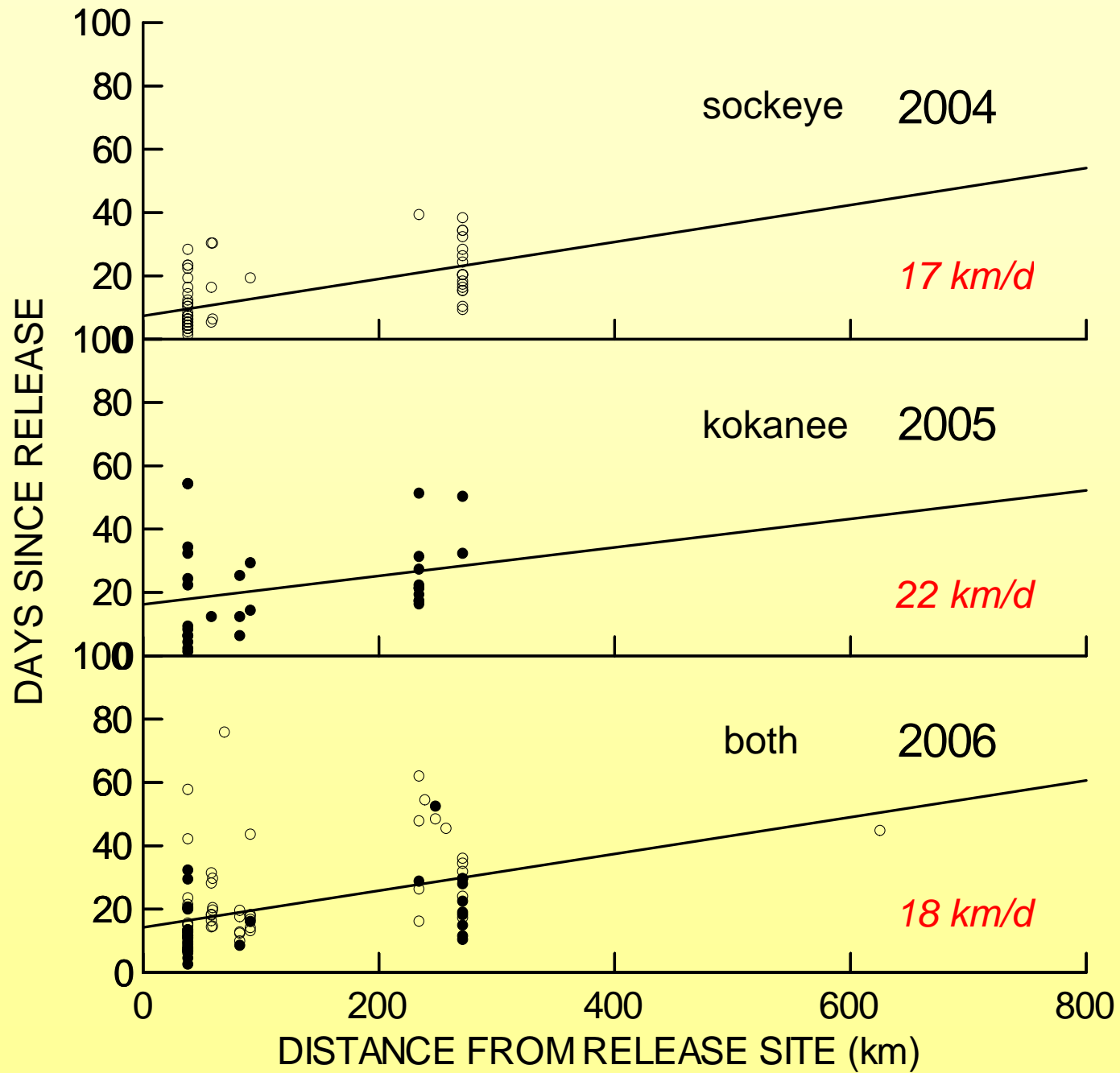


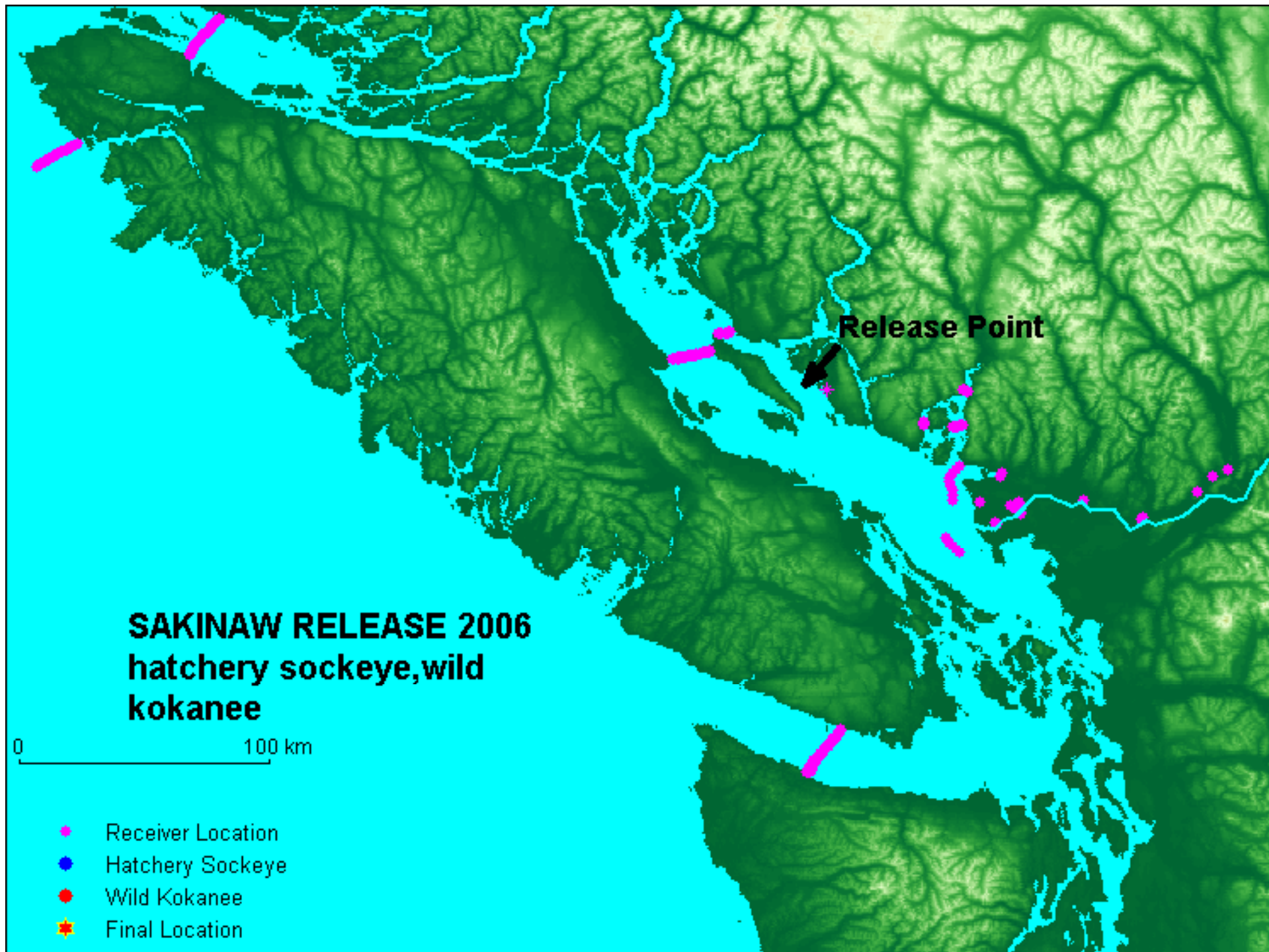
tagged resident



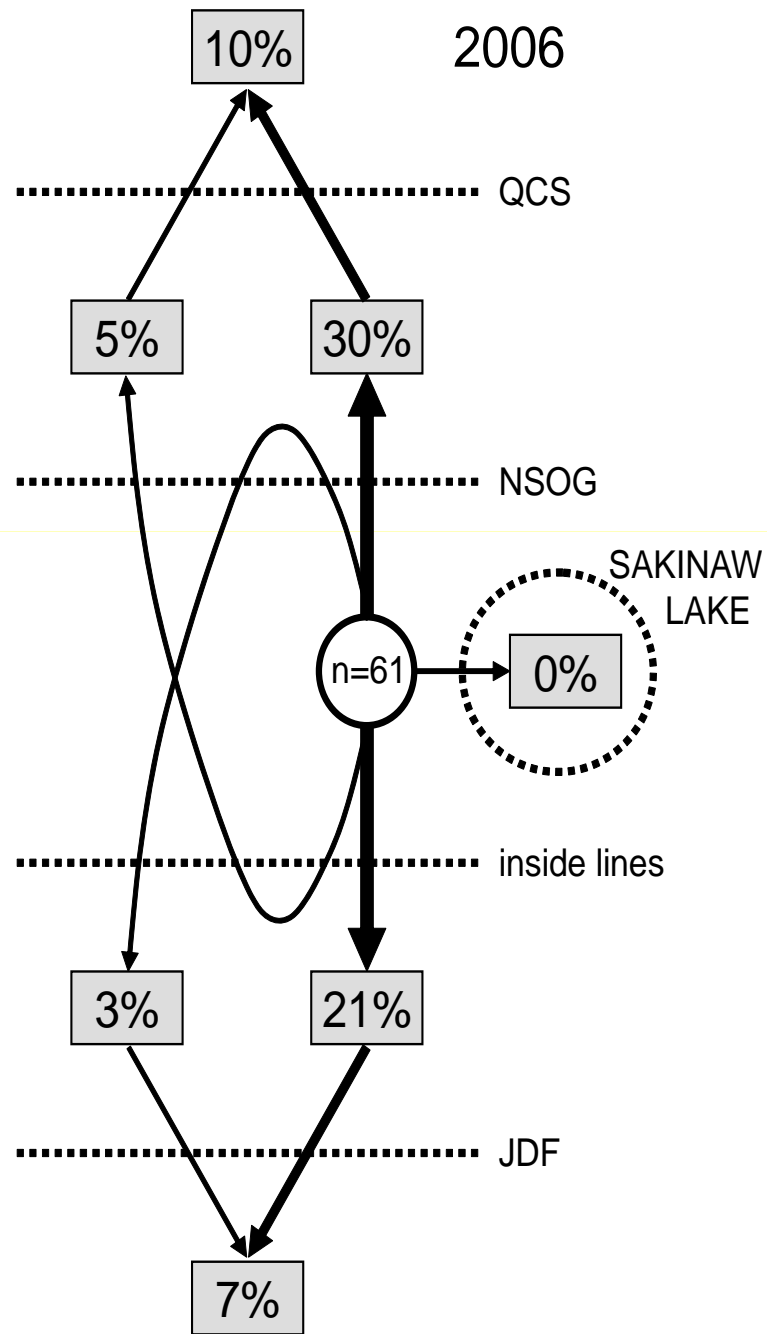




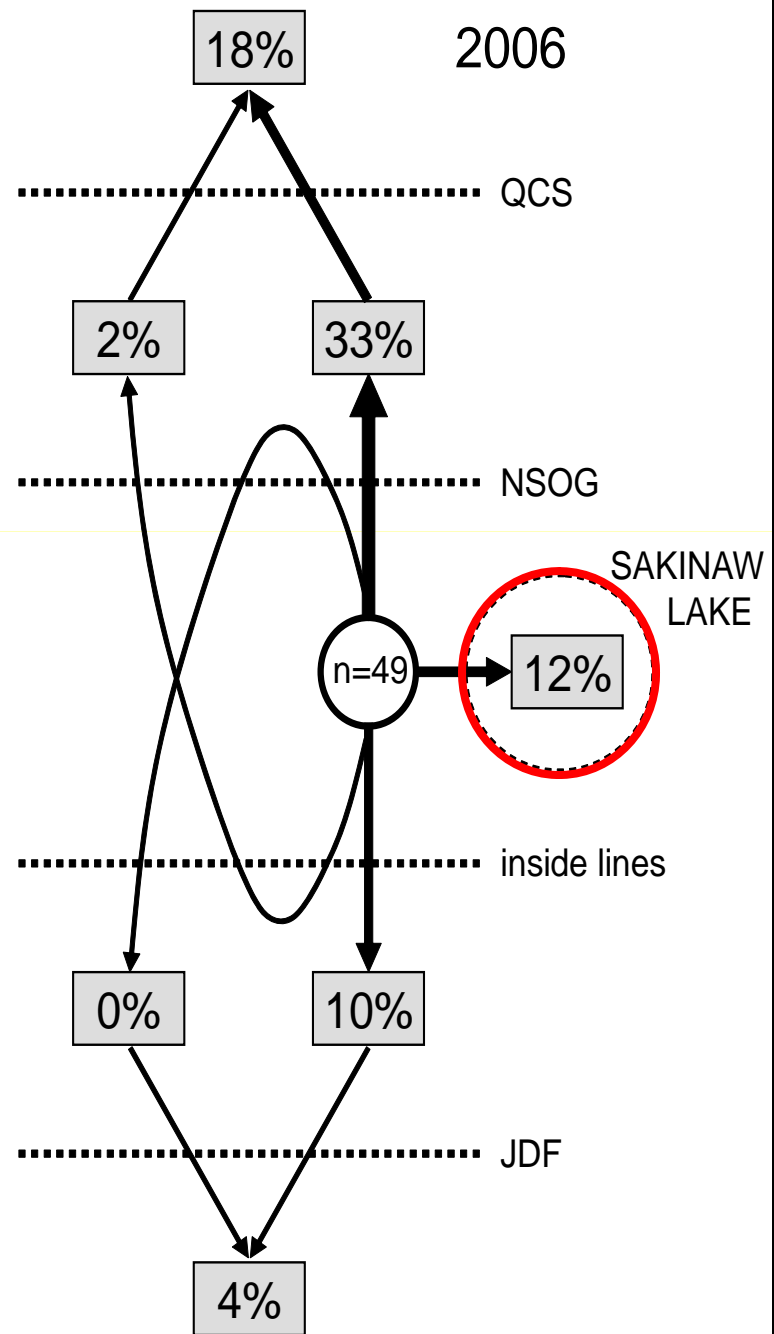




# SOCKEYE 2006



# KOKANEE 2006



## **Wild juvenile kokanee survived early ocean migration**

- (forced) seaward migratory behaviour of kokanee was similar to that of sockeye
- except that some returned to Sakinaw Lake immediately after release (no sockeye did)
- may be capable of re-anadromization as an alternative recovery strategy

## High mortality likely occurred **OUTSIDE** the Strait of Georgia

- Only **non-migratory sockeye** (*those that did NOT migrate seaward across POST arrays*) released in 2004 returned as adults (5%)
- Seaward migration similar to Fraser sockeye; ***cannot yet explain why mortality is higher for Sakinaw sockeye than Fraser sockeye***
- No pathogens or parasites found in smolts

## SUMMARY DATA

| Year | Tagging Data |                    |            |                       |                        | Number (%) detected             |                 |                           |            |               |
|------|--------------|--------------------|------------|-----------------------|------------------------|---------------------------------|-----------------|---------------------------|------------|---------------|
|      | Ecotype      | Release Date (UTC) | Number     | Length (mm) mean (SD) | Pre-release mortality  | As juveniles in year of release |                 |                           | As adults  |               |
|      |              |                    |            |                       |                        | All sites                       | QCS or JDF      | Sakinaw                   | POST array | Release site  |
| 2004 | sockeye      | 1 June 18:00       | 63         | 191 (14.5)            | 0                      | 29 (46%)                        | 12 (19%)        | --                        | 0          | 1 (2%)        |
|      | sockeye      | 16 June 21:00      | 34         | 197 (14.0)            | 0                      | 12 (35%)                        | 6 (18%)         | --                        | 0          | 2 (6%)        |
|      | all          |                    | <b>97</b>  | <b>193 (14.6)</b>     |                        | <b>41 (42%)</b>                 | <b>18 (19%)</b> | --                        | <b>0</b>   | <b>3 (3%)</b> |
| 2005 | kokanee      | 3 June 02:00       | <b>47</b>  | <b>191 (12.3)</b>     | <b>24%<sup>a</sup></b> | <b>26 (55%)</b>                 | <b>13 (28%)</b> | <b>1<sup>b</sup> (2%)</b> | <b>0</b>   | <b>0</b>      |
| 2006 | sockeye      | 3 June 04:00       | 61         | 213 (11.5)            | 0                      | 36 (59%)                        | 10 (16%)        | 0                         | 0          | 0             |
|      | kokanee      | 3 June 04:00       | 49         | 192 (10.0)            | 2%                     | 28 (57%)                        | 11 (22%)        | 6 (12%)                   | 0          | 0             |
|      | all          |                    | <b>110</b> | <b>204 (15.2)</b>     | <b>1%</b>              | <b>64 (58%)</b>                 | <b>21 (19%)</b> | <b>6 (5%)</b>             | <b>0</b>   | <b>0</b>      |
| all  | all          | all                | <b>254</b> | <b>197 (15.5)</b>     | <b>4%</b>              | <b>131 (52%)</b>                | <b>52 (20%)</b> | <b>7<sup>b</sup> (3%)</b> | <b>0</b>   | <b>3 (1%)</b> |

<sup>a</sup> 11.5% for fish collected 5 days before surgery; 90% for those collected the day of surgery.

<sup>b</sup> includes the detection of a reactivated tag in 2007; likely underestimated because fixed receivers were not deployed in Sakinaw Lake in 2005