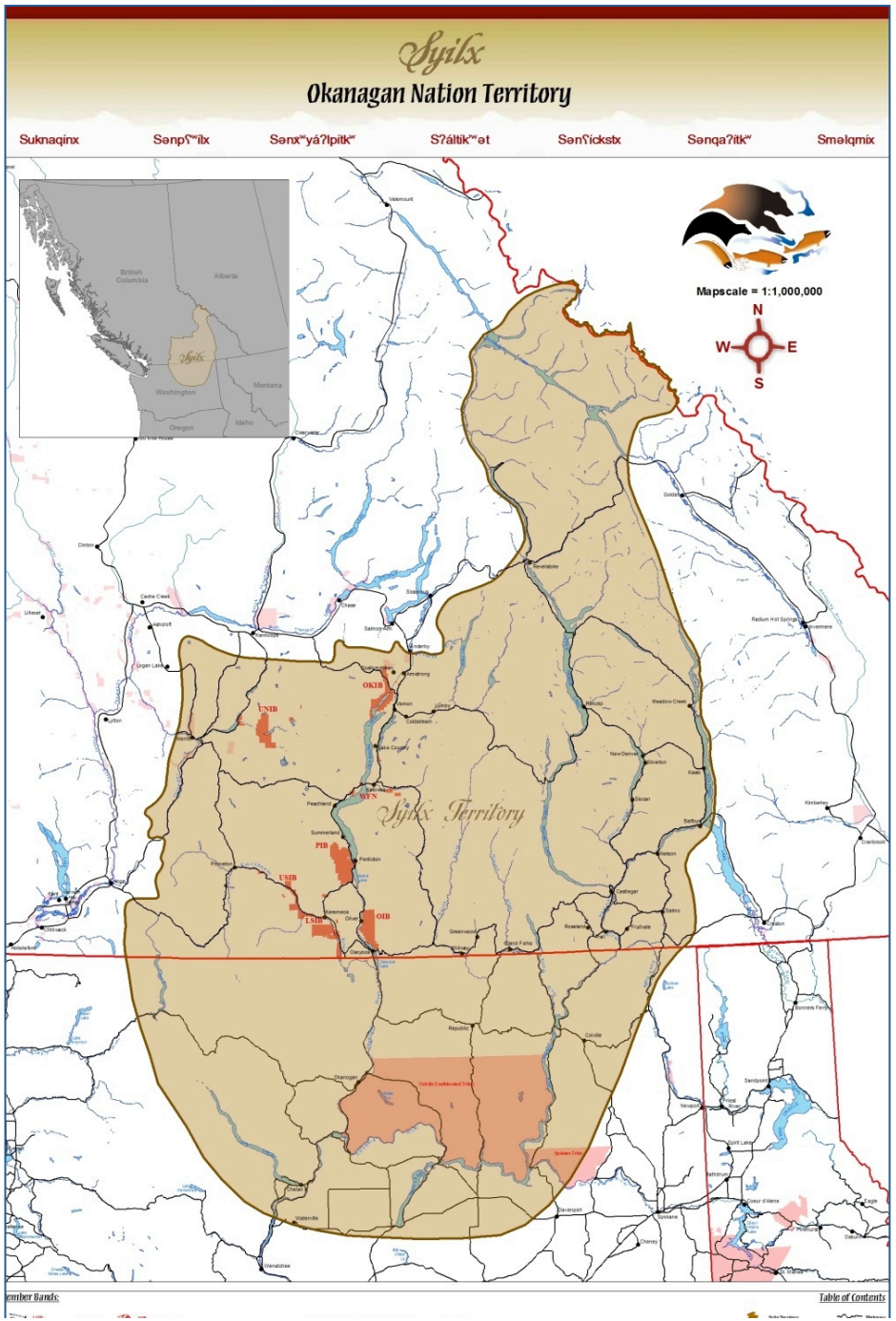
Okanagan Sockeye Re-Introduction to Skaha Lake Monitoring Program

Presented by: Howie Wright

Future of our Salmon Conference March 2014

syilx Okanagan Nation Alliance



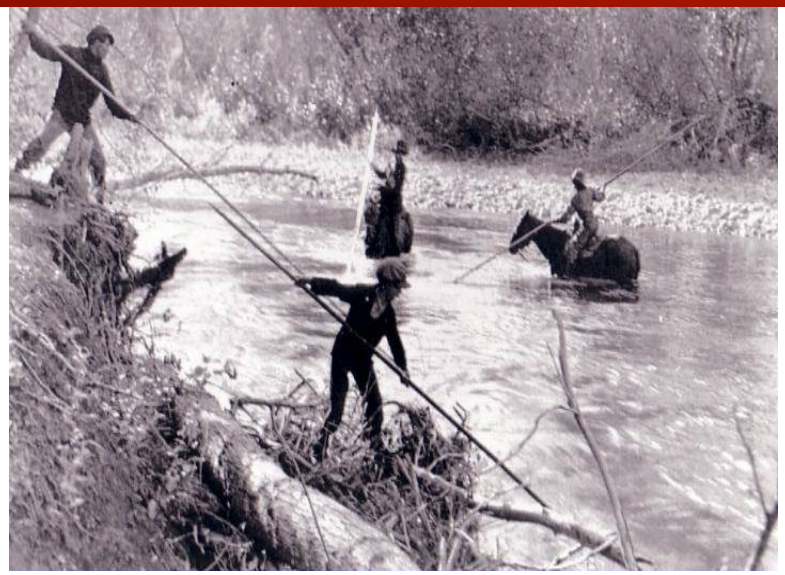
Revitalization of an Okanagan Fishery & the *Salmon* People

Seven member band communities:

1. Osoyoos Indian Band
2. Penticton Indian Band
3. Westbank First Nation
4. Okanagan Indian Band
5. Upper Nicola Band
6. Lower Similkameen Band
7. Upper Similkameen Band

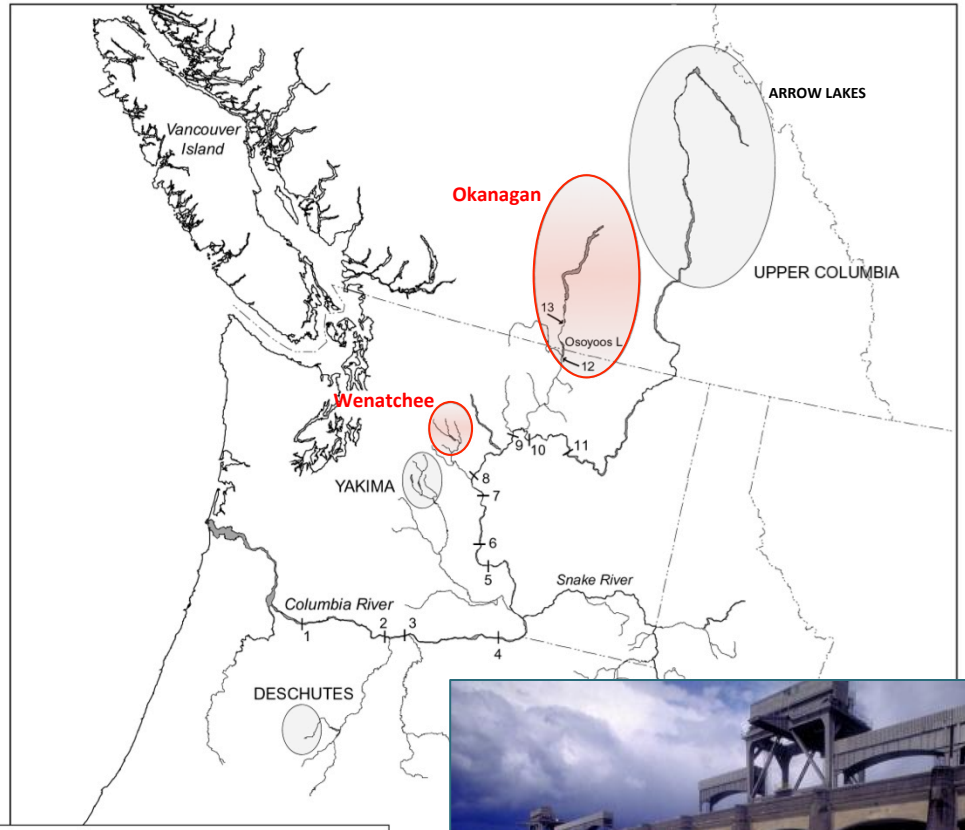
And the Colville Confederated Tribes (USA)

Salmon Integral to Okanagan Culture



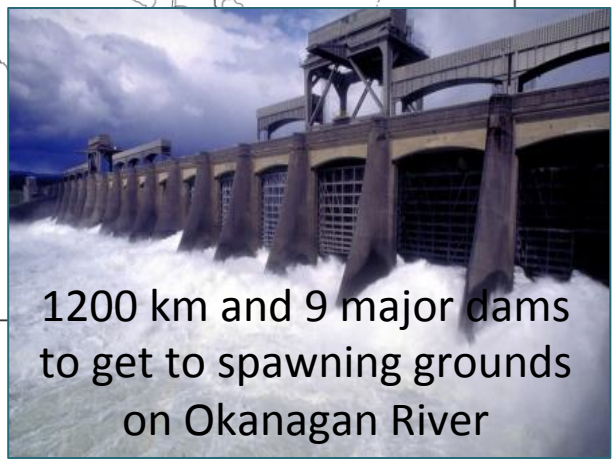
Background: Okanagan Sockeye

- Okanagan sockeye population is one of two remaining viable Columbia River stocks
- Okanagan run makes up 70-90% of all Columbia river sockeye



COLUMBIA RIVER DAM SITES

1 Bonneville	7 Rock Island
2 The Dalles	8 Rocky Reach
3 John Day	9 Wells
4 McNary	10 Chief Joseph
5 Priest Rapids	11 Grand Coulee
6 Wanapum	12 Zosel
	13 McIntyre



Columbia River sub-basins historically accessible to sockeye

Columbia River sub-basins with present day viable sockeye populations

History

- Commercial Salmon Fisheries U.S. (1870's)
- Historical decisions did not consider importance to Okanagan fisheries
  - Mainstem Columbia River Dams (1933)
  - Grand Coulee Dam blocks access to Upper Columbia (1938)
  - Grand Coulee Dam Fish Maintenance Project (1939-1943)
  - Columbia River Treaty (1961)
  - Okanagan River Channelization and salmon Access in Okanagan River restricted (McIntyre Dam -1915)

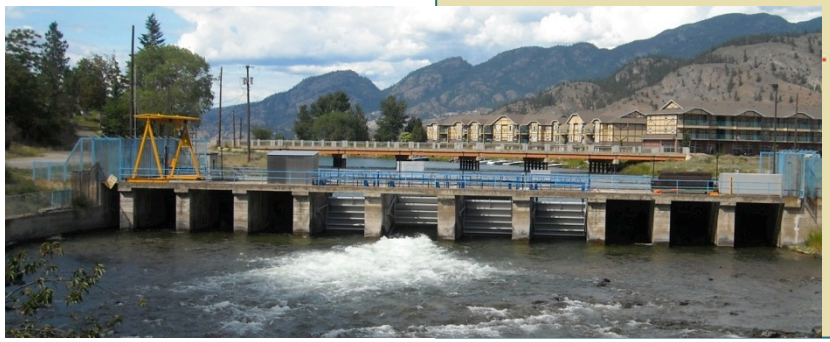
Historical Range of Okanagan Sockeye

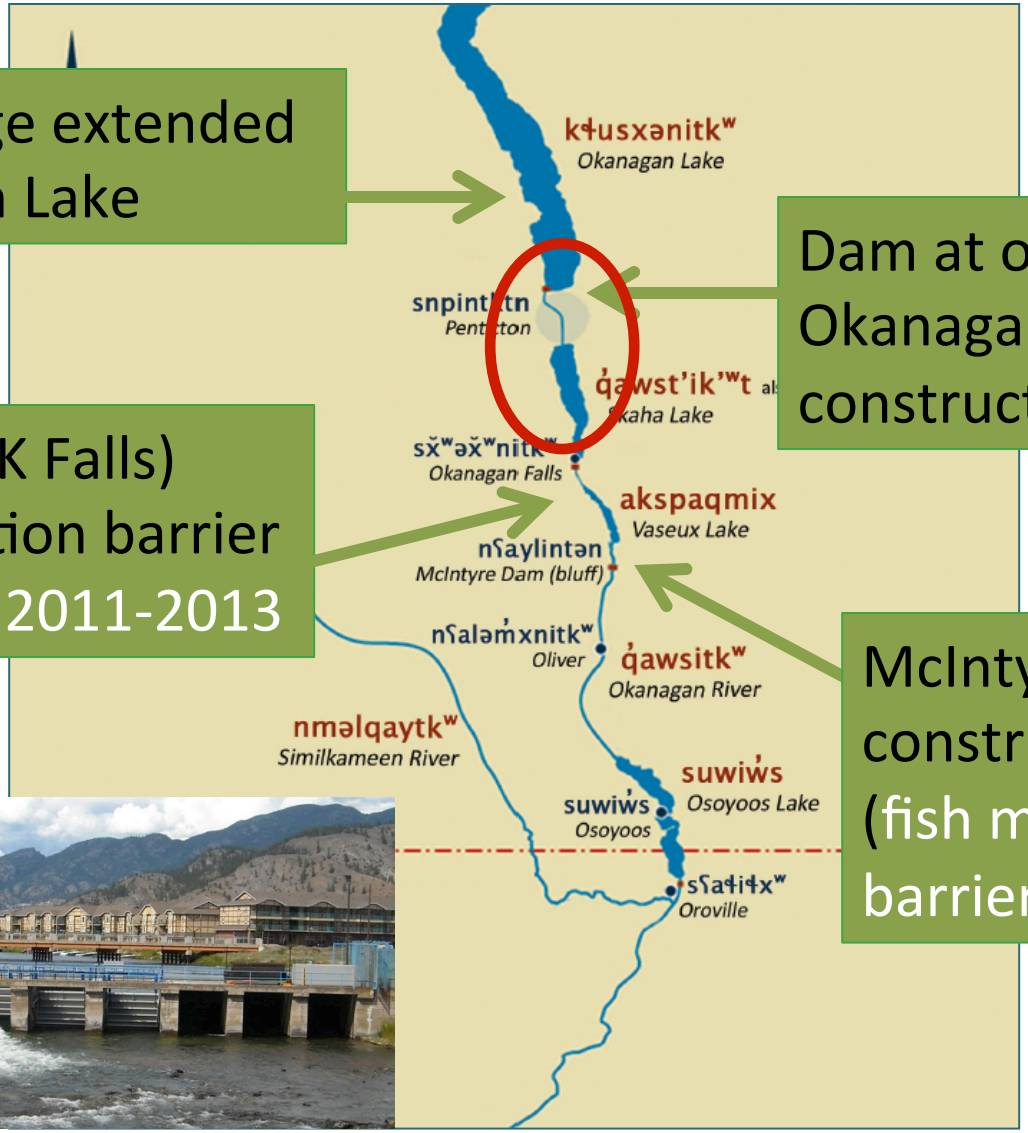
Historical range extended into Okanagan Lake

Dam at outlet of Okanagan Lake constructed in 1914

Skaha Dam (OK Falls) current migration barrier + fish passage 2011-2013

McIntyre Dam constructed in 1921 (fish migration barrier until 2009)





Sockeye Reintro Program Overview

- Initiated in 1997
- COBTWG (Canadian Okanagan Basin Technical Working Group)
- Three-year risk assessment completed in 2003
- 12 Year Reintroduction Program (2004-2016) into Skaha Lake
- Adaptive management framework
- Funded by Grant and Chelan County Public Utility District (Columbia hydro mitigation)
- Stepwise approach prior to Okanagan Lake
- Extensive Monitoring
- Decision at end of program for fish passage into Skaha

BRITISH COLUMBIA

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Fisheries and Oceans Canada

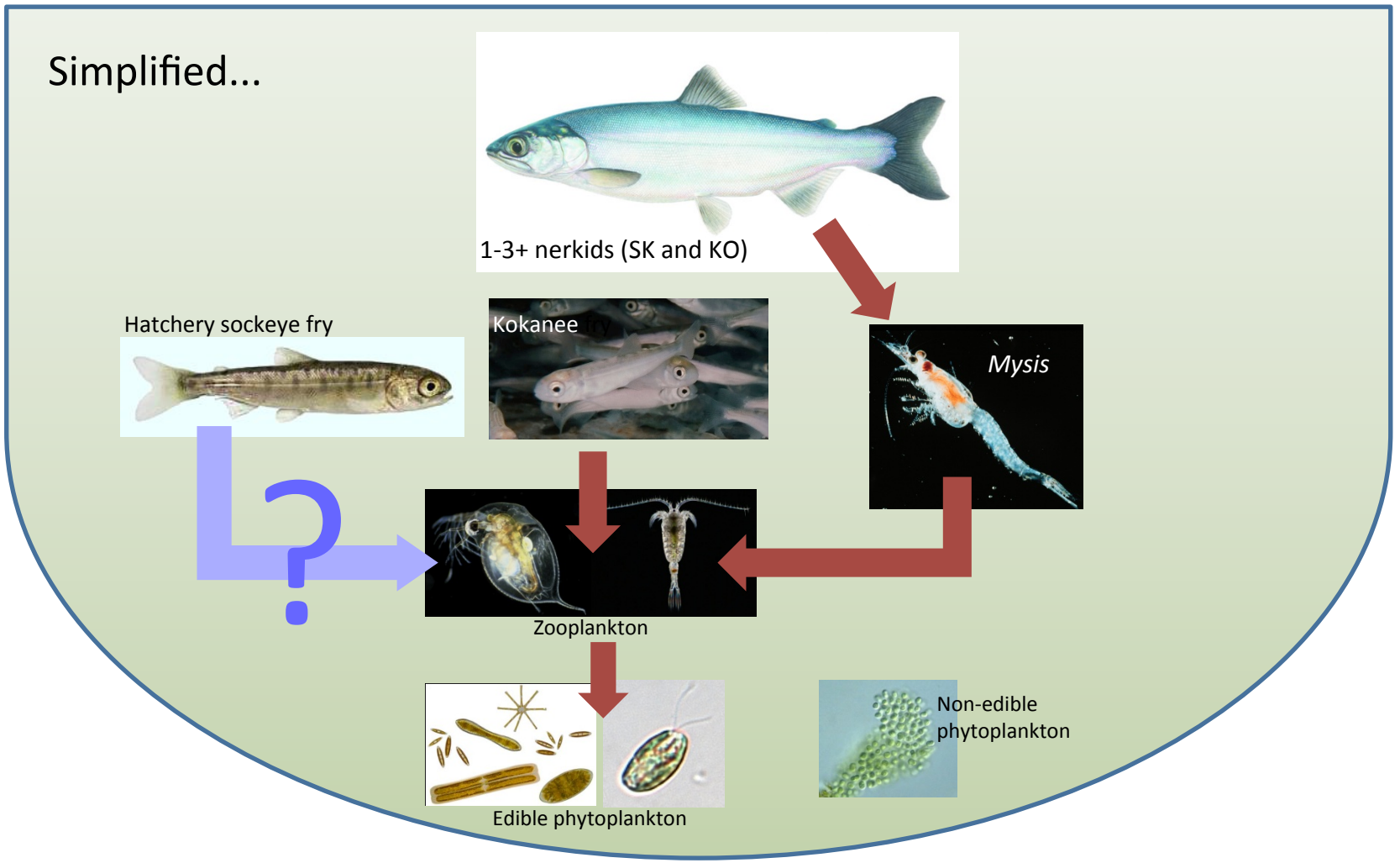
Pêches et Océans Canada

Program Overview: Key Questions

Key questions include (not limited to):

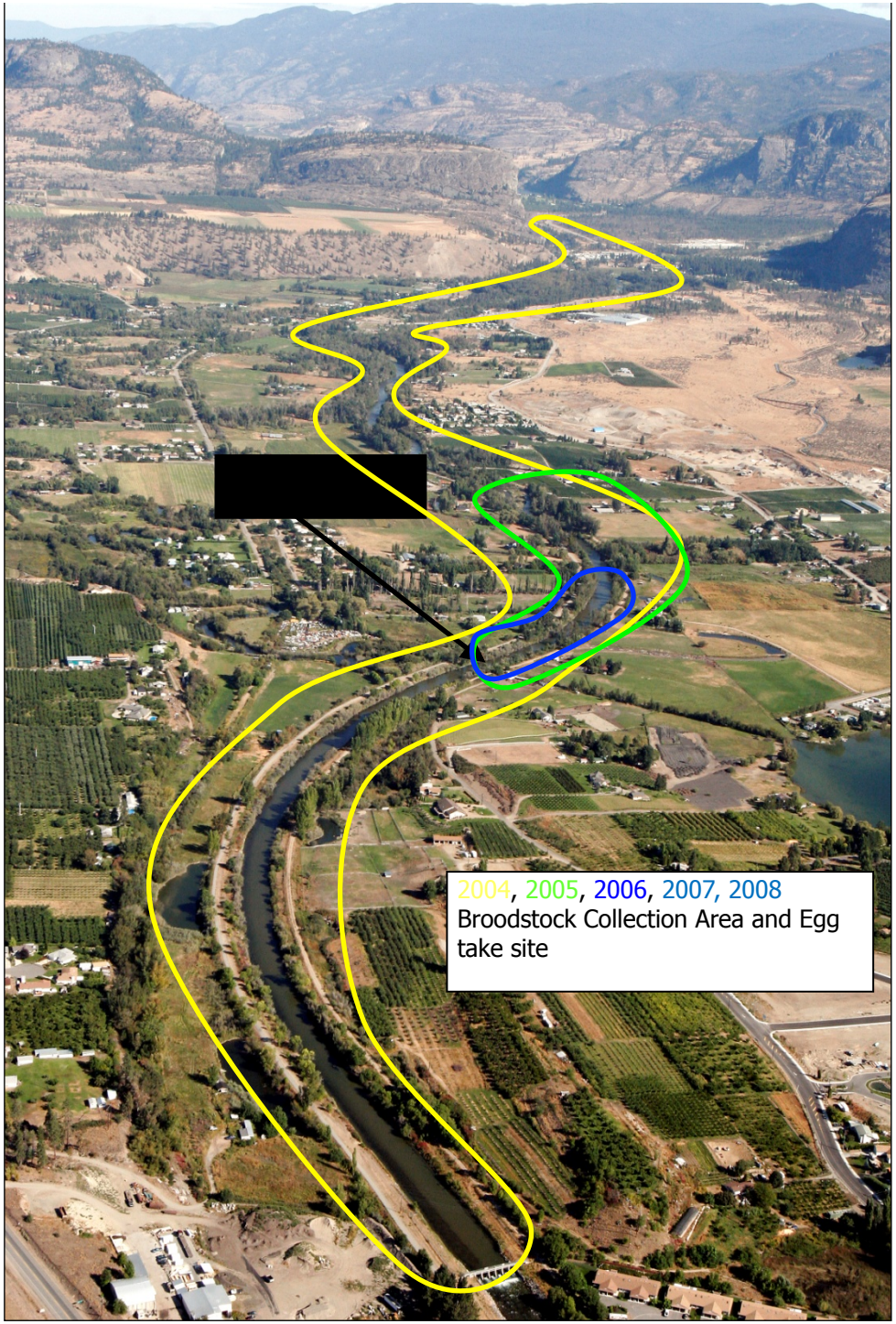
- **What impacts will sockeye have on existing kokanee stocks?**
- **What components of the food web and physical environment most strongly control the production of sockeye and kokanee?**
- What are the effects on the existing Osoyoos sockeye population?
- Learn for Okanagan Lake

Skaha Lake Pelagic Food Web



How are Sockeye Reintroduced?

- Eggs (400,000 - 2 million) taken from broodstock collected on spawning grounds near Oliver and raised to fry in hatchery
- Fry released in Penticton Channel (above Skaha Lake) the following spring


2004, 2005, 2006, 2007, 2008
Broodstock Collection Area and Egg take site

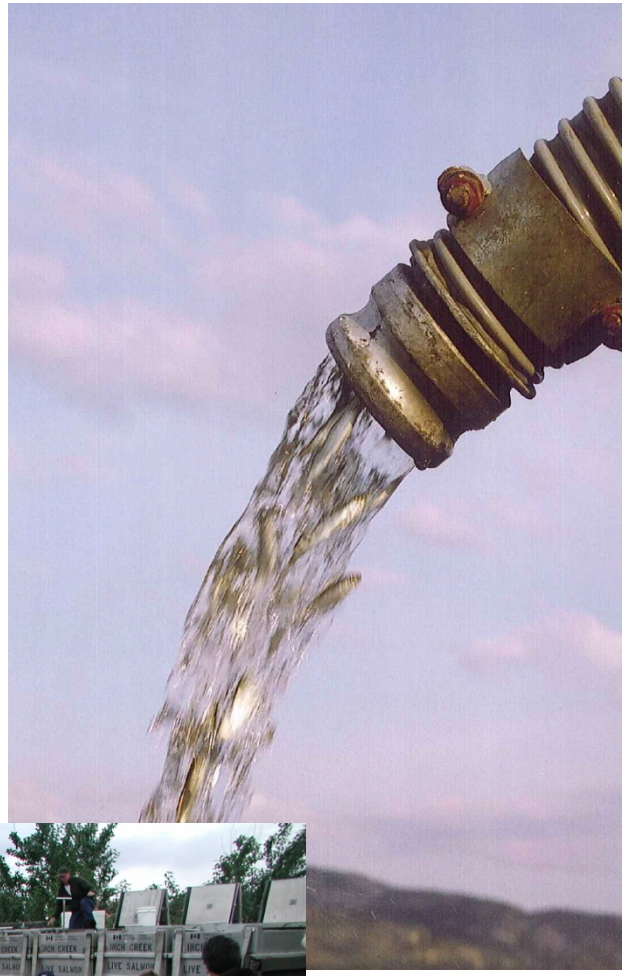
Collection, Transportation and Holding

Egg Take

Evening Release

Two release strategies for 2008 BY

1. June 2, Midnight release
2. June 3, early evening



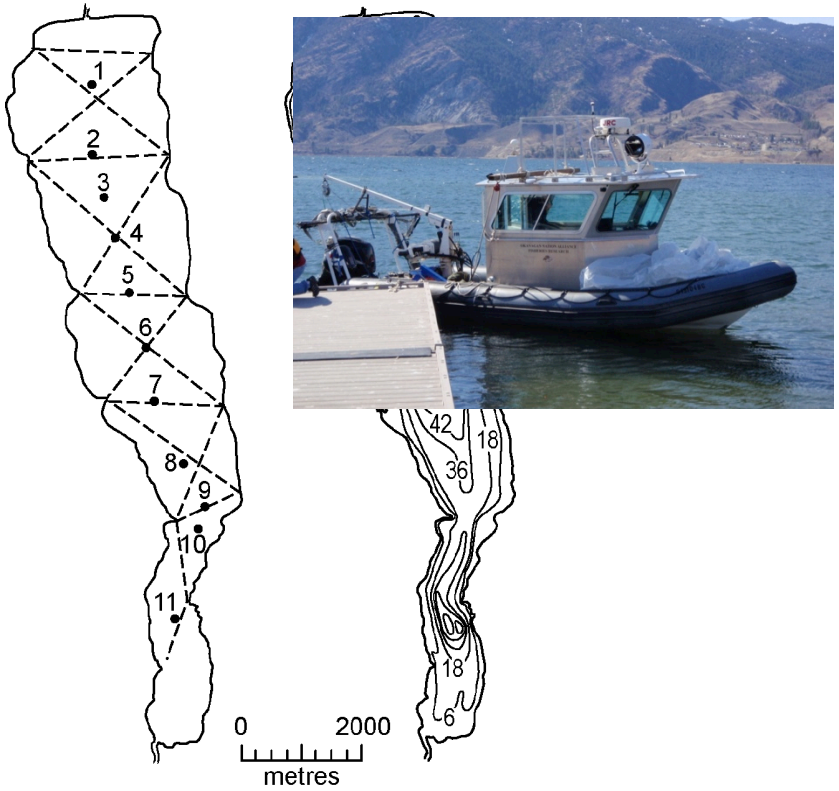
Ceremonial Release

Skaha In-Lake Sampling

Each spring since 2005, between 400,000 and 1.7 million sockeye fry released into Skaha Lake.

Intensive monitoring:

- Water chemistry
- Temperature
- Oxygen
- Phytoplankton
- Zooplankton
- Mysid shrimp
- Fish (SK and KO)



Results: Plankton & Chemistry

Since the stocking of sockeye fry in 2005, there has been no obvious changes in *Mysis*, zooplankton, phytoplankton, or water chemistry in Skaha Lake.

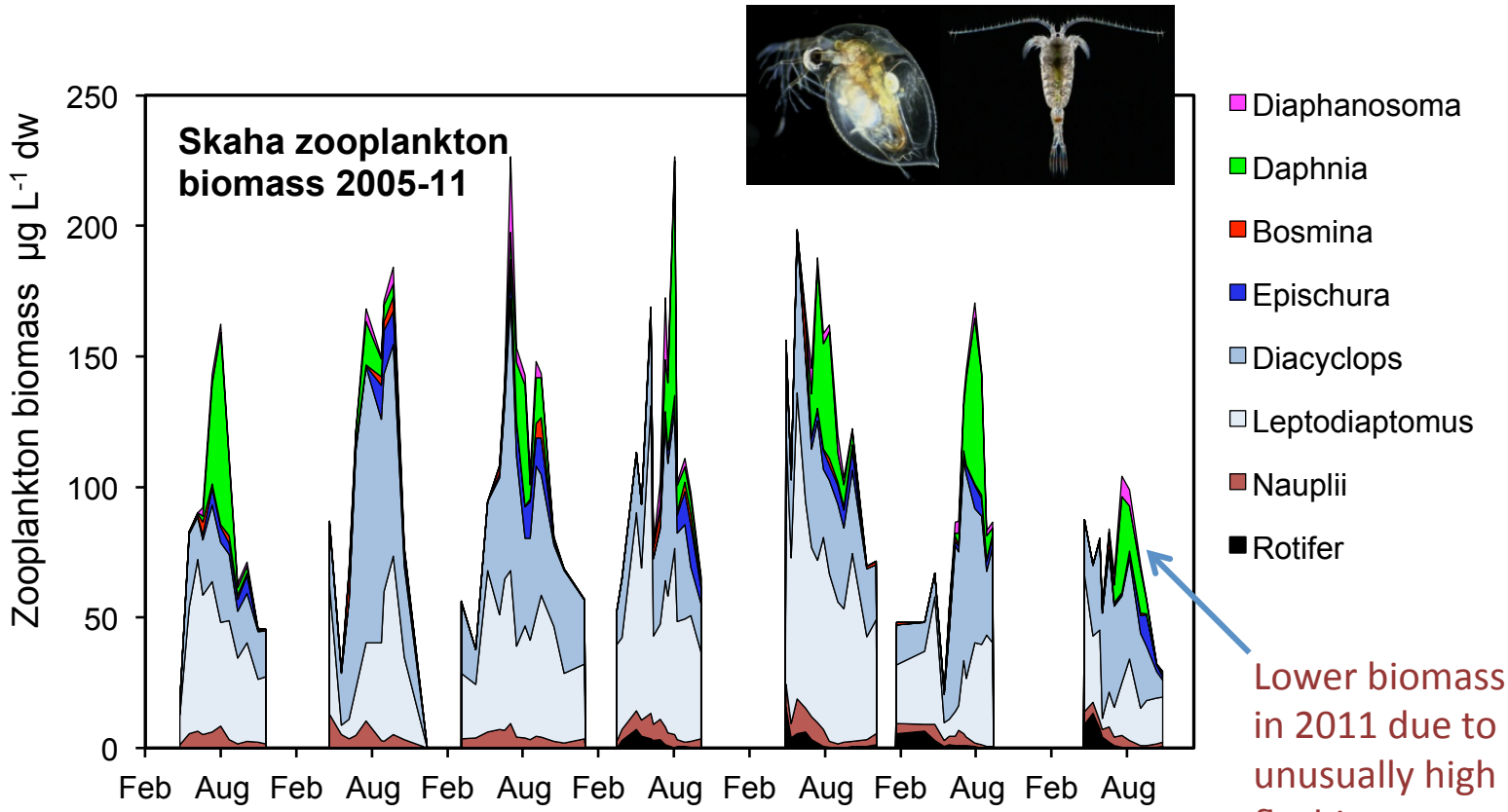


Figure from McQueen 2012.

Results: Kokanee Survival

Not determined by:

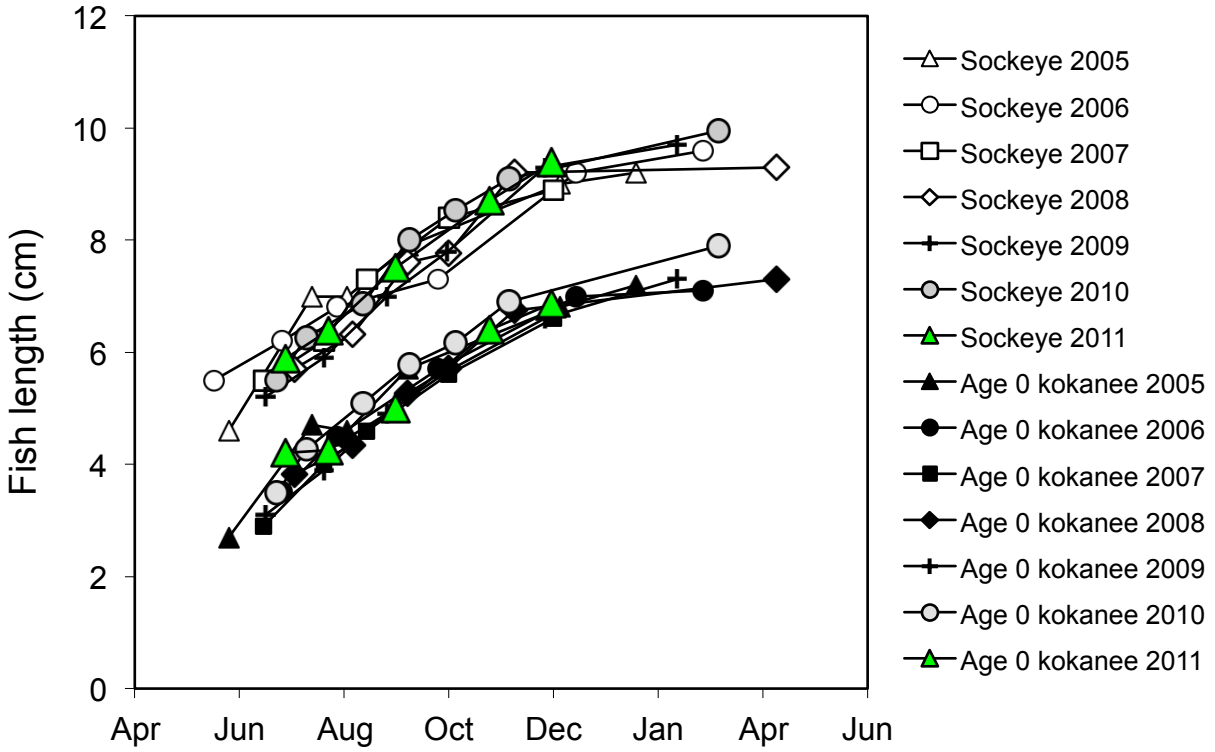
- Zooplankton biomass (food)
- Density of older kokanee (competitor or predator)
- Sockeye stocking density (competitor)
- *Mysis* biomass (competitor)
- Number of adult KO spawners

Possibly determined by:

- River discharge and/or air temperature?

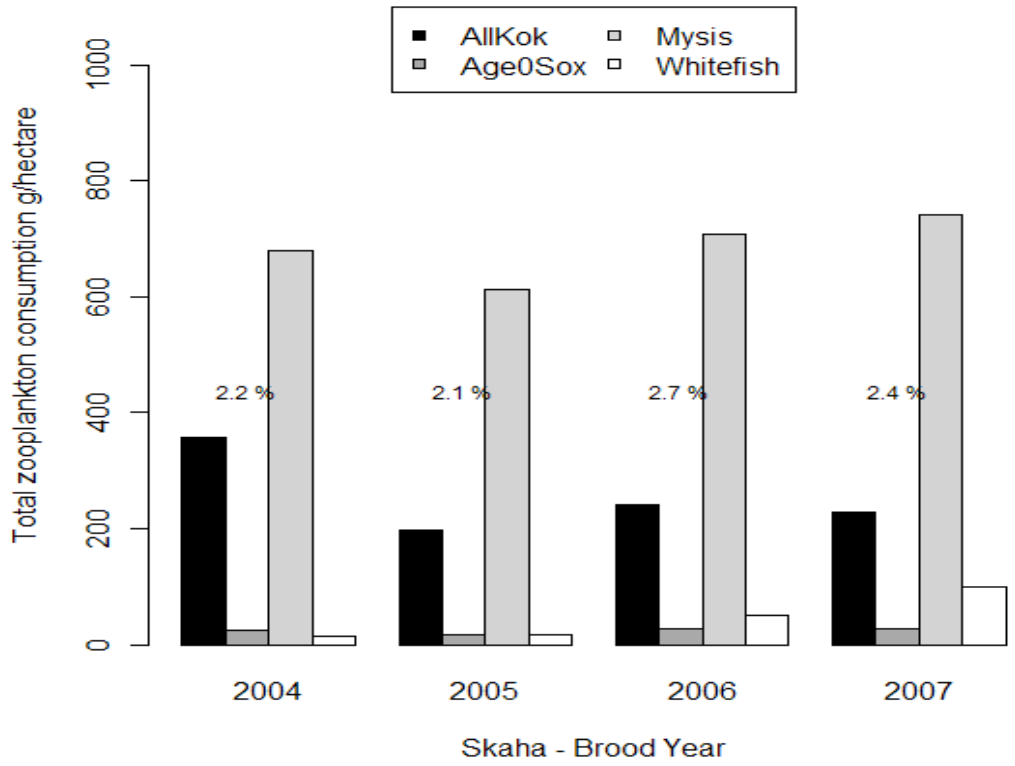
Results: Growth of juvenile Sockeye and Kokanee

Juvenile sockeye and kokanee growth rates have been very stable, despite variation in stocking density (ie. no evidence of density dependant growth).



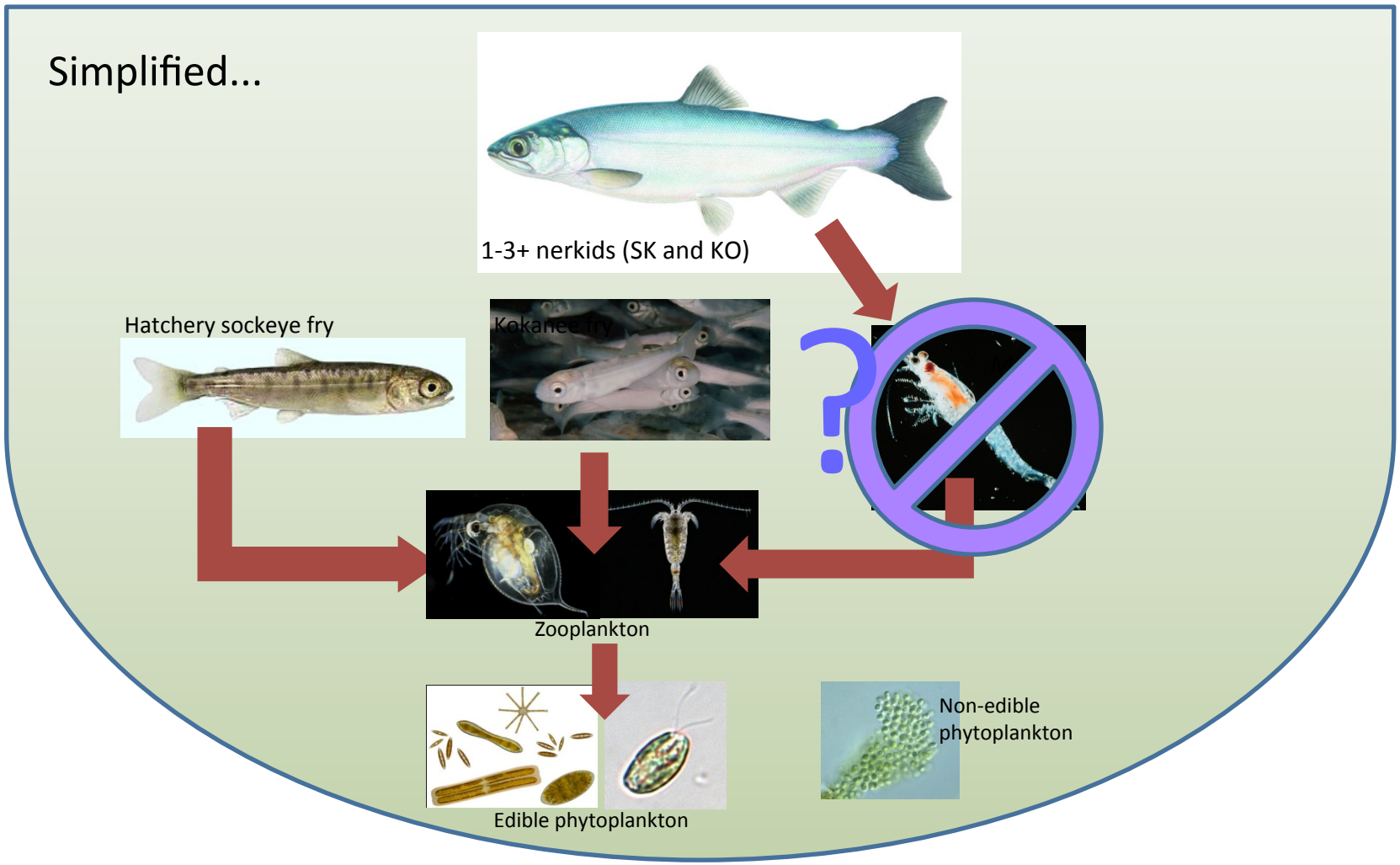
Results: Bioenergetics

Based on inputs of body weights, water temp, and food found in gut, model estimates the amount of food the fish/Mysis would have had to eat to grow as fast as it did grow in the field.



- Invasive *Mysis* consume 2-3 times as much zooplankton as all fish combined.
- Less than 15% of daily prey production is consumed by fish and *Mysis* together.
- Even at highest fish densities, these rates are much too low to have any impact on prey biomass.

A *Mysis* test fishery is being conducted Oct. 2012; this new experimental treatment will provide an opportunity to learn more about food web dynamics in Skaha Lake.



Take Home Messages: Skaha In-lake Studies

1) What impacts will sockeye have on existing kokanee stocks (growth and survival)? To date, no evidence of negative impacts. Lots of food for *Mysis*, sockeye, and kokanee!

2) What components of the food web and physical environment most strongly control the production of sockeye and kokanee? In Skaha Lake, *Mysis* is the main driver of the food web. *Mysis* harvest in 2012 will provide more insight.

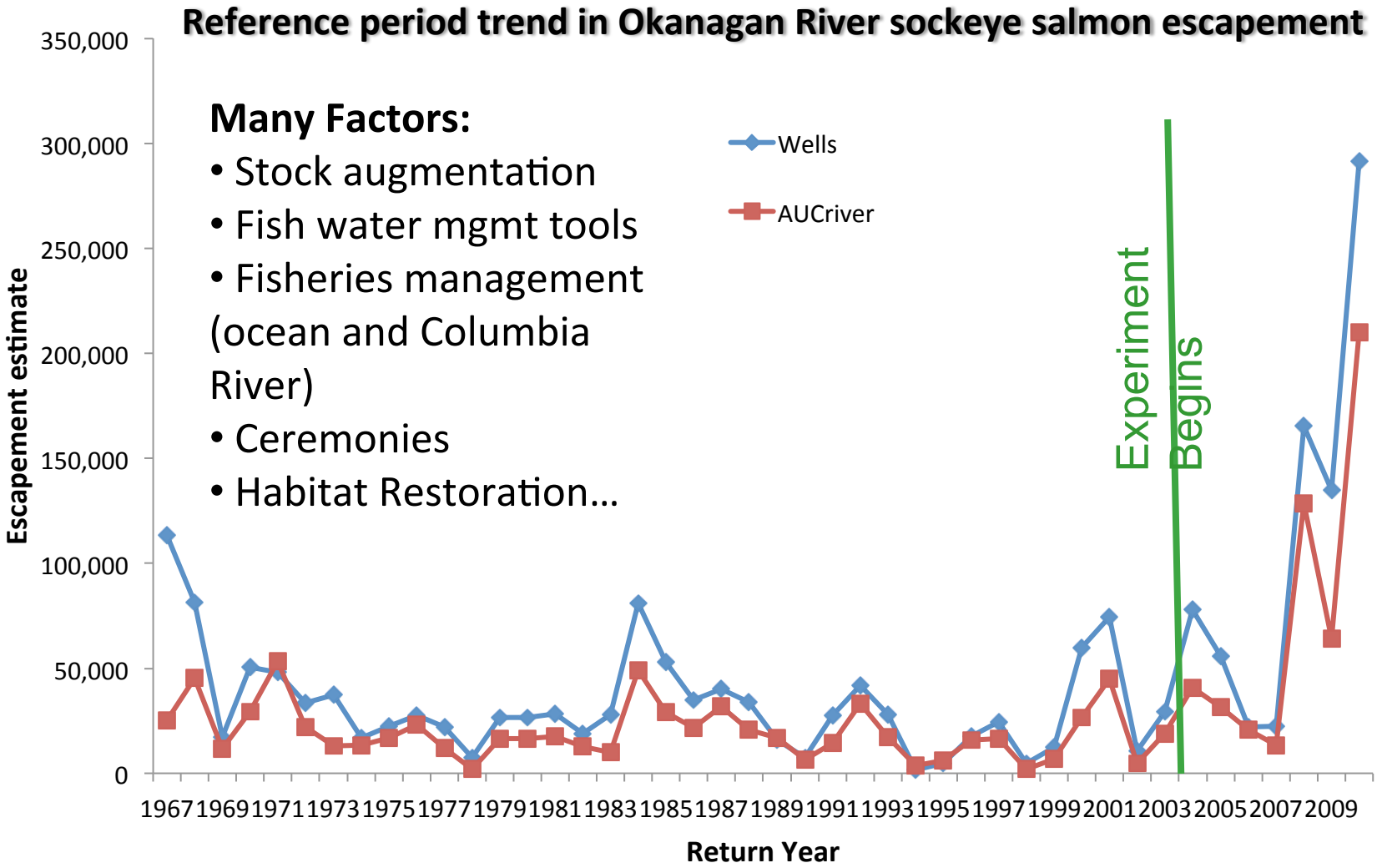
Summary of Program Results to Date

- Results from monitoring impacts of sockeye reintroduction are promising so far
- Relatively good juvenile abundance, growth, and survival
- Low impact to native fishes (such as kokanee)
- Increased understanding that *Mysis* shrimp are driving the foodwebs
- Increased Okanagan River sockeye escapement in recent years (2012 highest on record), but many factors involved and we expect to see some smaller runs in the near future

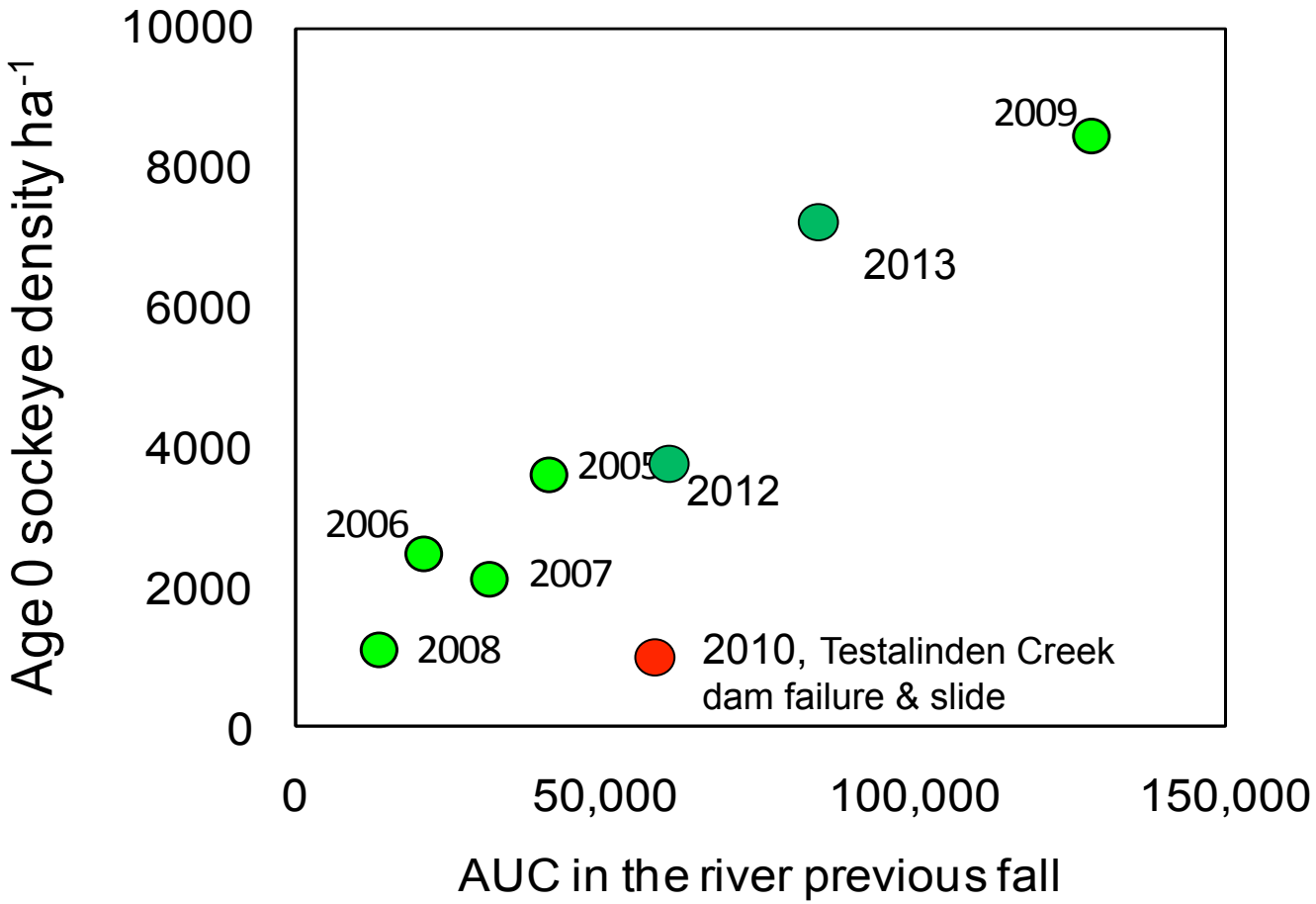
Future Direction

- Construct & operate Penticton hatchery for releasing up to 3.5 million sockeye fry and monitor fish-forage interactions
- Design and construct fish passage at Skaha Lake dam (fish passage by 2015)
- Expand telemetry program (acoustic and PIT arrays) to monitor adult and juvenile behaviour
- Specify long term biological goals
- Recommend management actions and re-establish timeframes and priorities for Okanagan Lake Reintroduction – expert workshop end of April 2014
- Habitat Restoration and improvement

How are the sockeye run doing?



Where do all the sockeye come from ?



Post FWMT deployment, more adult spawners clearly lead to more smolt production as per Hyatt & Rankin (1999) analysis of carrying capacity of river and lake habitats. However, density independent losses of eggs/fry do still occur e.g. spring 2010.

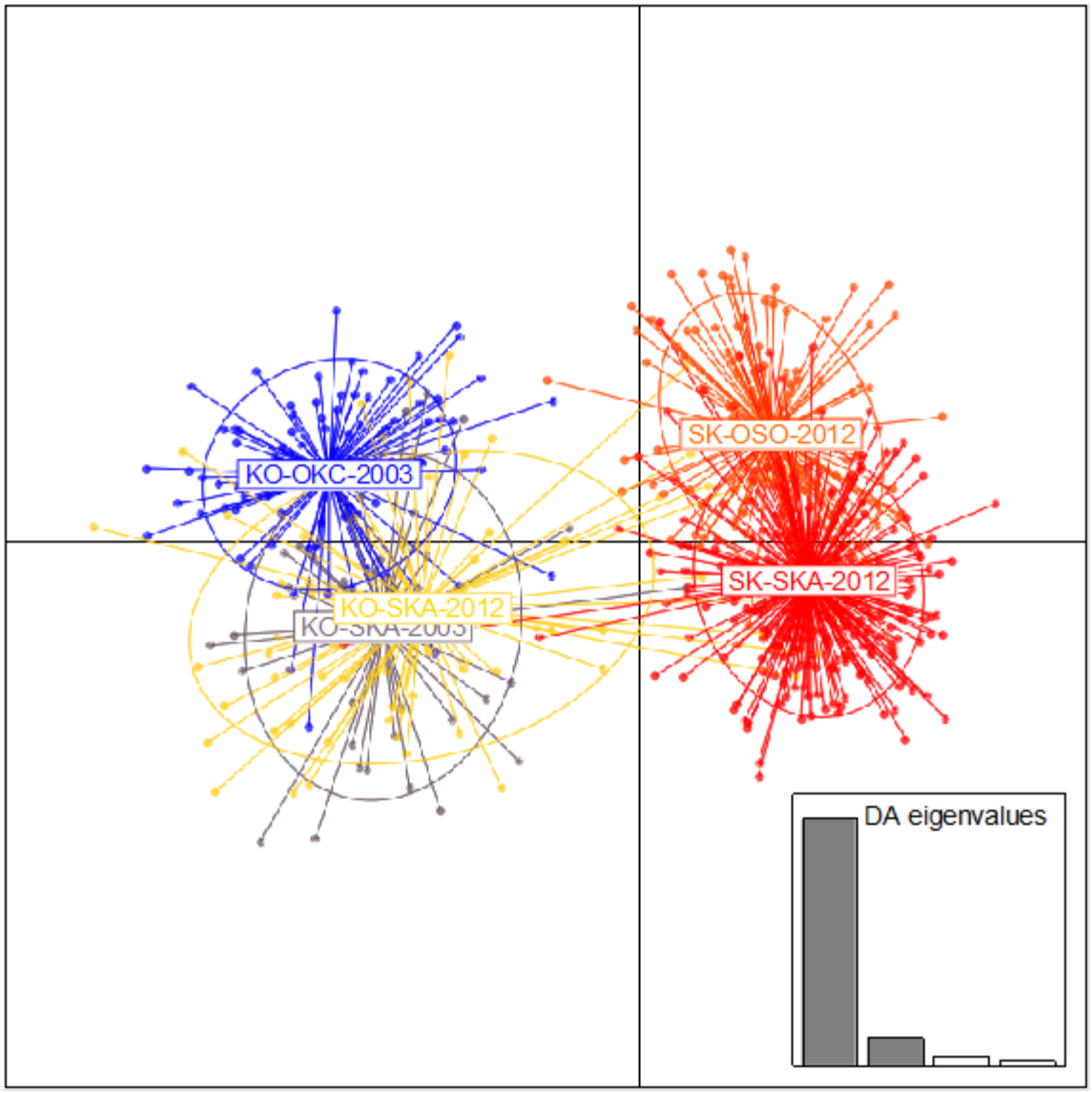
Out of Basin monitoring

Food fisheries/culture

- Okanagan Falls Salmon feast
- Salmon in diet
- Revitalizing a fishery
- Cultural ceremonies

Starting to see benefits-economic and recreational fisheries

669 3 Adult Genetics



Scatterplot depicting results of the discriminant analysis of principal components of sampled populations including 2003 Kokanee from Okanagan Channel (KO-OKC-2003), 2003 Kokanee from Skaha Lake (KO-SKA-2003); 2012 Kokanee from Skaha Lake (KO-SKA-2012), 2012 Sockeye from Skaha Lake (SK-SKA-2012), and 2012 Sockeye from Osoyoos Lake (SK-OSO-2012).

Population Genetics Conclusions

Osoyoos and Skaha SOCKEYE populations are not genetically differentiated, continue to manage as an aggregate,

•Skaha (Penticton Channel) sockeye and kokanee indicating part introgression (~ 6%); more work needed to conclude if occurring more frequently in both kokanee and sockeye, Ho: incresaing in KO, less so for sockeye at this early stage. Recommend larger sample size for sockeye, and closer look at new hybrid program methodology,

•Skaha population (thermal marks) indicate majority of donor stock from hatchery outplants (imprinting to lake) in 2011, 2012;

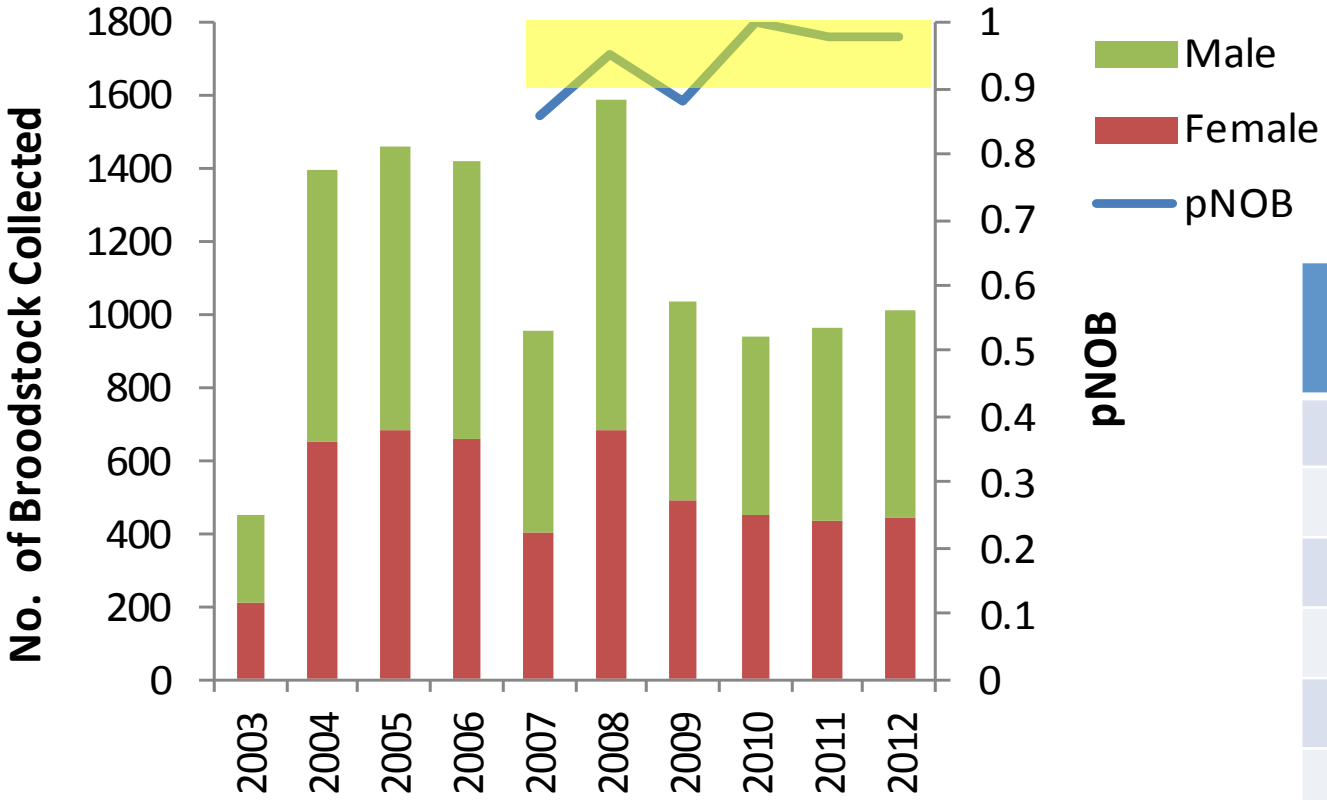
• Low straying rate of Skaha outplants to Index sections of Okanagan River (Osoyoos; otoliths), or Wenatchee River (PIT Tags).

Hatchery

Hatchery

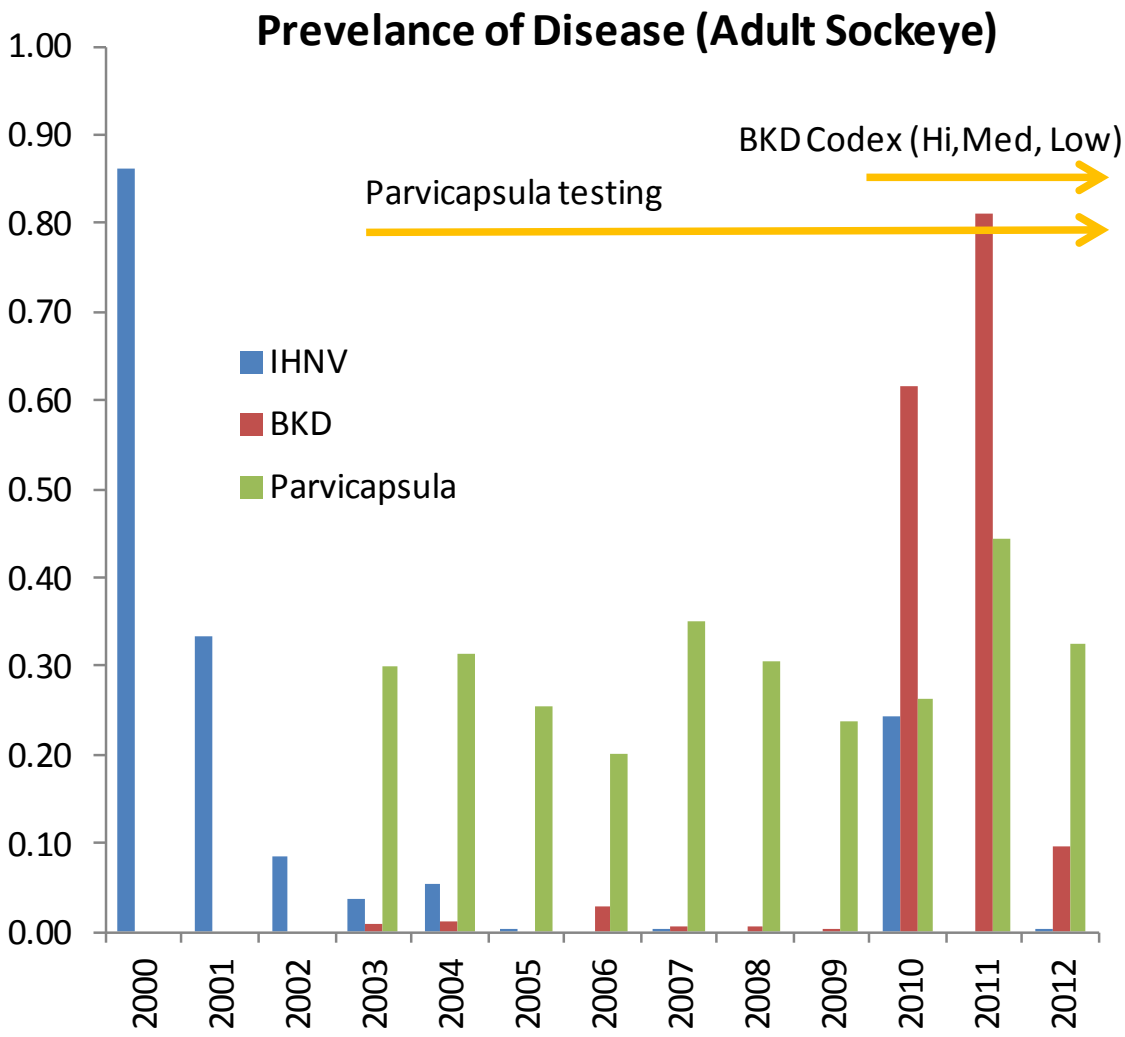
Hatchery

Stock Augmentation: Broodstock



Brood Year	PNI
2007	0.88
2008	0.94
2009	0.86
2010	0.92
2011	0.80
2012	TBD

Disease & Fish Health



NOTE: Alevin and fry (hatchery) sampled each year as well – all negative.

Lim Limp't (Thank You)

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