History and Status of Okanagan Fisheries & Salmon Reintroduction

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This presentation is meant to:

Showcase our salmon story, novel hatchery outcomes for salmon recovery, and speculate a salmon future in the Okanagan.

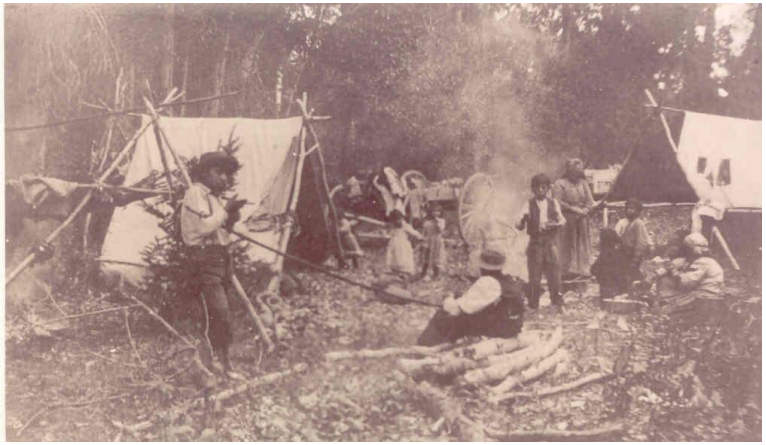
Inspire stakeholders to engage in collaborative action to create and advance responses to sustainability challenges

Catalyze partnerships among enterprises, corporations and investors, NGOs and Governments on projects that create mutual benefit for stakeholders and beneficiaries

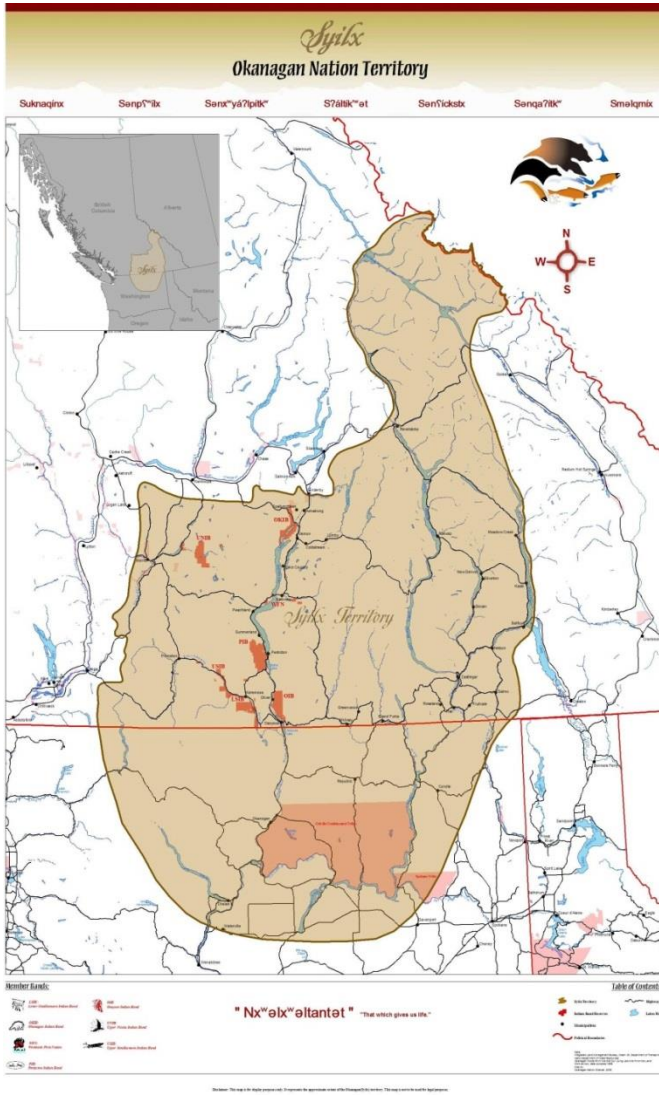
OKANAGAN SALMON RECOVERY

Element	Pre-Contact (1800's)	Industrial Era (1830-1985)	Current Status (1985 to present)
Okanagan Population	75,000 – 100,000	15,000 to 70,000	15,000 (5,000 CAN/10,000 US)
Salmon Abundance	1-6 million	0.2 -1 million	0.005-0.6 million
Salmon Diversity (viable populations)	Five species (Chinook (chief), Sockeye, Steelhead, Coho, Chum)	Sockeye, Chinook	Sockeye
Salmon Distribution	Osoyoos Lake, Skaha Lake, Okanagan Lake	Osoyoos Lake	Osoyoos, 90% total run, Skaha Re-Intro 10% total run, Okanagan (reintroduction)
Salmon Timing	Year round	July to September	June to October
Fishery Management	Salmon Chief (tribal/kinship)	Canadian/US federal agencies	Joint management (ONA-DFO, Canada, Pacific Salmon Treaty; US vs Oregon (US)
Fishing Camps/Sites	Kettle Falls (hoop net, dip, gaff); Okanagan River Weir (Omak), Skaha Falls (OK Falls, Fish baskets, gaff/dip)	Collapse of fishery by 1960's (loss of food fishery, intertribal trade essential)	Re-vitalize platforms at base of Chief Joe, Okanagan Weir, Osoyoos Lake, Ok Falls trap.

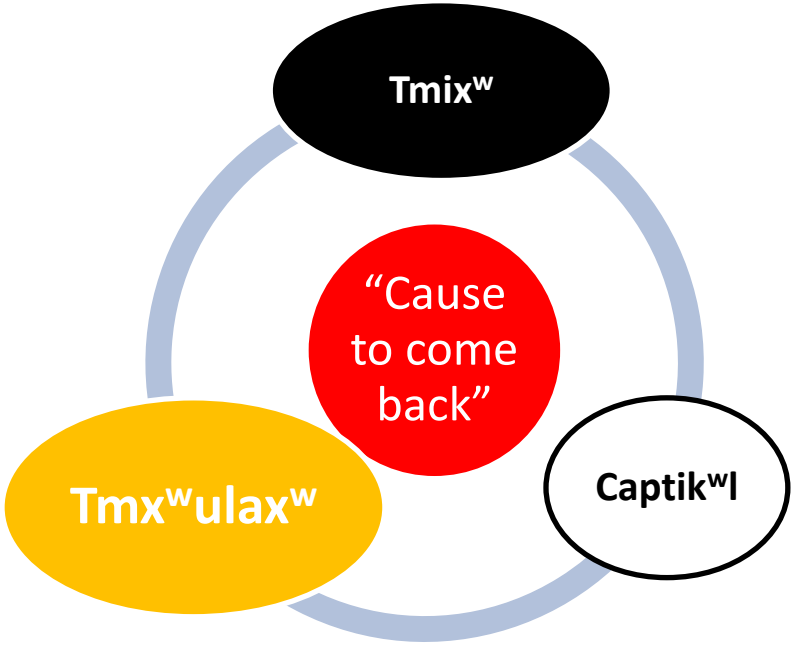
A SALMON PEOPLE



- Salmon is a primary food for the Syilx (Okanagan) People.
- In late summer, as the fish returned to spawn in the rivers, large fishing camps were set up.
- When plentiful, Sockeye was a valuable trading item.



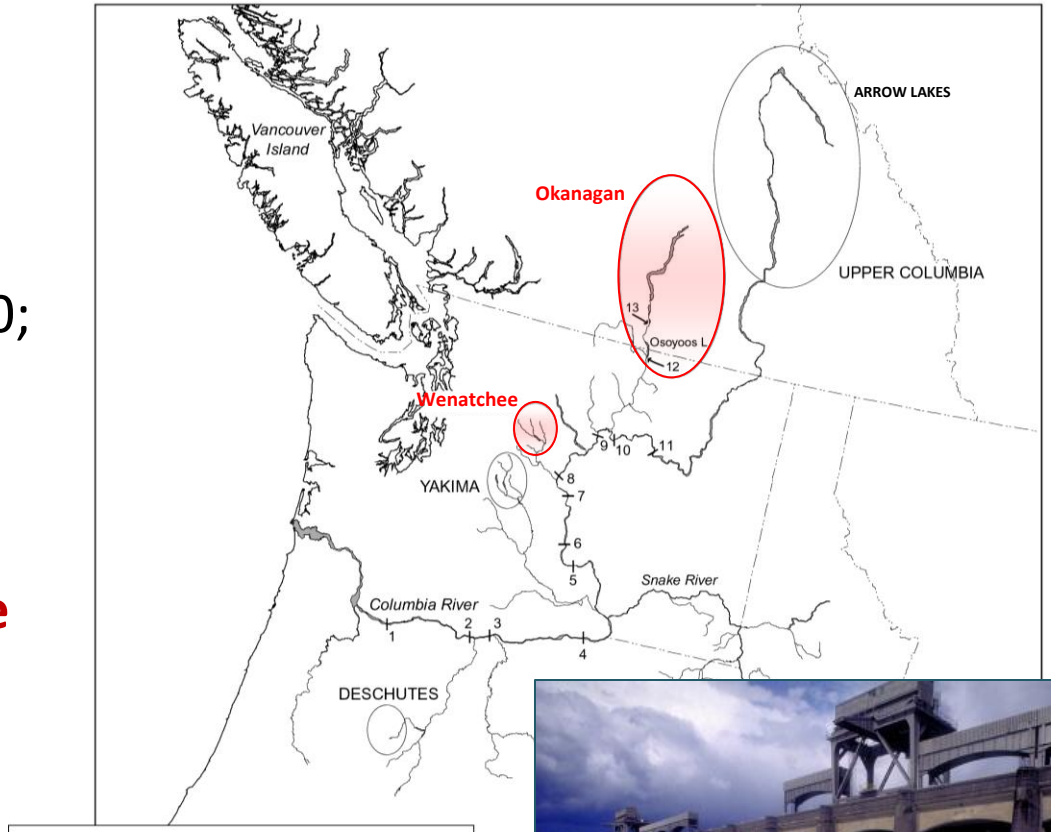
ONA Mission Statement - The conservation, protection, restoration, and enhancement of indigenous fisheries (anadromous and resident) and aquatic resources within Okanagan Nation Territory.



OKANAGAN NATION AQUATIC ENTERPRISES LTD.

Okanagan Sockeye Re-Introduction

- Okanagan Sockeye population is one of three remaining Columbia River stocks
- Mid 90's less than 3,000; by 2010 via restoration returns over 200,000
- **Okanagan run now makes up 70-90% of all Columbia river Sockeye**

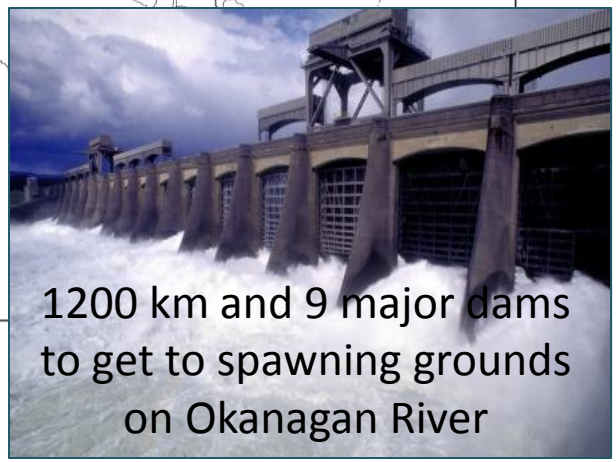


Columbia River sub-basins historically accessible to sockeye

Columbia River sub-basins with present day viable sockeye populations

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



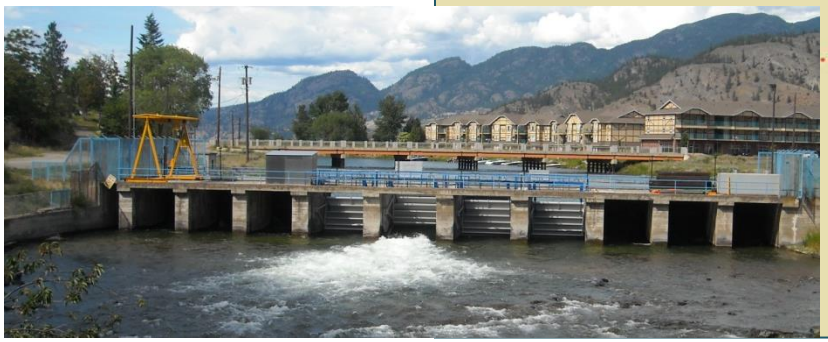
Historical Range of Okanagan Sockeye

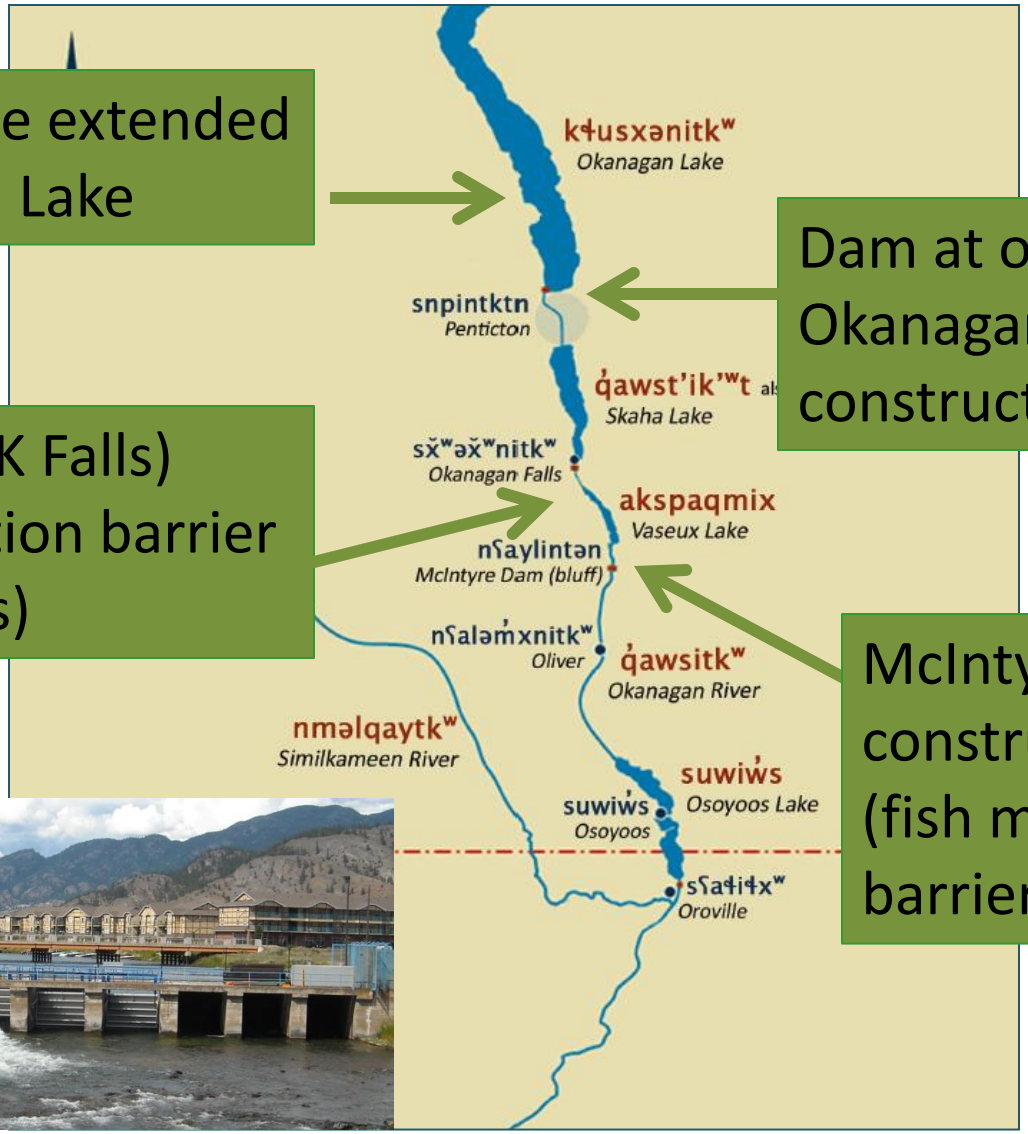
Historical range extended into Okanagan Lake

Skaha Dam (OK Falls) current migration barrier (limited access)

Dam at outlet of Okanagan Lake constructed in 1914

McIntyre Dam constructed in 1954 (fish migration barrier until 2009)





Building a Salmon Recovery & Sustainability Model – Canadian Okanagan Basin Technical Working Group

Key Providers	Govern	Admin	Finance	Op Lead	Data	Outreach
ONA (+ CCT)	33.%	100%	~ 5%	Habitat (OBMEP, ORRI), Hatchery (Skaha), Harvest, FWMT	Skaha	100%
DFO	33.3%		~ 10%	Genetics, Disease, Limno research, FWMT	Osoyoos	
FLNRO	33.3%		~ 5%	Invasive Species, Resident fishes, FWMT	Okanagan	
Grant, Chelan, Douglas			~ 80%	Fish Passage ,FWMT		

Key Partners

OIB, PIB, LSIB, USIB, UNB, WFN, OKIB, CCT, Enowkin, Newbury Hydraulics, ESSA technologies, Summit Environmental, Jensyd Bio Tech, Biomark, CRITFC, Greyback Construction, IIES, Western Water, University of Regina, University of British Columbia-Okanagan, Wolksi Environmental, Glen Fir Consulting

Impacts

33 full time employed, + 75 part time employed, 7 of 10 years achieved min. spawner escapement, $ 10 M capital investment, $ 7 M op budget, 20 year agreements

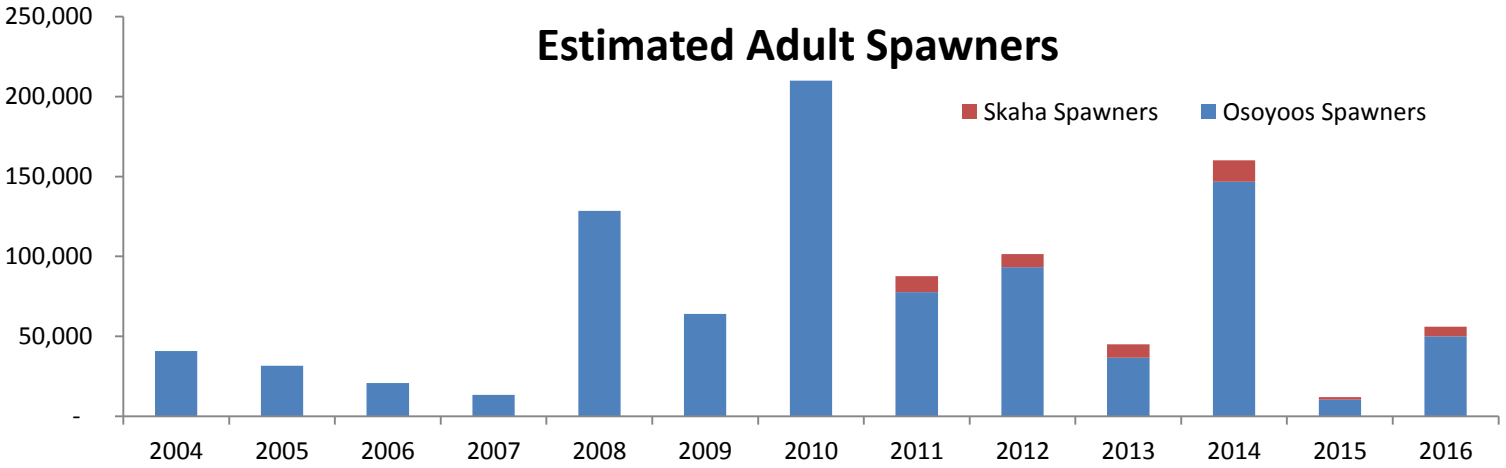
Project Hatchery Re-Introduction History

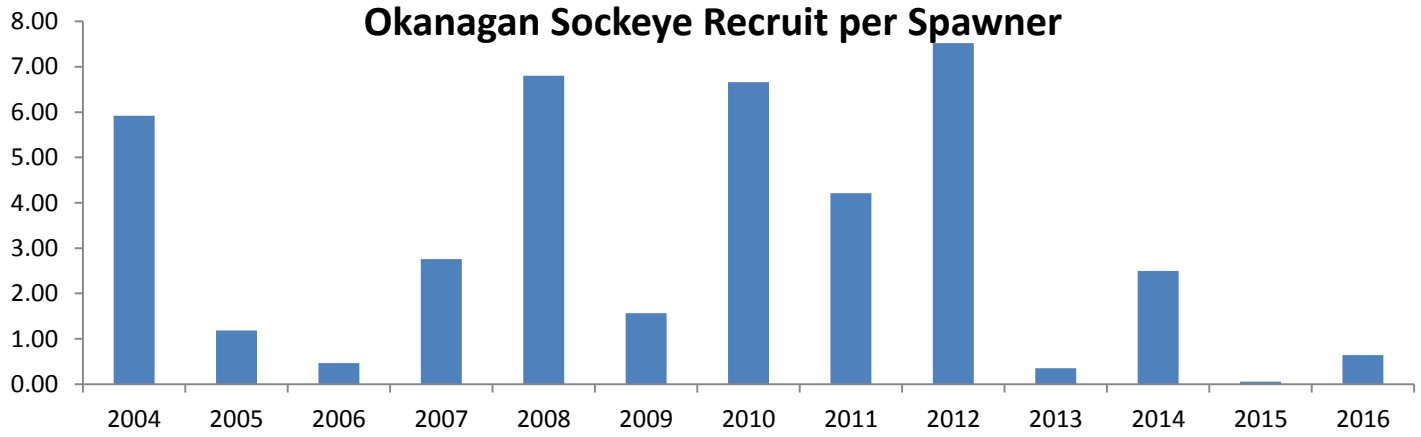
(1997)	Concept outlined to reintroduce sockeye into Okanagan Lake
(1998)	ONA and Canadian agencies agreed to investigate feasibility study
(2000)	Terms of reference adopted between Canadian tripartite *www.obtwg.ca*
(2000 – 2003)	Pre-feasibility risk assessments (disease, life cycle model, habitat, invasive)
(2003)	Test adult sockeye collection, egg fertilization and incubation methods
(2004)	**First sockeye salmon fry release** (June) at Penticton Channel.
(2004 –2016)	Implementation, annual peer review, outreach, communications
(2009)	Fish passage at McIntyre Dam
(2010)	**Sockeye spawners in Penticton Channel**
(2011)	Sockeye and **Chinook** volitionally pass upstream of Skaha Dam (hi flows)
(2012)	Largest recorded harvest in Osoyoos Lake ~ 75 years (60,000)
(2013)	**First Bull trout** observed migrating to Osoyoos Lake (Zozel video)
(2014)	**First coho salmon** observed migrating to Osoyoos Lake
(2014)	Hatchery start up at Penticton capacity 5 million eggs/fry
(2015)	Largest egg take since full implementation (5.2 million)
(2016)	Ceremonial out-plant to Okanagan Lake (< 10,000 fry)
(2018)	**First sturgeon** captured in Osoyoos Lake (purse seine)

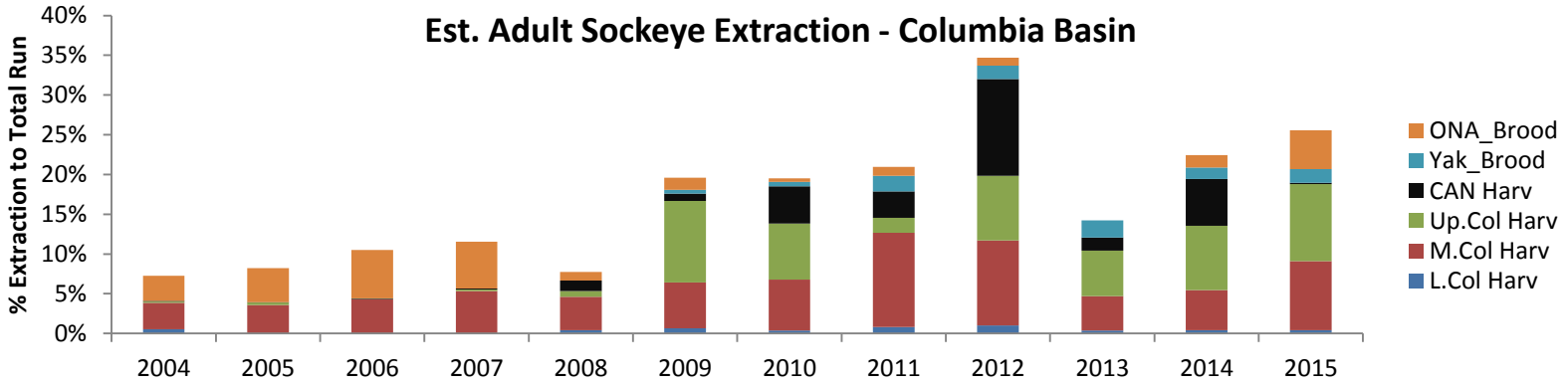
Summary of Program Results to Date

- At tested treatment levels (176-2,009 fry/ha), Sockeye outplanting **does not influence growth and survival of the resident kokanee** population in Skaha Lake
- Lake **food web driven by Mysis shrimp**, which consume 2-3x as much zooplankton as all fish combined
- **Possible hatchery effect on Sockeye fry** - hatchery origin fry are larger but do not survive as well as wild origin fry
- Skaha hatchery **smolt-to-adult survival is equal or better** than the natural Sockeye population
- **No disease outbreaks** recorded in hatchery stock
- **Majority of Sockeye imprinting on Skaha Lake**, Penticton Channel (low straying)
- ***Spawning habitat is the limiting factor for Sockeye production*** in Skaha Lake, therefore recommend habitat enhancement and restoration

Nation Owned Hatchery in Penticton


Estimated Adult Spawners
Skaha Spawners
Osoyoos Spawners
250,000
200,000
150,000
100,000
50,000
-
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016


Okanagan Sockeye Recruit per Spawner
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016


Est. Adult Sockeye Extraction - Columbia Basin
% Extraction to Total Run
40%
35%
30%
25%
20%
15%
10%
5%
0%
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
ONA_Brood
Yak_Brood
CAN Harv
Up.Col Harv
M.Col Harv
L.Col Harv

Future Okanagan Salmon Outlook

- **Target Species**
  - Viable Focal species
  - Spawner Goals
  - Stock Status
- **Native Species Interactions**
  - Life history
  - Disease
  - Genetics
  - Predation-Competition
- **Downstream Habitat**
  - Intrinsic Potential
  - Biological Thresholds
  - Bottlenecks Mitigated Dn Vs Up
- **Other Physical Barriers**
  - Morphological
  - Hydraulic (min flows)
  - Water Quality (temp, do, pH, sediment, toxicity)
- **Upstream Habitat**
  - Intrinsic Potential (WUP)
  - Modeling &Meta-analysis
  - Uncertainty Research (AM)
  - Trend Analysis survival, production, diversity

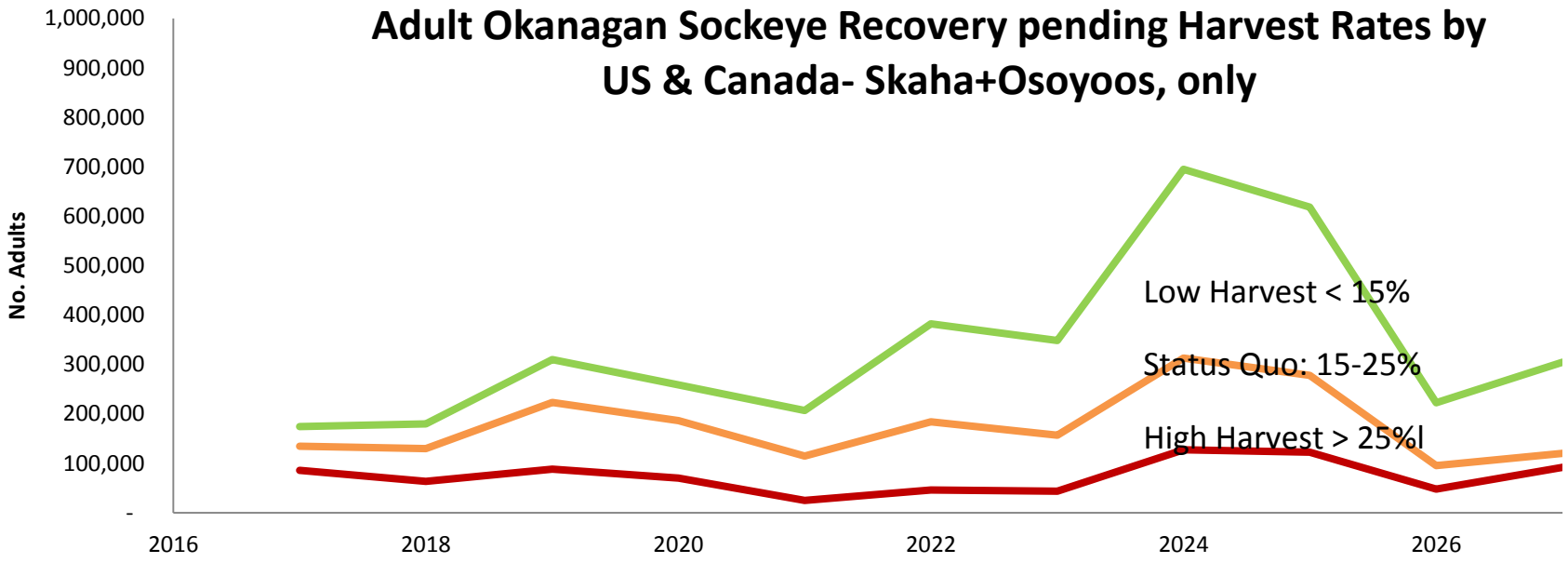
salmon results

	50-year NPV	100-year NPV	200-year NPV
cultural importance	Not quantified. Sockeye are integral to Syilx People's relationship to the land and the spiritual world. Few (if any) substitutes for sockeye.		
sockeye harvested in Canada	$11.2 - $14.5 million	$13.7 - $17.8 million	$14.4 - $18.7 million
sockeye harvested in the US	$36.8 - $51.9 million	$45.2 - $63.7 million	$47.6 - $67.0 million
avoiding extinction	$645.6 million	$792.9 million	$834.1 million
20-year existence value	$2.6 - $3.5 billion		
health and nutrition	Not quantified. Individuals ingest important nutrients when consuming the sockeye they harvest. Substitutes exist.		

Target Species

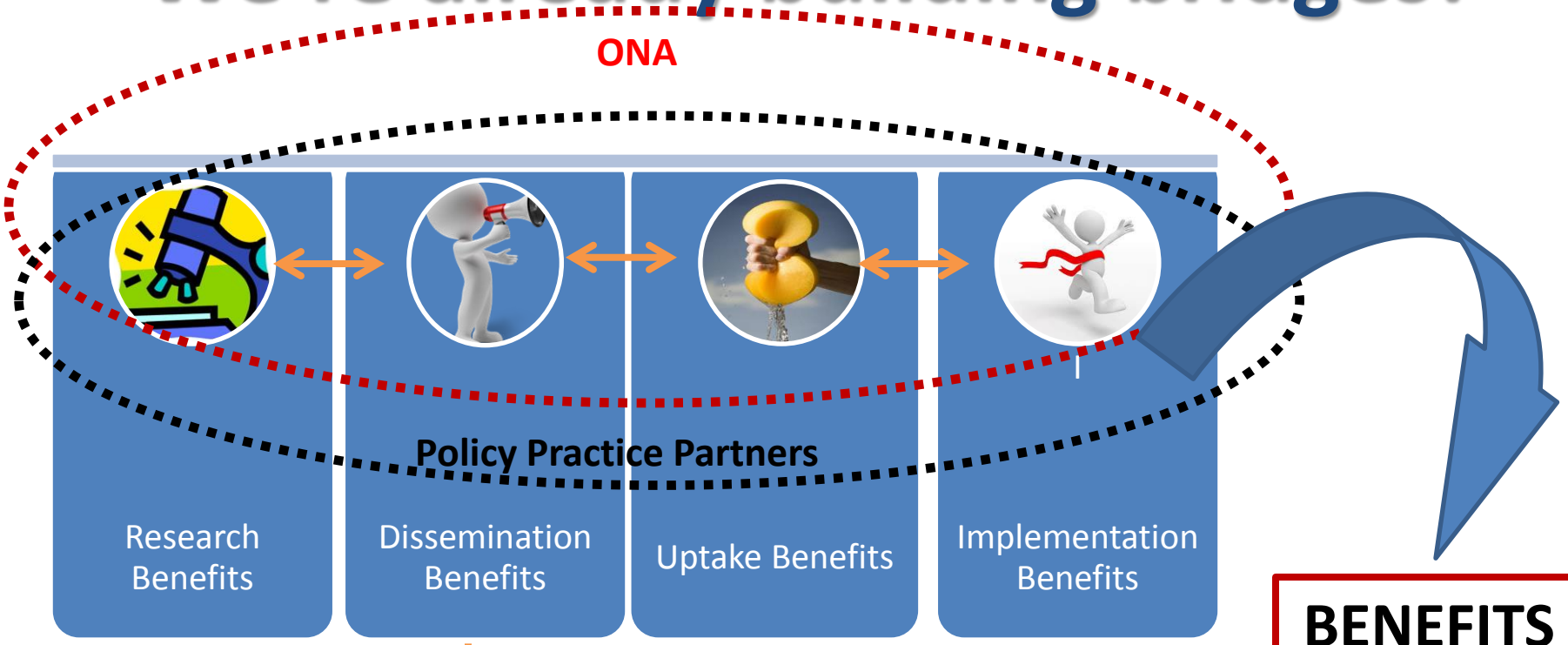
- Viable Focal species
- Spawner Goals
- Stock Status

		Interim Targets (Present to 2030)
Target Species	**Sub-Basin**	**Minimum Spawner Goal**
Sockeye Stream	Okanagan Lake	**3,000**
	Skaha Lake	**9,000**
	Osoyoos Lake	**90,000**
Sockeye Beach	Okanagan Lake	**3,000**
	Skaha Lake	-
	Osoyoos Lake	-
Chinook Spring	Okanagan Lake	**750**
	Skaha Lake	**50**
	Osoyoos Lake	**50**
Chinook Summer-Fall	Okanagan Lake	**150**
	Skaha Lake	**50**
	Osoyoos Lake	**300**
Steelhead	Okanagan Lake	**750**
	Skaha Lake	**50**
	Osoyoos Lake	**300**
Coho	Okanagan Lake	**0**
	Skaha Lake	**0**
	Osoyoos Lake	**0**
Kokanee	Okanagan Lake	**30,000 S/100,000 B**
	Skaha Lake	**1500 S/30,000 B-S**
	Osoyoos Lake	**1500 S/0 B**
Rainbow Trout	Okanagan Lake	**TBD**
	Skaha Lake	**TBD**
	Osoyoos Lake	**TBD**
Bull Trout	Okanagan Lake	**TBD**
	Skaha Lake	**TBD**
	Osoyoos Lake	**TBD**



Nursery Lake	Current Smolt Capacity Est.	Estimated Juvenile Nerkid Biomass
Osoyoos	30 kg/ha	28,000 kg
Skaha	10-12 kg/ha	24,000 kg
Okanagan	3-6 kg/ha	80,000 kg

We're already building bridges!



- ✓ New knowledge
- ✓ Validate TEK
- ✓ New Methods
- ✓ New Tools
- ✓ New Questions

- ✓ Publications
- ✓ Conference, workshops
- ✓ Social media
- ✓ Media/public awareness
- ✓ Intellectual Property

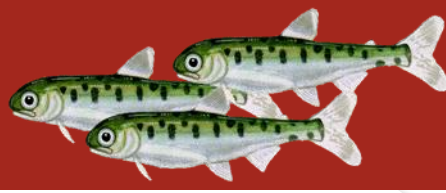
- ✓ Validate Research
- ✓ Training Practices
- ✓ New Research Questions
- ✓ Technical licensing
- ✓ Best practices established

- ✓ New R&Q
- ✓ Training
- ✓ New program $
- ✓ New product development
- ✓ BioInformatics

BENEFITS

- ✓ Citizens served
- ✓ Socio-economic enviro, health benefits
- ✓ Media, public awareness
- ✓ Vulnerabilities addressed
- ✓ New Research

Take Home Message



- Core essence: Okanagan are **a Salmon People, Salmon is a Food Chief.**
- Do, learn, and redo; doing nothing is not an option: Novel hatchery practices demonstrate short term, **net +++ benefits**.
- Helping the species re-adapt: **Cold Water refugia** in Skaha Lake provides opportunity for viable persistence, Okanagan sockeye relied on as key donor stock for middle and upper Columbia (Arrow lakes),
- With sockeye, **multi-species (BT, CH**, etc) are returning home.
- **Let the fish** do what they are programmed to **do as an ecosystem engineer:** 1. Fish passage + 2. habitat + 3. hatchery stocking + 4. harvest regulation; as the program adapts to future Freshwater survival + Marine survival rates

THE OKANAGAN SOCKEYE

snx̌aʔiwləm : "Honouring the Sacredness of the River."

For More Information visit us at
www.okanagannation.com