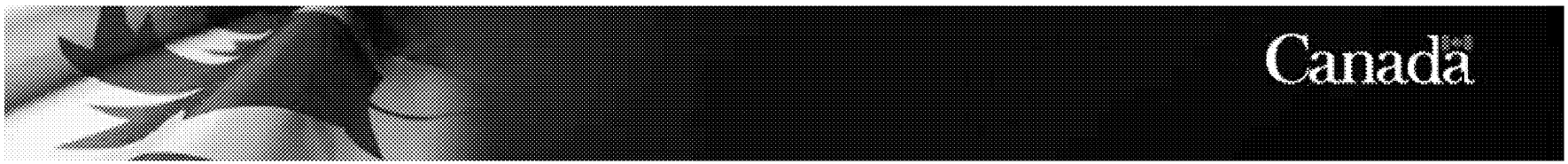
Update on 2009 Fraser Sockeye: Context, Forecasts & Returns

Roundtable presentation
Vancouver September 11, 2009

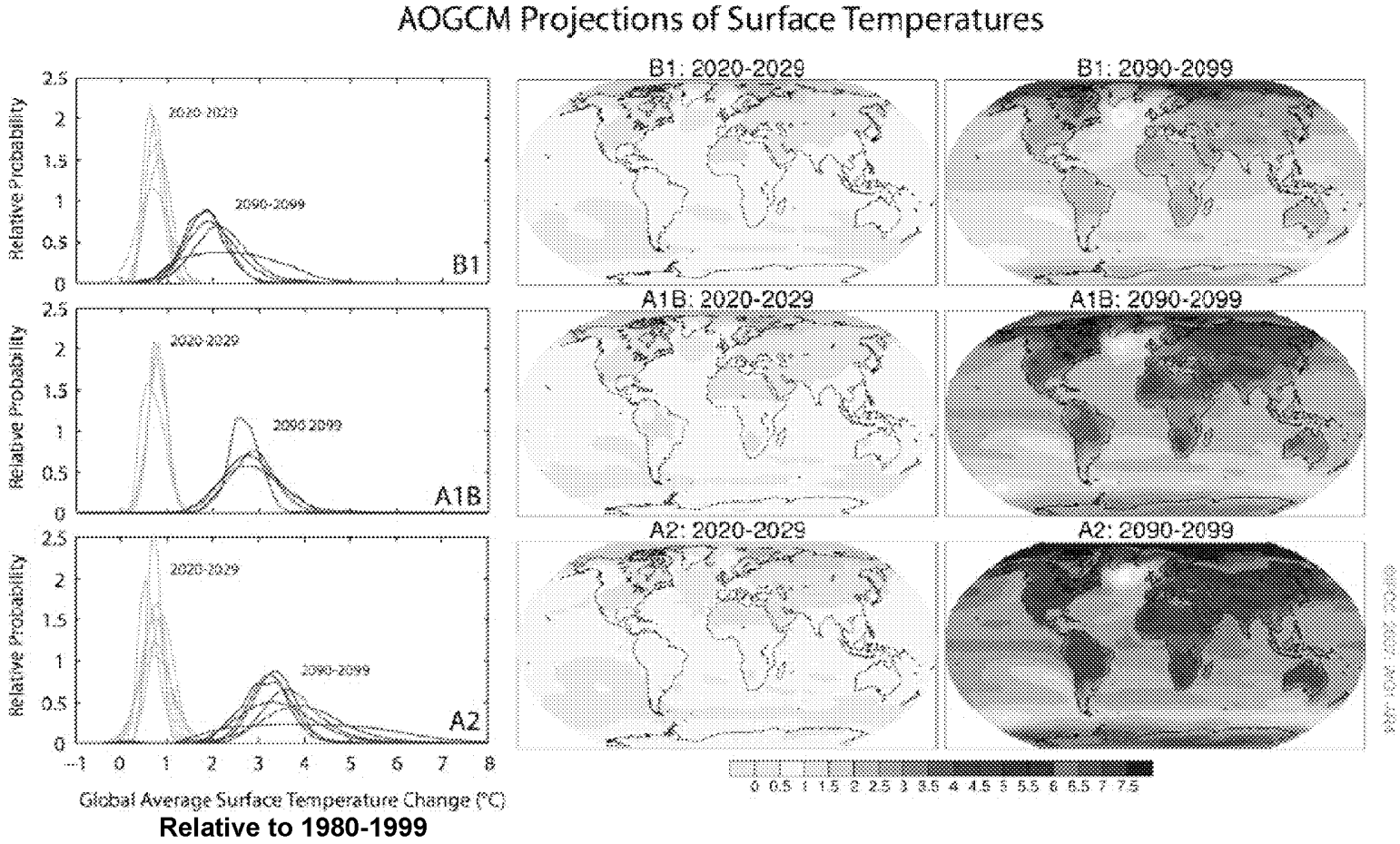


This talk will cover

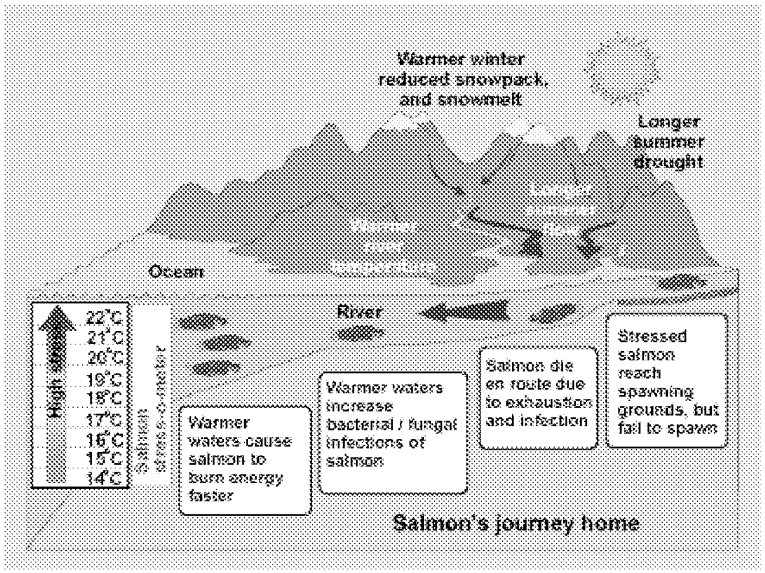
1. Environmental context: increased variability & uncertainty
2. Preparation of pre-season forecasts
3. In-season management & 2009 Fraser sockeye returns

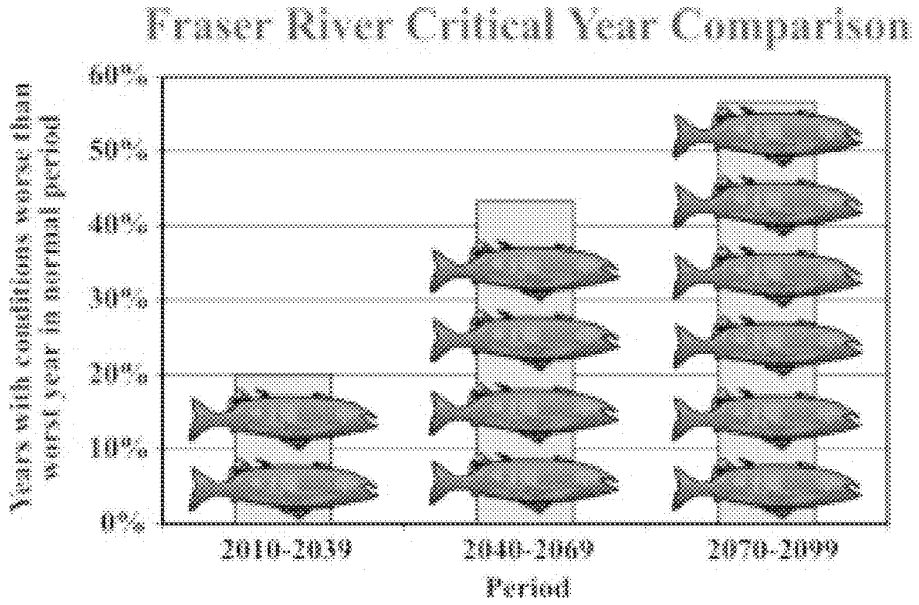
Part 1: Environmental context

A warming world



Impacts on salmon: Higher temperatures in streams, lakes and rivers



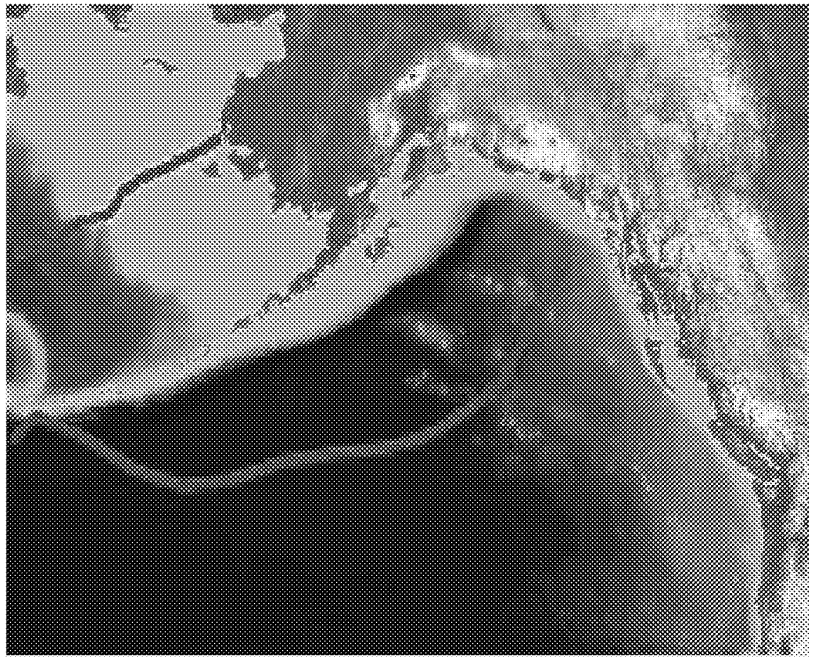


By the end of the century, returning salmon will experience conditions in most years that are more severe than any year during the 1961-1990 base period.

Impacts in the open ocean – reduction in habitat for sockeye in the North Pacific?

Projected southern limit of sockeye salmon under a doubling of CO2 climate change scenario

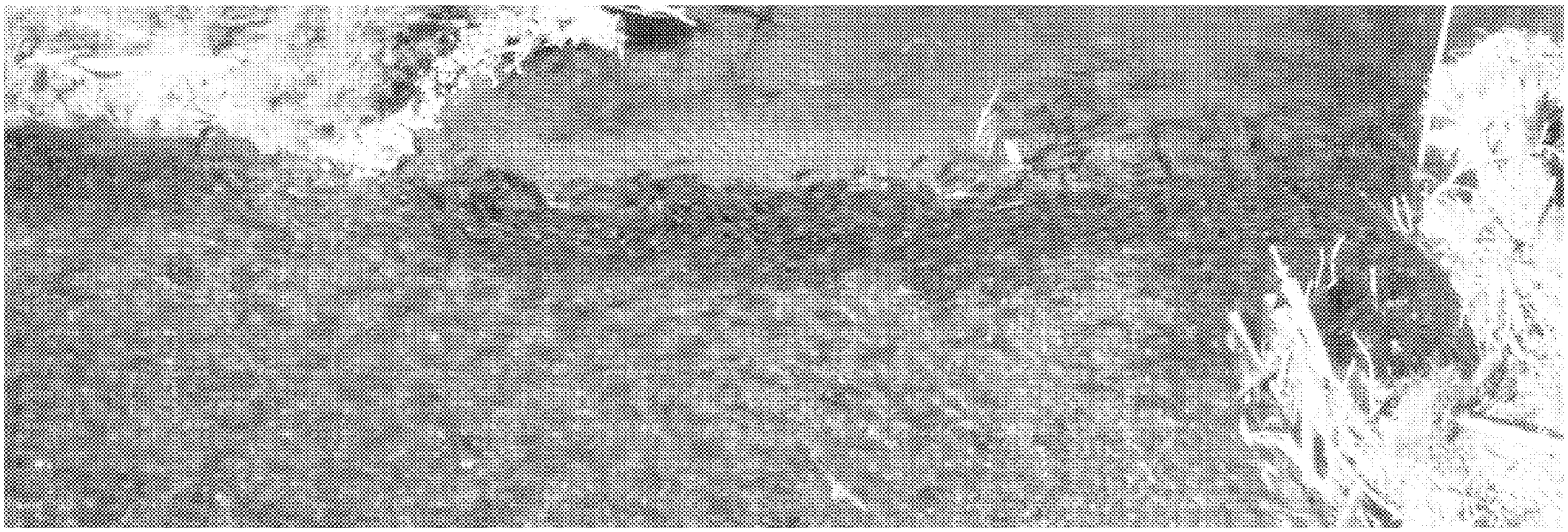
1995 southern limit of sockeye salmon distribution



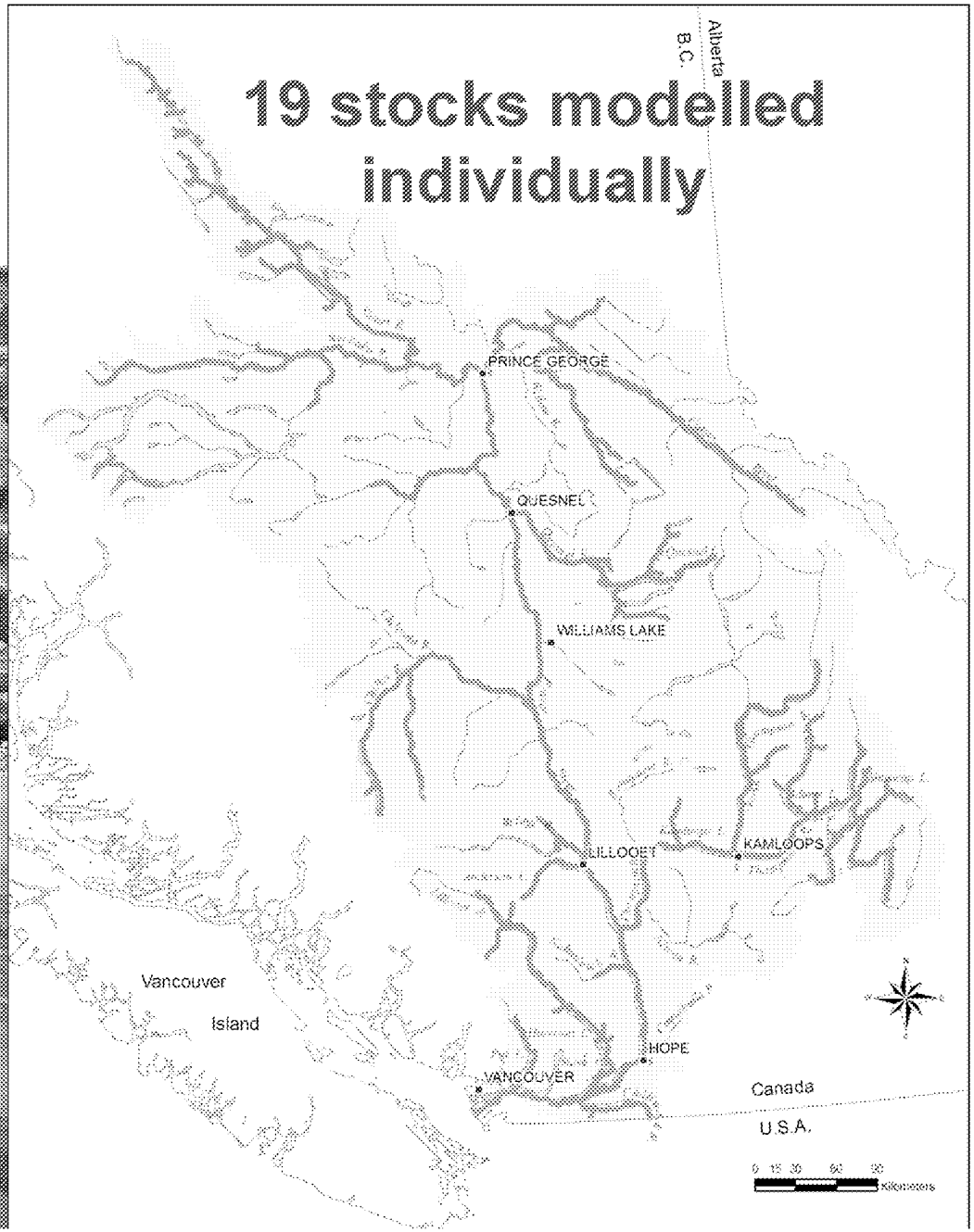
What can we expect?

- Changes will not be “smooth”
  - El Nino/La Nina and decadal climate variability overlay global warming. There will be periods (last year was one) where the ocean will cool rather than warm
- Our ability to predict future status of fish stocks will likely decrease as we move out of the historical range of our observations
  - Prediction of impacts has proven to be difficult at the management unit level e.g. Fraser River sockeye stocks do not all show a clear, coherent response to ocean conditions
- New issues and challenges
  - Hypoxia, acidification, disease

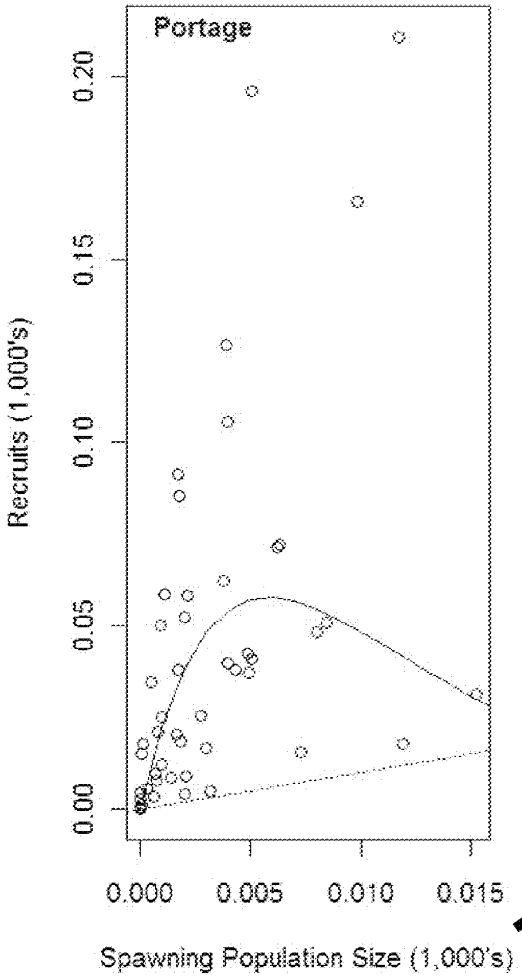
Part 2: Preparation of pre-season forecasts

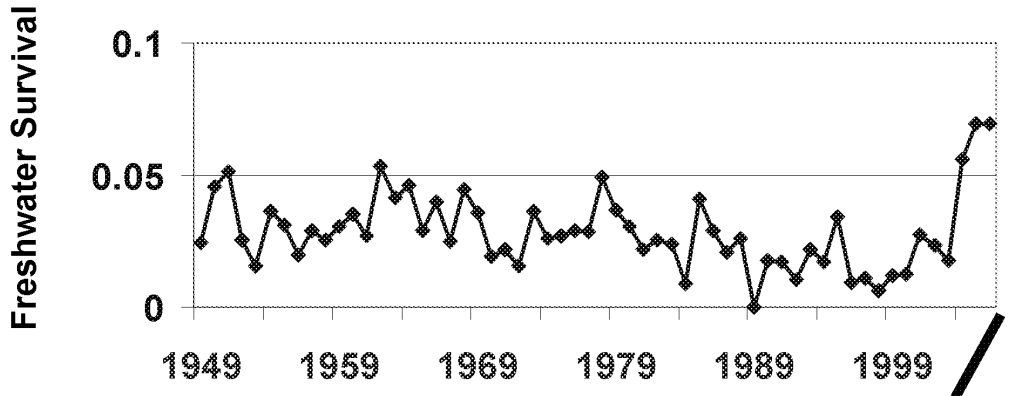


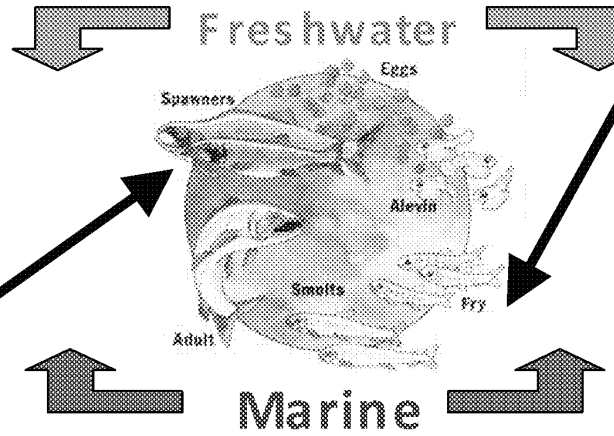
Fraser Basin Watershed



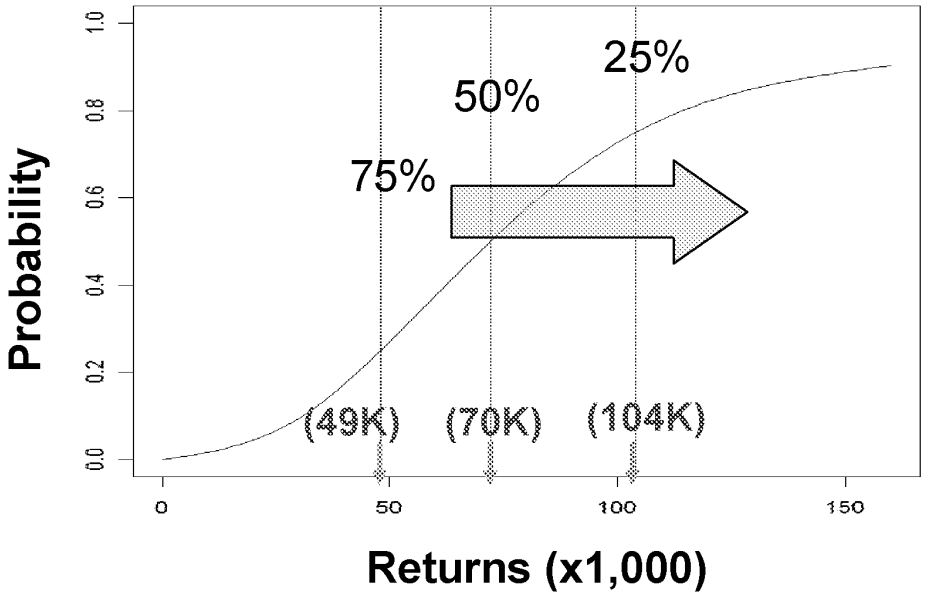
Building a forecast







Role of Probability



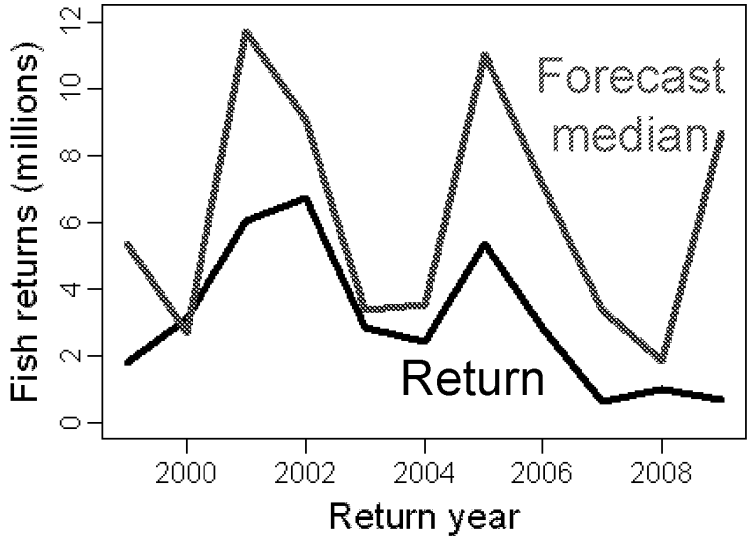
Forecasts are presented as slices through a cumulative probability distribution (probability of exceeding a specified run size).

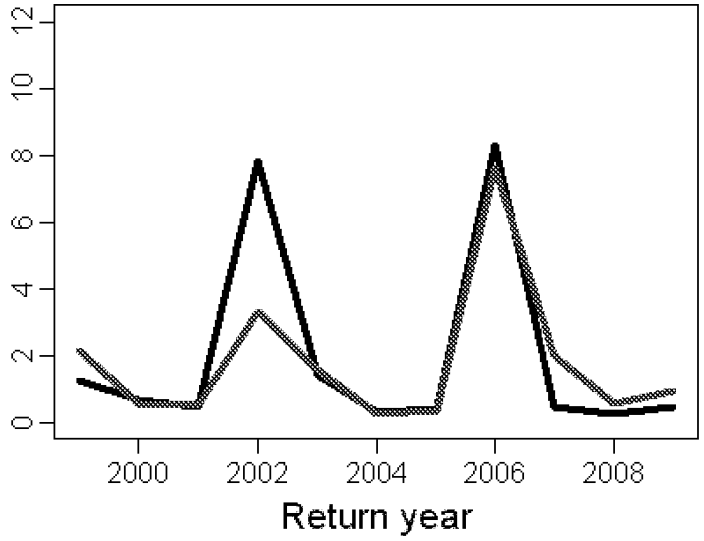
Probability of Exceeding Specified Run Sizes

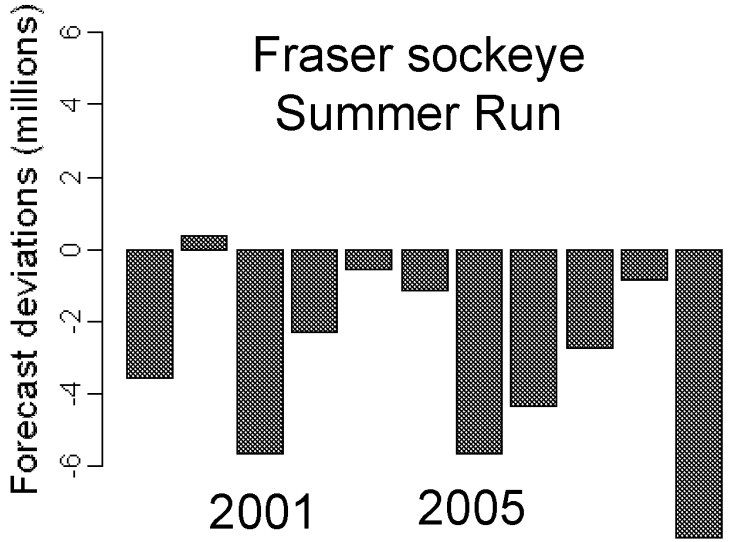
Sockeye run timing group	Mean Run Size 2009 cycle	10%	50%	90%
Early Stuart	**797,000**	645,000	255,000	107,000
Early Summer	**(316,000)**	2,284,000	739,000	264,000
Summer	**11,111,000**	31,813,000	8,677,000	2,858,000
Late	**(946,000)**	2,875,000	907,000	327,000
Total	**13,170,000**	37,617,000	10,578,000	3,556,000

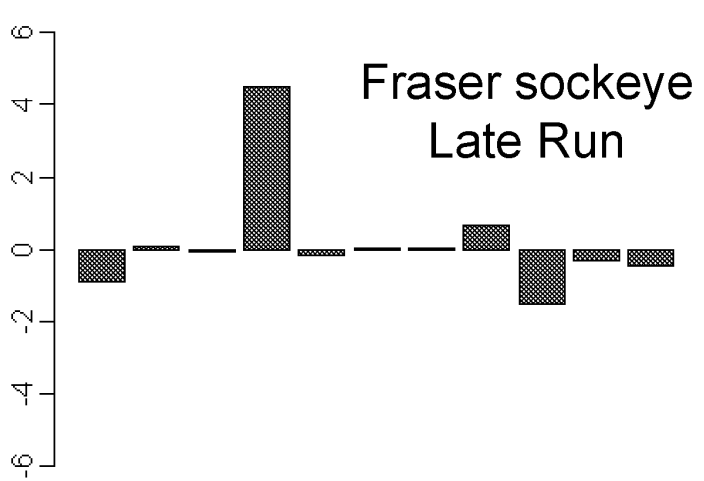
S.Grant & A.Cass (DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/022)

Forecasts have high uncertainty







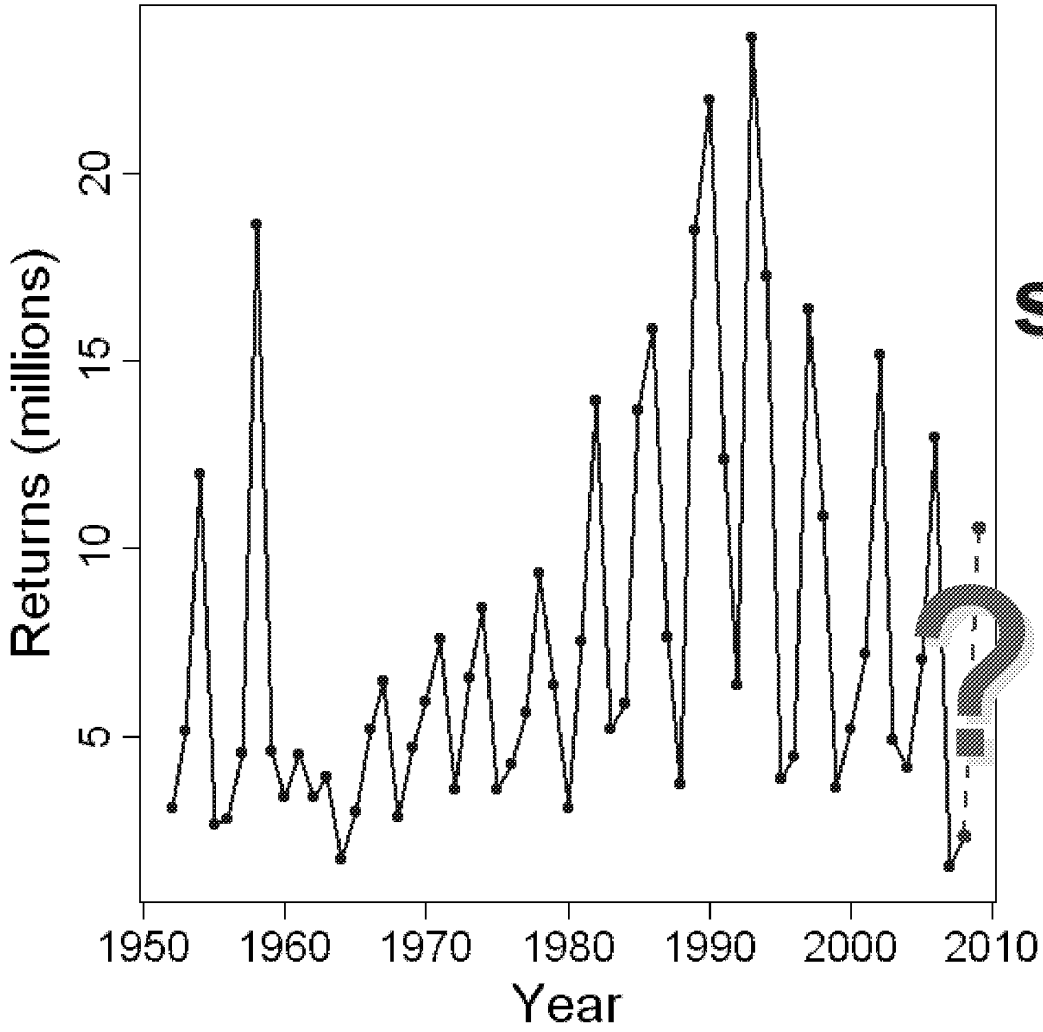


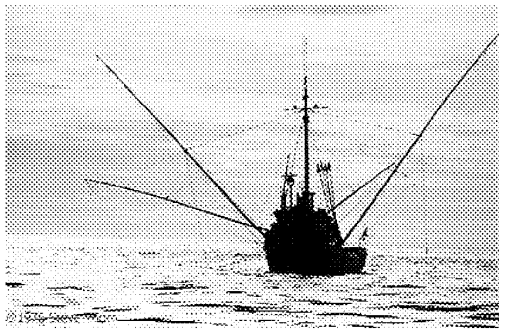
Consider indicators of ocean conditions

(BROOD YEAR)	(1996)	(1997)	(1998)	(1999)	(2000)	(2001)	(2002)	(2003)	(2004)	(2005)
OCEAN ENTRY YEAR	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
(RETURN YEAR)	(2000)	(2001)	(2002)	(2003)	(2004)	(2005)	(2006)	(2007)	(2008)	(2009)
Chilko Marine Survival	G	Y	G	G	R	Y	G	R	Y	R
Ocean Indices										
1 PDO (Jan-March average)	R	G	G	R	G	R	R	R	Y	Y
2 ALPI	R	G	Y	R	R	R	R	Y	G	G
Physical Conditions										
3 SST (Entrance Island)	R	G	G	G	G	R	R	R	Y	Y
4 SST (Pine Island)	R	G	G	G	Y	R	R	R	Y	G
5 Upwelling index (48°N)	G	G	R	Y	G	R	Y	R	Y	G
6 Spring transition timing (48°N)	G	G	Y	Y	G	Y	Y	R	Y	Y
Biological Conditions										
7 Southern Copepods (SVI)	R	G	Y	G	G	R	Y	R	R	G
8 Boreal Shelf Copepods (SVI)	R	G	G	Y	G	Y	R	R	R	G
9 Southern Copepods (NVI)	R	G	G	G	Y	R	Y	R	R	G
10 Boreal Shelf Copepods (NVI)	Y	G	G	R	G	R	R	R	Y	G

Part 3: In-season management &

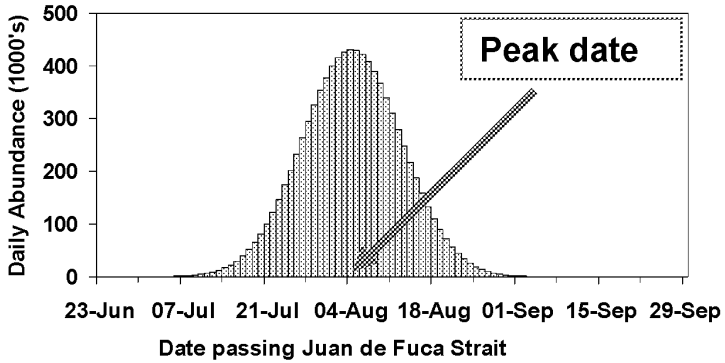
Fraser River sockeye salmon returns

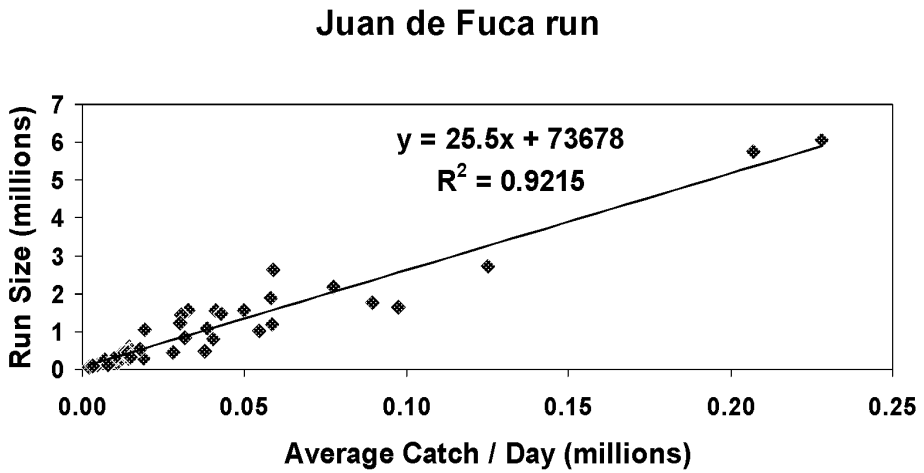


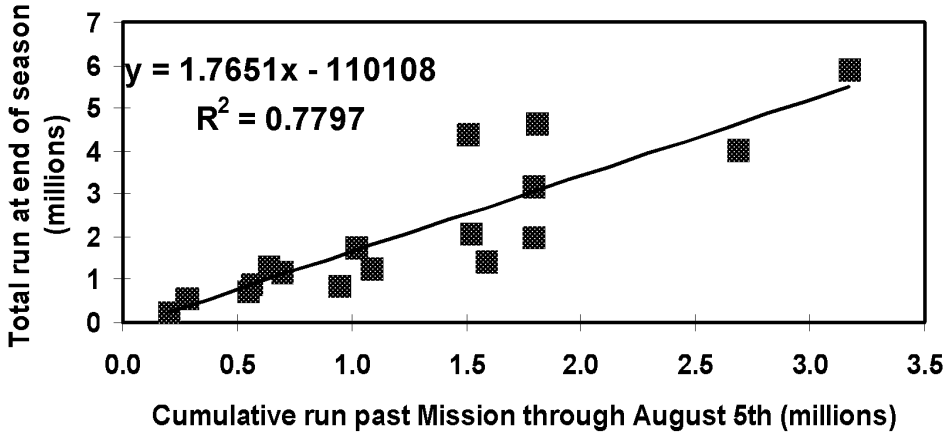


Test fisheries & acoustic monitoring to update estimates in-season

Graphs from www.psc.org







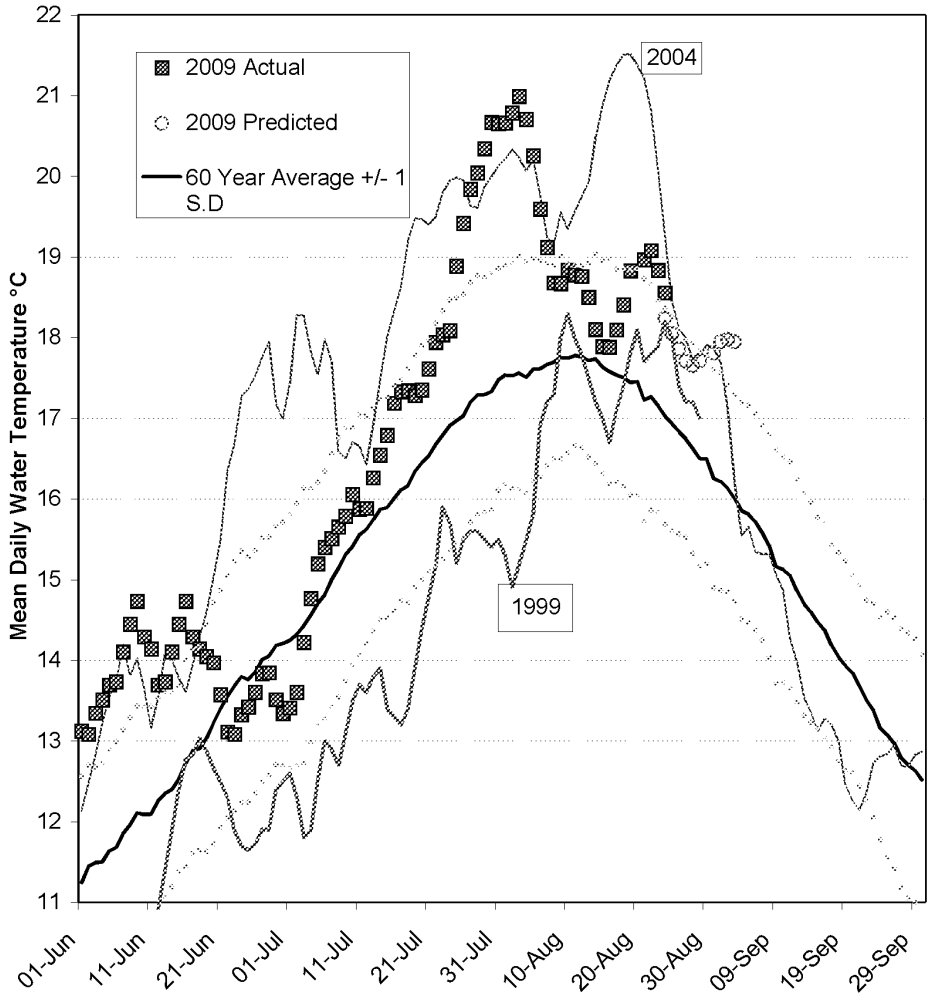
Each data point is a different year

Separate relationships for each week of fishing

Assume normal distribution for run timing

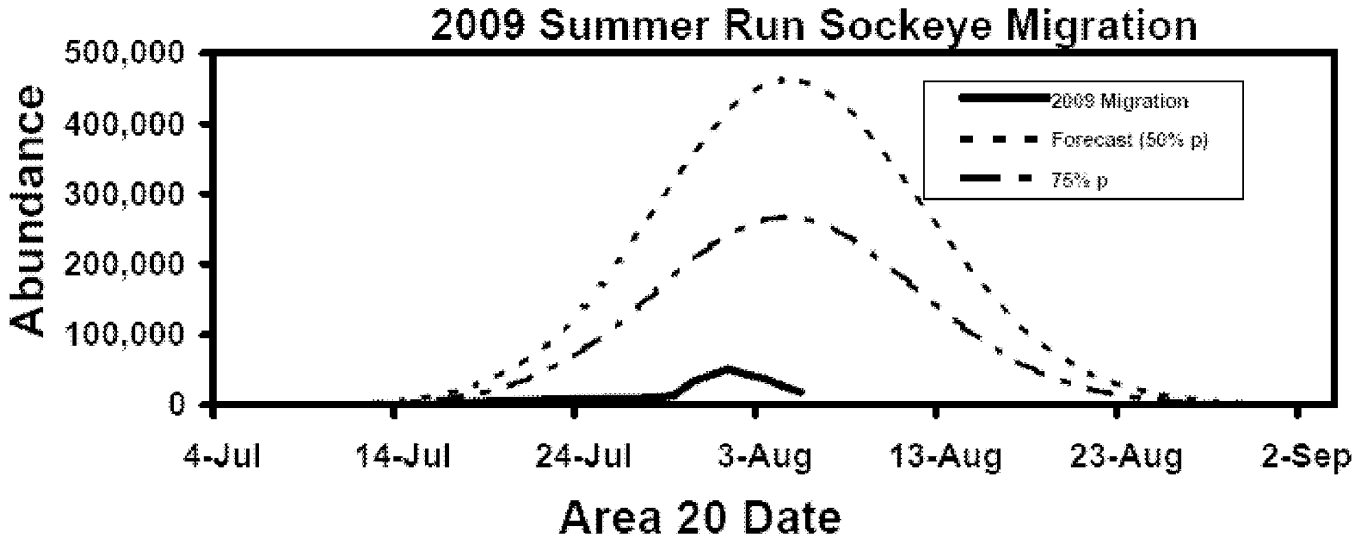
Operational Models to guide in-season decision-making

- A numerical model predicts Fraser River flow and temperature conditions
- These predictions drive a biological effects model to estimate in-river mortality
- If required, harvest levels are reduced to compensate for excessive predicted in-river mortality (i.e. management adjustment)



What happened in 2009?

DFO took immediate measures to curtail harvests



Fraser Panel news release (Aug 7, 2009):

"current estimates of Summer-run sockeye run size are considerably below their 90% probability level forecast of 2,858,000 fish and are less than those needed to provide harvestable surpluses"

Fraser River Sockeye Catch Estimates

Commercial	-
Recreational	-
FN FSC – Marine	10,020
FN FSC – Fraser	49,240
Canadian Total	**59,260**
Test Fishing	33,146
U.S.	3,400
TOTAL	**95,806**

10-year average of 782,000

Catches as of 08-Sep-2009

No First Nation group met their full FSC target. DFO took actions to provide access to all where possible.

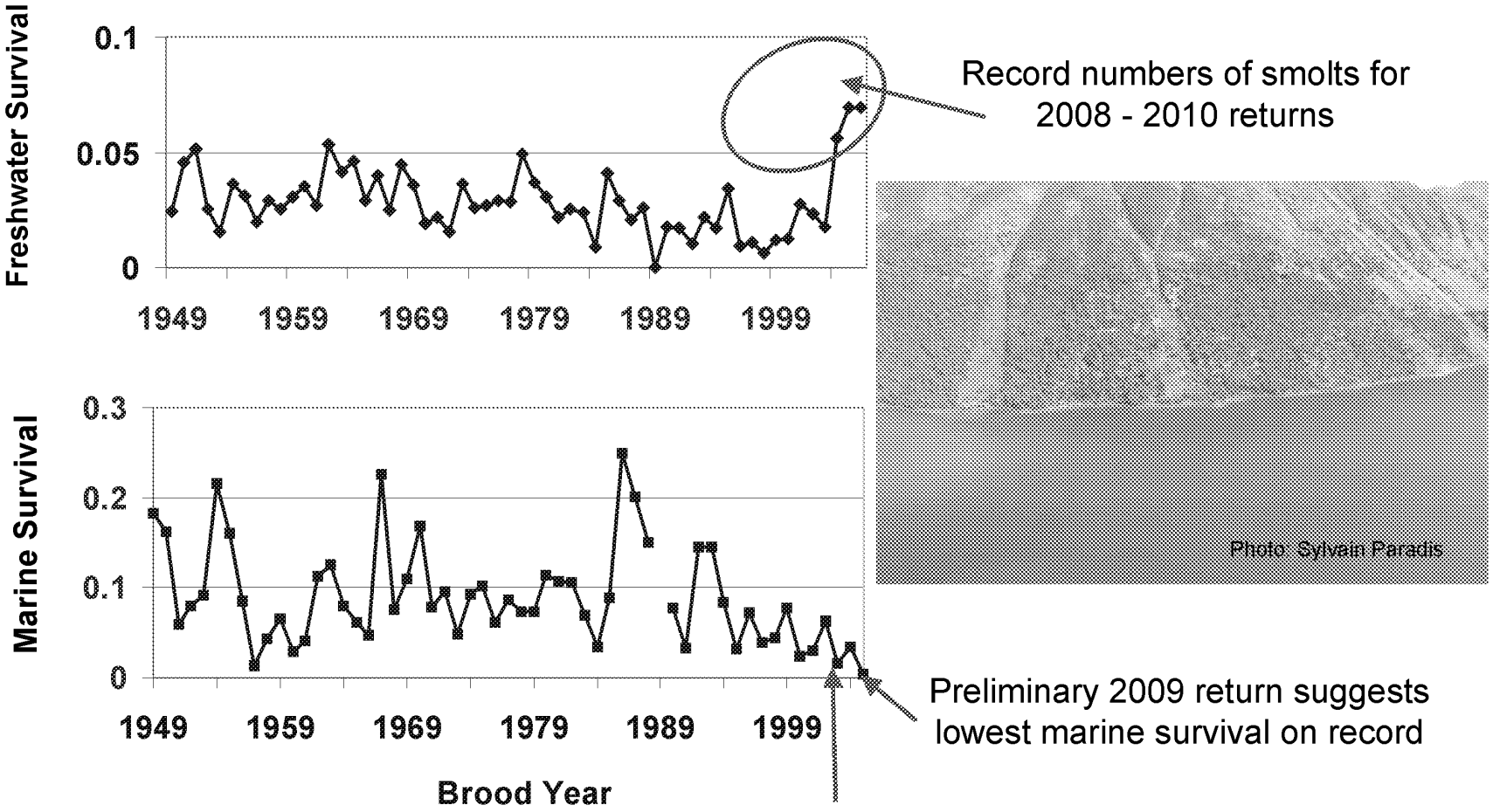
Fraser Sockeye Escapement

Management Group	Escapement goal	Projected Escapement*	Actual Escapement For 2009 Cycle (1953-2005)
Early Stuart	85,000	55,370	222,000
Early Summer	175,000	98,720	100,000
Summer	520,000	466,980	1,850,000
Birkenhead	48,000	56,400	50,000
L.Lates	320,000	92,563	89,000
Total	***1,148,000***	***770,033***	***2,311,000***

* Escapement based upon in-season run size minus projected en-route mortality

Given 2009 management actions, harvest amounts to only 6% of the total return.

Chilko Lake sockeye survival



Record numbers of smolts for 2008 - 2010 returns

Preliminary 2009 return suggests lowest marine survival on record

Poor marine survival for 2007 return (2005 sea entry)

Preliminary 2009 salmon returns coastwide

Chinook salmon

Taku, Stikine, Skeena, Fraser (spring age 4): well below average
Fraser (spring / summer age 5): near expectation & below average
Fraser (summer age 4): near expectation & above average

Coho salmon

Taku, Skeena, WCVI, Columbia: average to well above average

Sockeye salmon

Taku, Stikine, Nass, Skeena, Smith, Fraser: well below average
Barkley Sound, Columbia: above expectation & below average

Pink salmon

Taku: below average
Skeena, Johnstone St, St of Georgia, Fraser, Puget Sound: above expectations; records in some areas