Pre-Season Run Size Forecasts:
Fraser River Sockeye Salmon in 2014

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Fisheries and Oceans Canada

Pêches et Océans Canada

presented by: A.Huang
to: FN Forum
date: 19/20 Feb, 2014

Early Stuart Run

- one forecasted stock

Early Summer Run

- 7 forecasted stocks
- 3 “miscellaneous” stocks

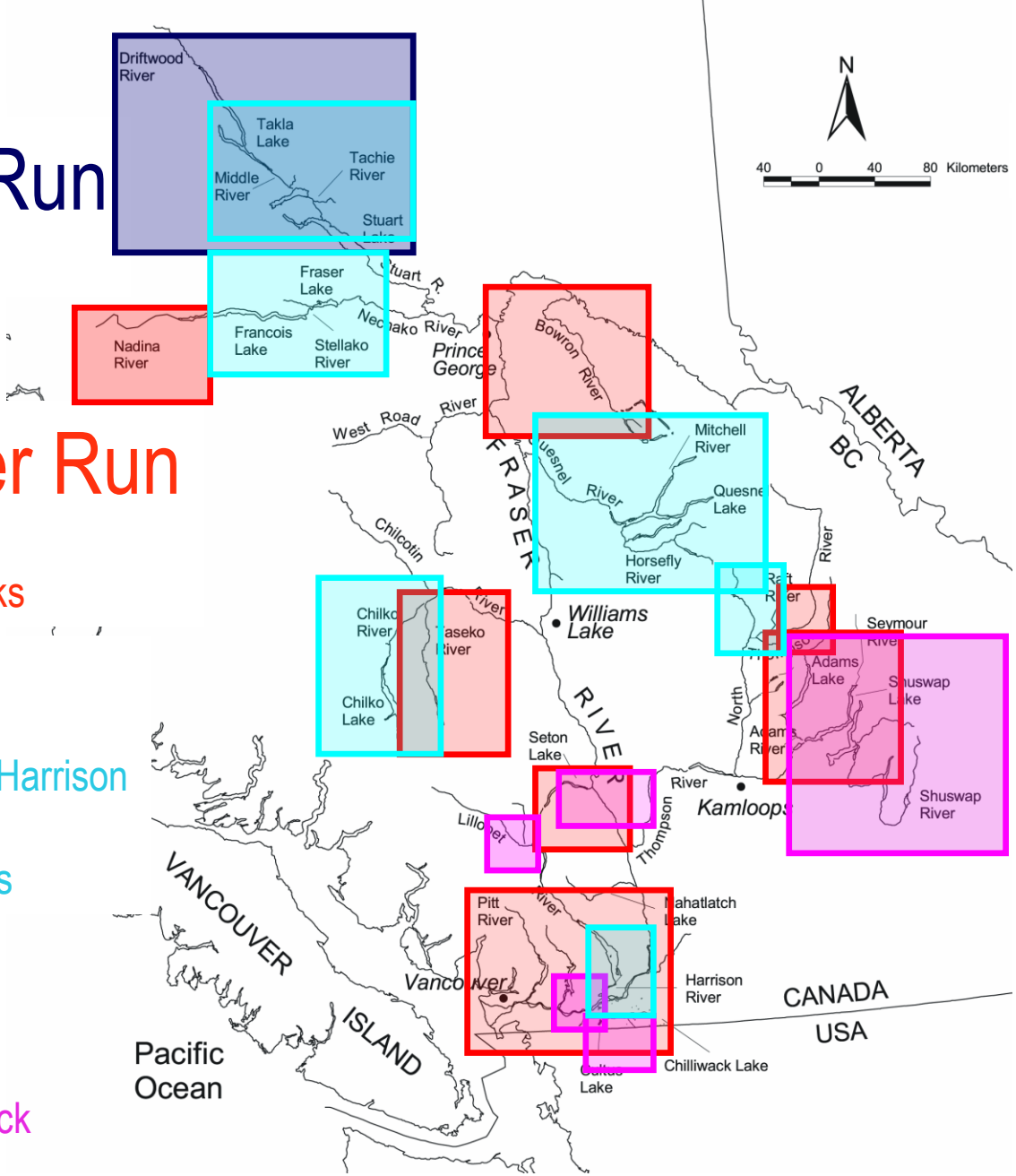
Summer Run

includes Raft, N.Thomp, & Harrison

- 6 forecasted stocks
- 2 “miscellaneous” stocks

Late Run

- 5 forecasted stocks
- 1 “miscellaneous” stock



Factors influencing total returns

Brood Year Escapement

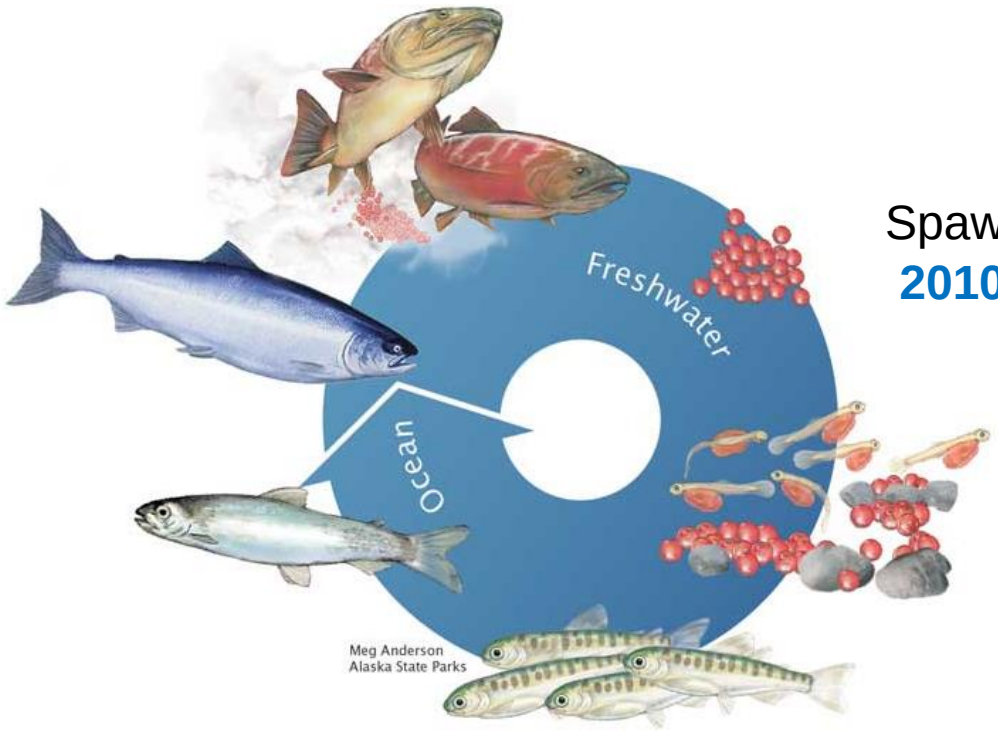
Age of Maturity

Average age: 4_2

Marine: 2 Winters

Freshwater: 2 Winters

Returns
2014



Juveniles
2012-2014

Spawn (eggs):
2010

Fry emergence:
2011

Smolts
2012

Adult Spawners

Five Year Old Brood Year

Four Year Old Brood Year

Four Year Old Brood Year

effective female spawners

Run timing group / Stocks	2009 Brood Year (Age-5)
Early Stuart	21,900
Early Summer	
Bowron	1,000
Fennell	700
Gates	5,300
Nadina	3,700
Pitt	18,800
Scotch	2,700
Seymour	3,100
Summer	127,367
Chilko [j]	34.4 M
Late Stuart	43,300
Quesnel	82,800
Stellako	15,900
Raft	6,000
Harrison	387,100
Late	
Cultus	174,000
Late Shuswap	20,200
Portage	800
Weaver	12,900
Birkenhead	34,500

smolts

age-3

E. Shuswap — **12 %**

Chilko: 20%

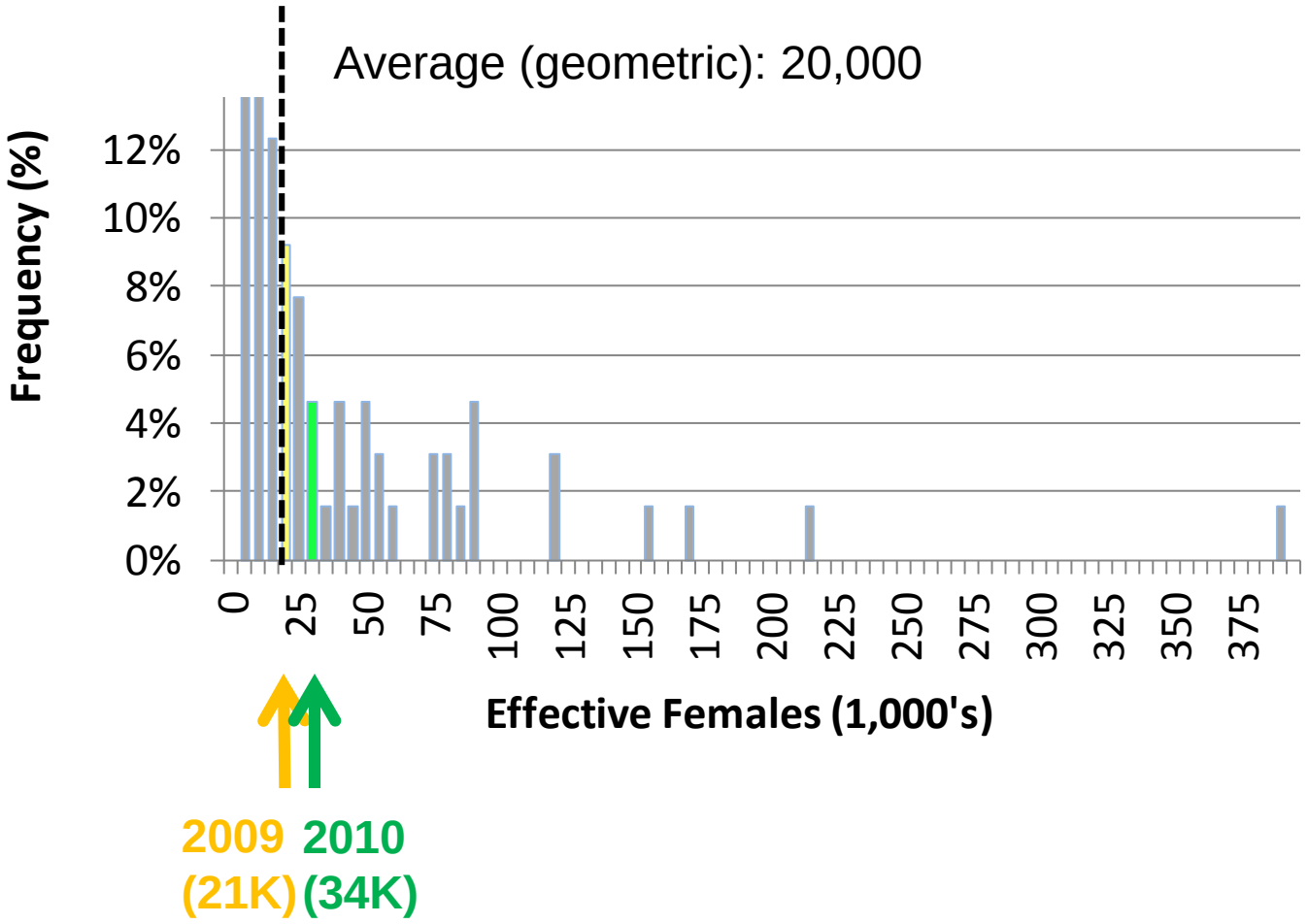
Harrison: 7%

27%

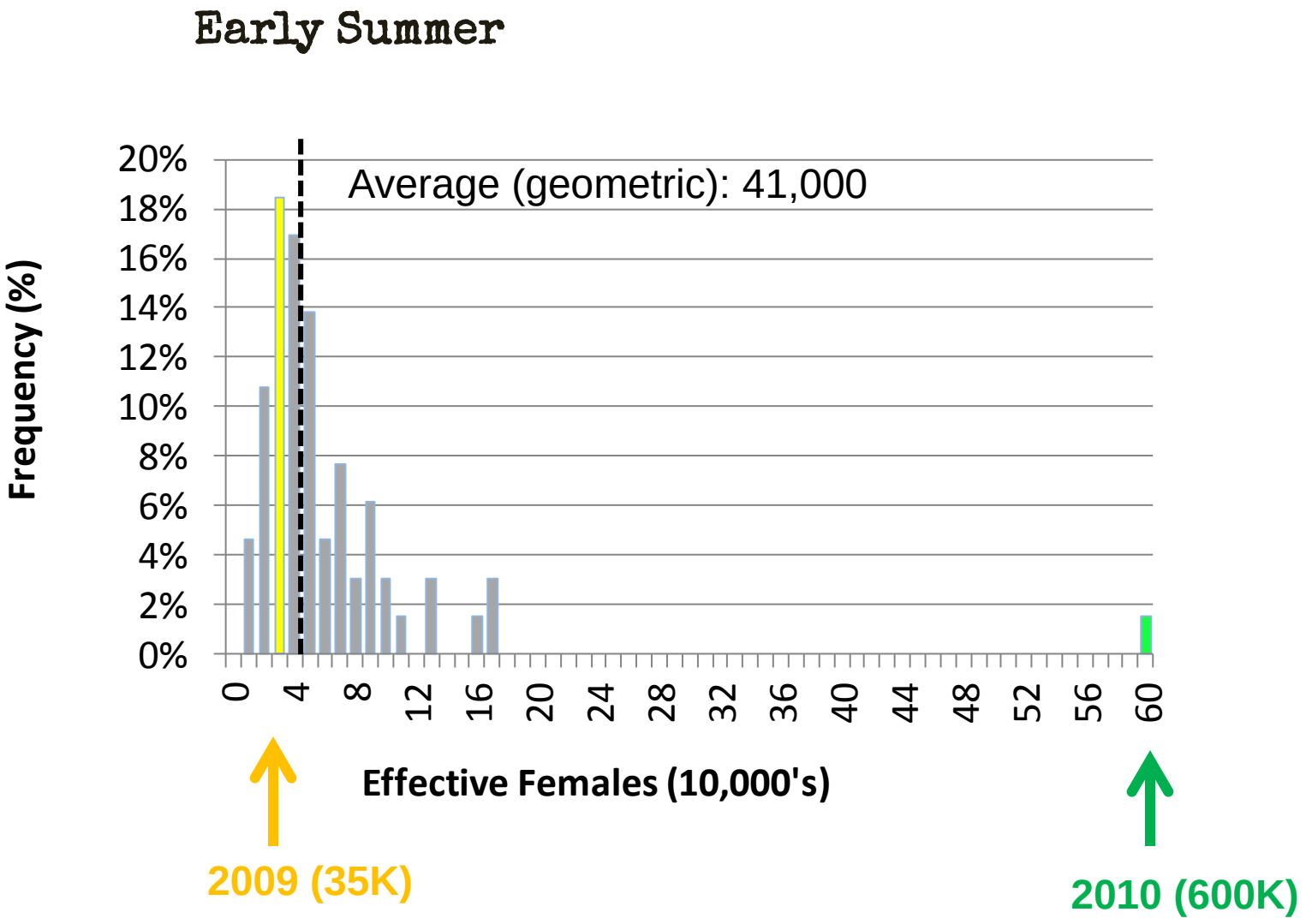
L. Shuswap — **53%**

Adult Spawners

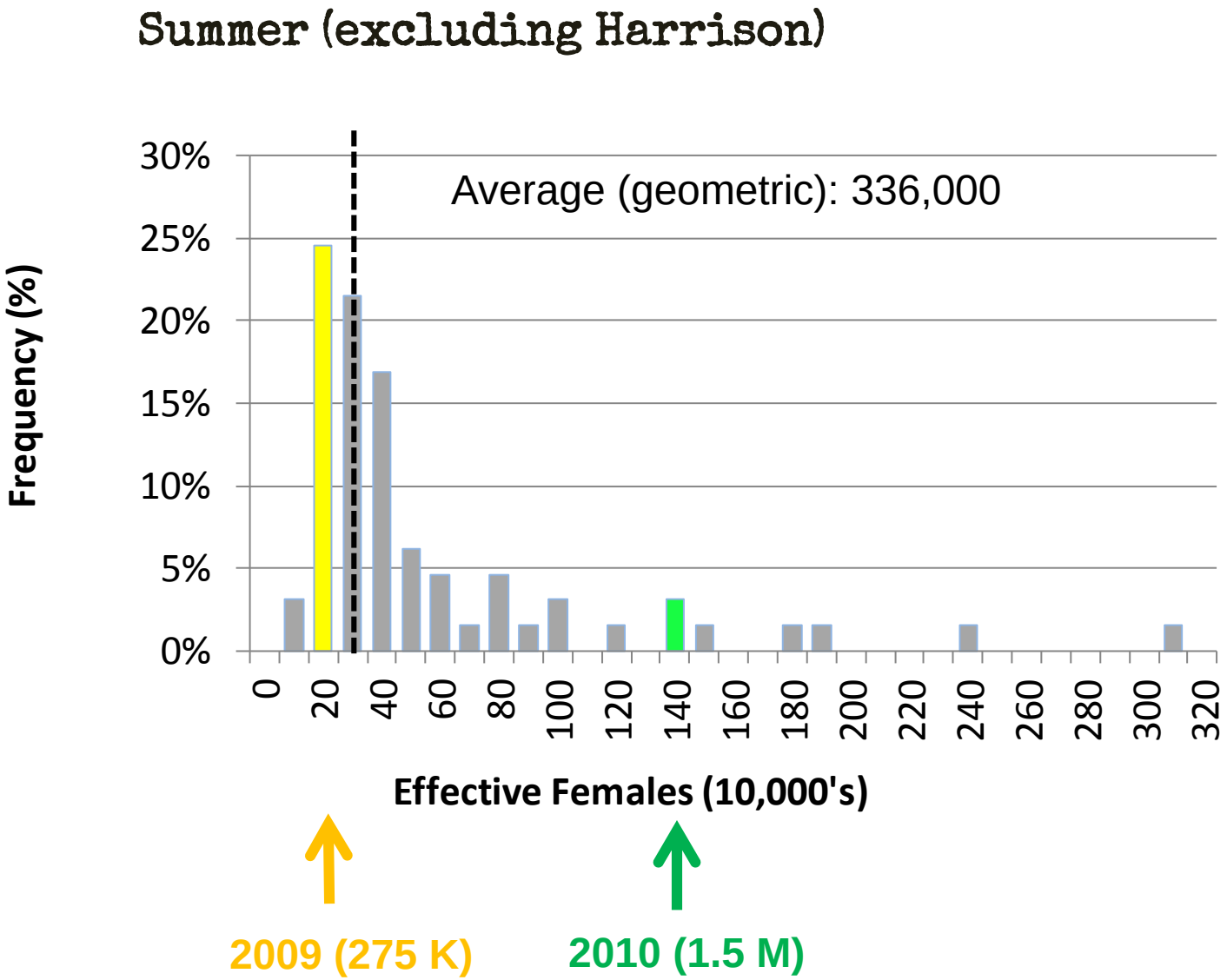
Early Stuart



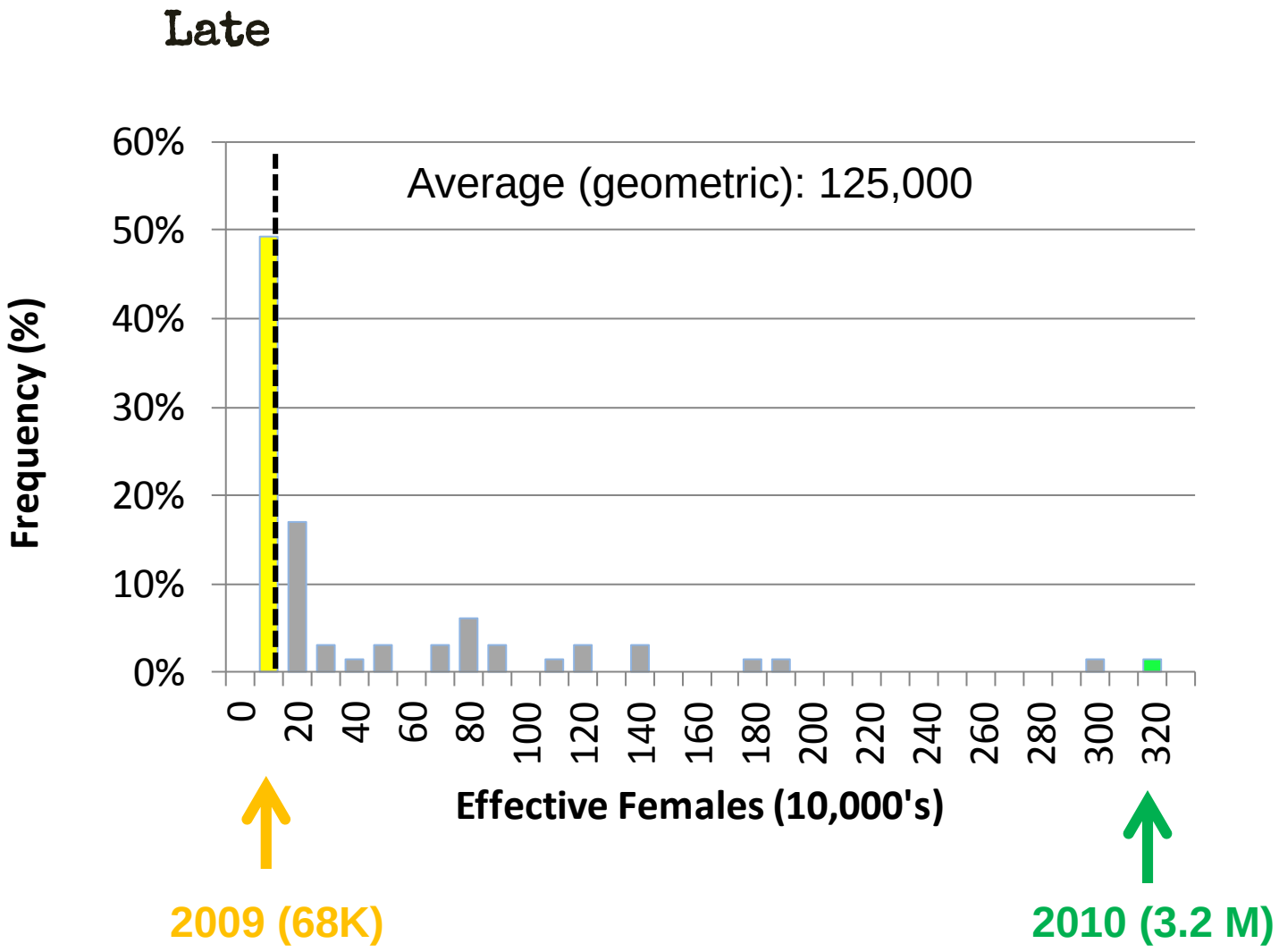
Adult Spawners



Adult Spawners

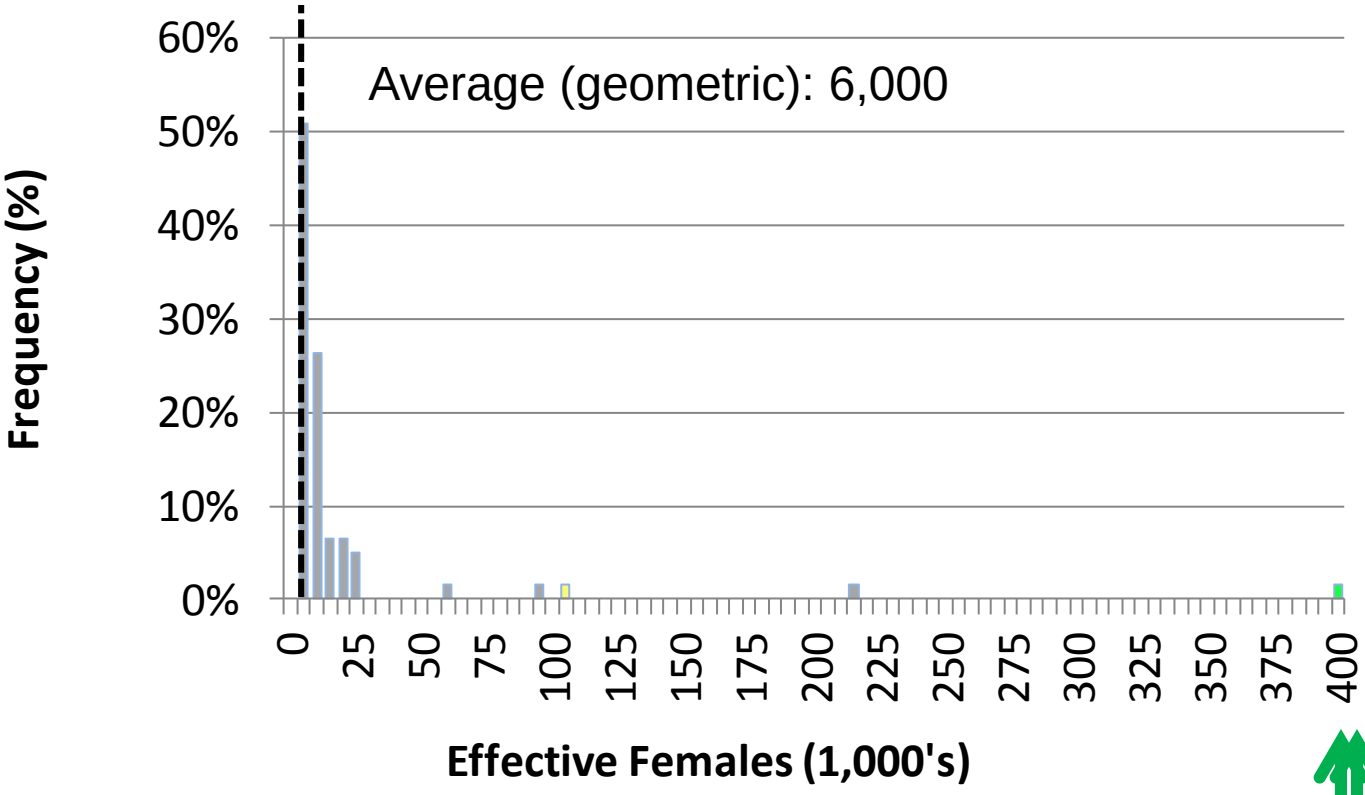


Adult Spawners



Adult Spawners

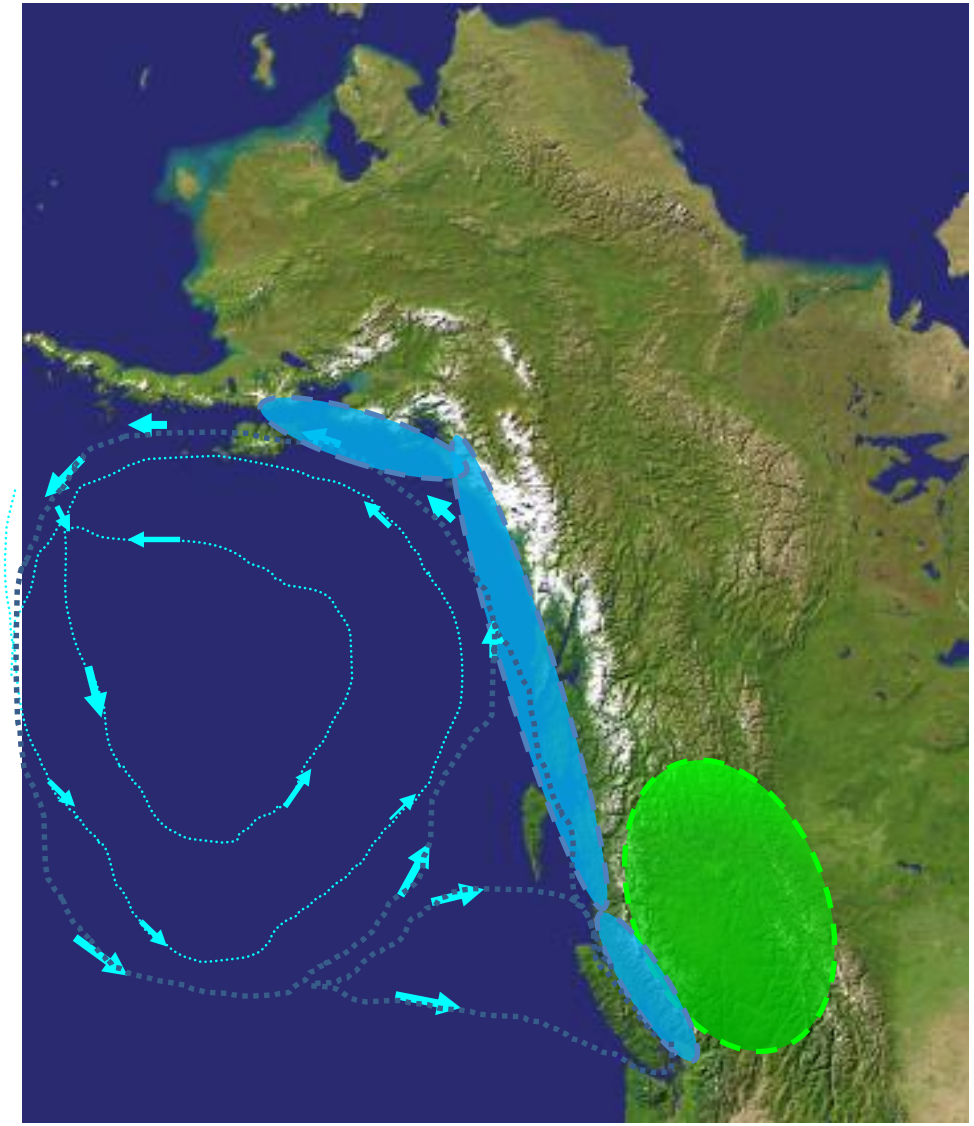
Harrison



2010 (400K) 2011 (400K)

Survival

Marine
Two Winters



Freshwater
Two Winters

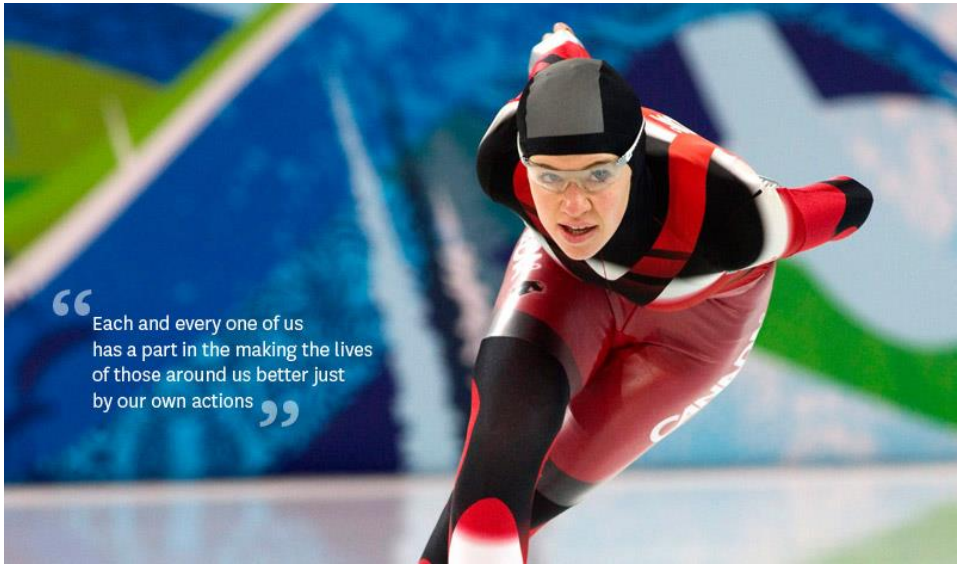
Tucker et al. 2009 (2012)
Trans. Am. Fish. Soc. 138: 1458-1480

Preikshot et al. (2012)
Mar. & Coast. Fish. 4: 438-449

Forecast Background

Clara Hughes: **pre-season**

Sue's gratuitous Olympics Image



Clara Hughes: **in-season**

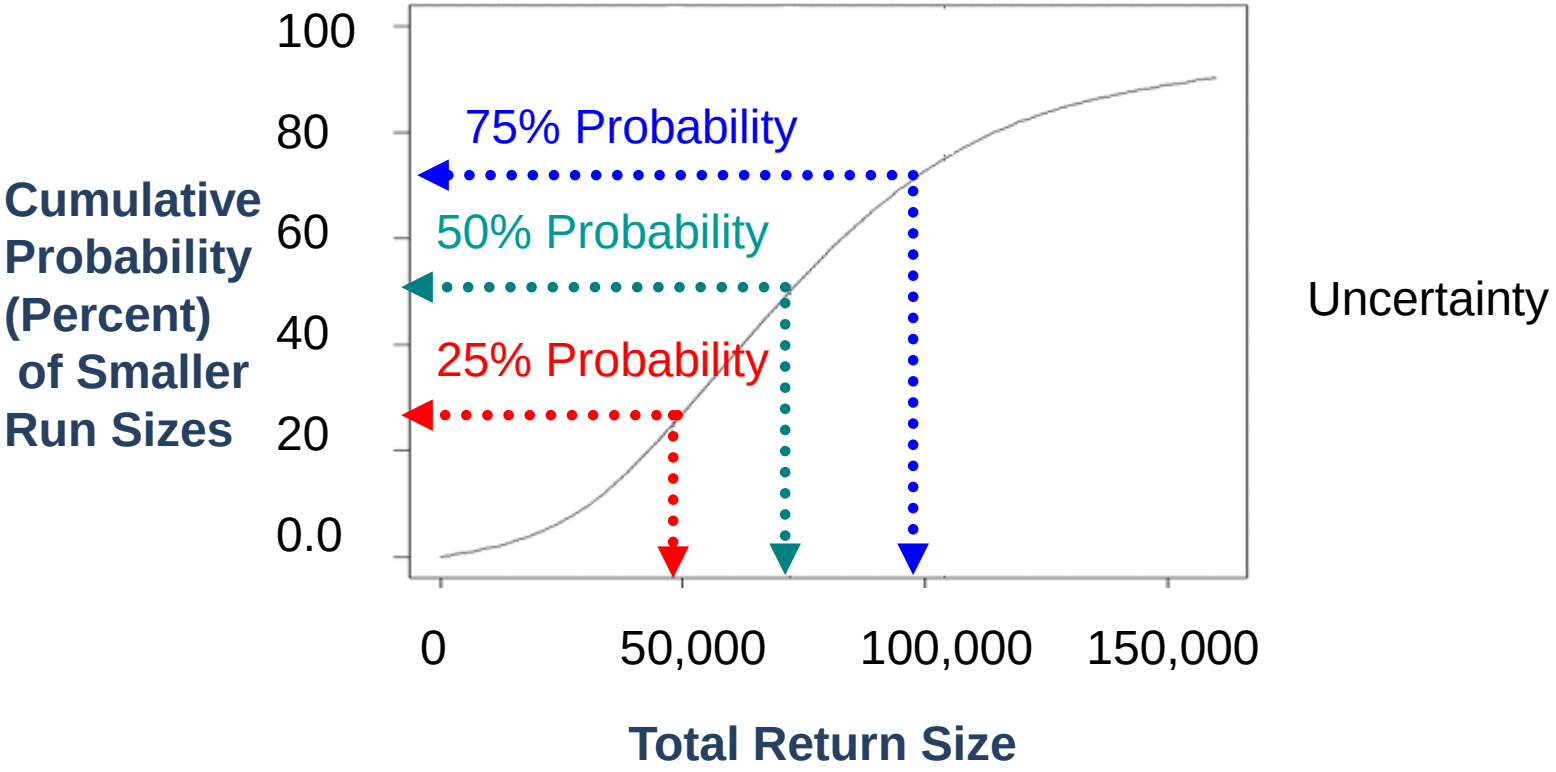
Forecast distributions are used for the following:

frame out the range of fishing opportunities over different stock survival conditions

Bayesian priors for in-season run size estimation models. The have a diminishing influence as more stock-specific in-season data become available

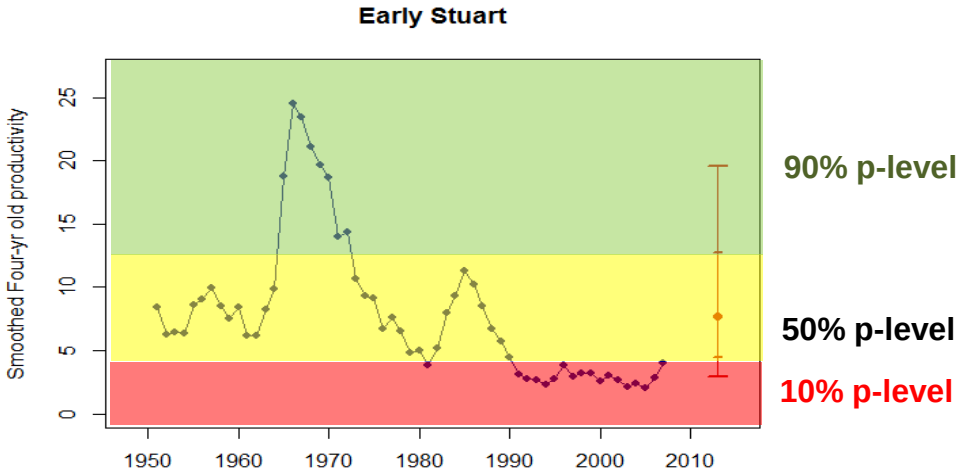
Forecasts are probability distributions

Stock	25%	50%	75%
Hypothetical	48,000	75,000	98,000



2014 Fraser Sockeye Forecasts

Run timing group / Stocks	Probability that Return will be at/or Below Specified Run Size [a] 10%	25%	50%	75%	90%
Early Stuart	**132,000**	**189,000**	**299,000**	**476,000**	**709,000**
Early Summer	**772,000**	**1,734,000**	**4,019,000**	**8,483,000**	**16,524,000**
(total excluding miscellane	***568,000***	***1,278,000***	***3,017,000***	***6,878,000***	***13,651,000***
Bowron	8,000	15,000	30,000	60,000	113,000
Fennell	9,000	13,000	24,000	41,000	68,000
Gates	31,000	47,000	79,000	131,000	228,000
Nadina	26,000	51,000	109,000	233,000	460,000
Pitt	31,000	46,000	73,000	127,000	208,000
Scotch	309,000	677,000	1,448,000	3,361,000	6,746,000
Seymour	154,000	429,000	1,254,000	2,925,000	5,828,000
Misc (EShu & Taseko) [e]	193,000	434,000	961,000	1,531,000	2,734,000
Misc (Chilliwack) [f]	4,000	8,000	14,000	26,000	48,000
Misc (Nahatlatch) [f]	7,000	14,000	27,000	48,000	91,000
Summer	**2,090,000**	**3,353,000**	**5,701,000**	**10,035,000**	**17,642,000**
(total excluding miscellane	***2,092,000***	***3,357,000***	***5,670,000***	***10,051,000***	***17,673,000***
Chilko [g]	1,121,000	1,670,000	2,615,000	4,274,000	6,790,000
Late Stuart	92,000	172,000	329,000	672,000	1,308,000
Quesnel	467,000	845,000	1,524,000	2,950,000	5,864,000
Stellako	275,000	413,000	690,000	1,096,000	1,694,000
Raft [h]	17,000	25,000	39,000	63,000	98,000
Harrison [h & i]	118,000	228,000	473,000	980,000	1,888,000
Misc (N. Thomp. Tribs) [h & j]	2,000	4,000	8,000	16,000	31,000
Misc (N. Thomp River) [h & j]	7,000	13,000	23,000	46,000	91,000
Late	**4,246,000**	**7,461,000**	**12,723,000**	**22,047,000**	**36,697,000**
(total exlcuding miscellane	***4,230,000***	***7,432,000***	***12,670,000***	***21,955,000***	***36,534,000***
Cultus [g]	3,000	6,000	13,000	28,000	56,000
Late Shuswap	3,900,000	6,894,000	11,730,000	20,240,000	33,503,000
Portage	20,000	45,000	111,000	265,000	657,000
Weaver	102,000	176,000	323,000	591,000	1,019,000
Birkenhead	205,000	311,000	493,000	831,000	1,299,000
Misc. non-Shuswap [k]	16,000	29,000	53,000	92,000	163,000
TOTAL SOCKEYE SALMON	**7,240,000**	**12,737,000**	**22,742,000**	**41,041,000**	**71,572,000**
(TOTAL excluding miscella	***(7,020,000)***	***(12,252,000)***	***(21,687,000)***	***(39,344,000)***	***(68,536,000)***



7.2 M
(10% p-level)

71.5 M
(90% p-level)

2009 Returns

Cass et al. 2006 CSAS 2006/060

Run timing group / Stocks	Probability that Return will be at/or Below Specified Run Size [a]				
	10%	25%	50%	75%	90%
Early Stuart	107,000	165,000	255,000	426,000	645,000
Early Summer	264,000	443,000	739,000	1,338,000	2,284,000
Summer	2,858,000	4,914,000	8,677,000	16,071,000	31,813,000
Late (excl Harrison)	294,000	471,000	838,000	1,456,000	2,502,000
(Harrison Only)	33,000	46,000	69,000	160,000	373,000
TOTAL	**3,556,000**	**6,039,000**	**10,578,000**	**19,451,000**	**37,617,000**

2010 Returns

Grant, Michielsens, Porszt & Cass CSAS 2010/042

Res. Doc. & SAR (new models & approach):

External Reviews: R. Peterman & C. Wood

USES RECENT SURVIVAL MODELS

Run timing group / Stocks	Probability that Return will be at/or Below Specified Run Size [a]				
	10%	25%	50%	75%	90%
Early Stuart	55,000	85,000	135,000	213,000	315,000
Early Summer	387,000	723,000	1,518,000	3,544,000	7,993,000
Summer	1,434,000	2,304,000	3,972,000	6,981,000	11,875,000
Late (excl Harrison)	3,434,000	5,146,000	8,102,000	12,074,000	18,818,000
(Harrison Only)	50,000	93,000	262,000	729,000	1,923,000
TOTAL	**5,360,000**	**8,351,000**	**13,989,000**	**23,541,000**	**40,924,000**

2011 Returns

Grant & MacDonald CSAS 2011/134

USES RECENT SURVIVAL MODELS

Run timing group / Stocks	Probability that Return will be at/or Below Specified Run Size [a]				
	10%	25%	50%	75%	90%
Early Stuart	21,000	30,000	47,000	71,000	100,000
Early Summer	164,000	284,000	518,000	958,000	1,785,000
Summer	1,067,000	1,598,000	2,464,000	4,138,000	6,579,000
Late (excl Harrison)	411,000	682,000	1,218,000	2,247,000	3,985,000
(Harrison Only)	37,000	99,000	380,000	1,660,000	2,637,000
TOTAL	**1,700,000**	**2,693,000**	**4,627,000**	**9,074,000**	**15,086,000**

Three new recent productivity models & three scenarios

"long-term average model performance" presented here

2012 Returns

MacDonald & Grant CSAS 2012/011

Run timing group / Stocks	Probability that Return will be at/or Below Specified Run Size [a]				
	10%	25%	50%	75%	90%
Early Stuart	39,000	61,000	99,000	161,000	270,000
Early Summer	109,000	195,000	359,000	665,000	1,214,000
Summer	529,000	828,000	1,420,000	2,449,000	4,160,000
Late (excl Harrison)	46,000	80,000	158,000	304,000	589,000
(Harrison Only)	20,000	39,000	83,000	184,000	401,000
TOTAL	**743,000**	**1,203,000**	**2,119,000**	**3,763,000**	**6,634,000**

One Long-Term Performance Scenario

2013 Returns

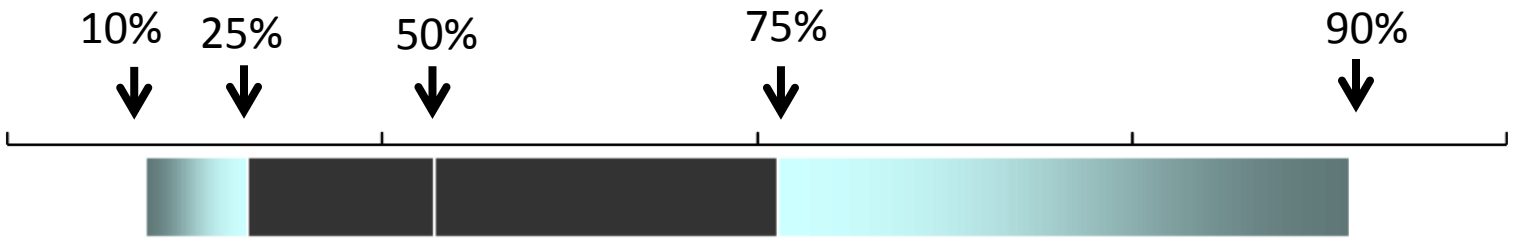
Grant & MacDonald CSAS 2012/145

Run timing group / Stocks	Probability that Return will be at/or Below Specified Run Size [a]				
	10%	25%	50%	75%	90%
Early Stuart	92,000	137,000	211,000	331,000	507,000
Early Summer	73,000	130,000	253,000	468,000	844,000
Summer (exl. Harrison)	1,210,000	2,064,000	3,636,000	6,458,000	11,662,000
(Harrison Only)	12,000	31,000	82,000	205,000	469,000
Late	167,000	293,000	583,000	1,133,000	2,126,000
TOTAL	**1,554,000**	**2,655,000**	**4,765,000**	**8,595,000**	**15,608,000**

One Long-Term Performance Scenario

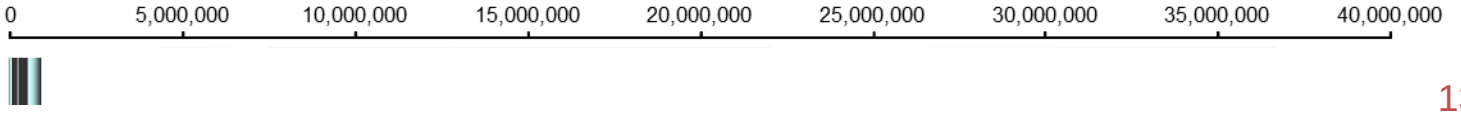
2014 Forecasts

2014 Fraser Sockeye Forecasts



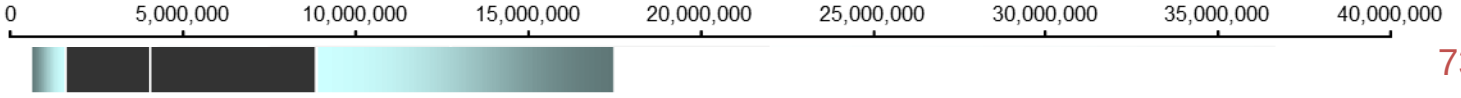
7.3 M – 72.5 M

Early Stuart



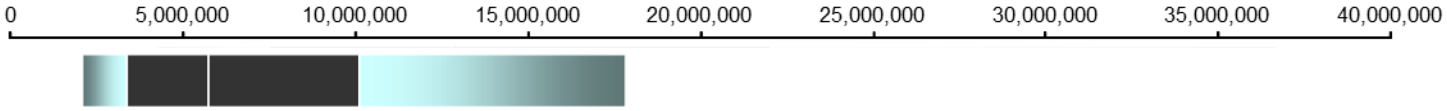
132K – 709 K

Early Summer



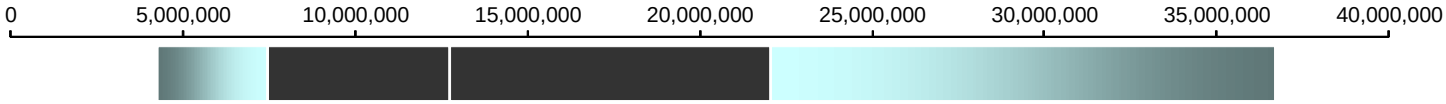
730 K – 16.8 M

Summer



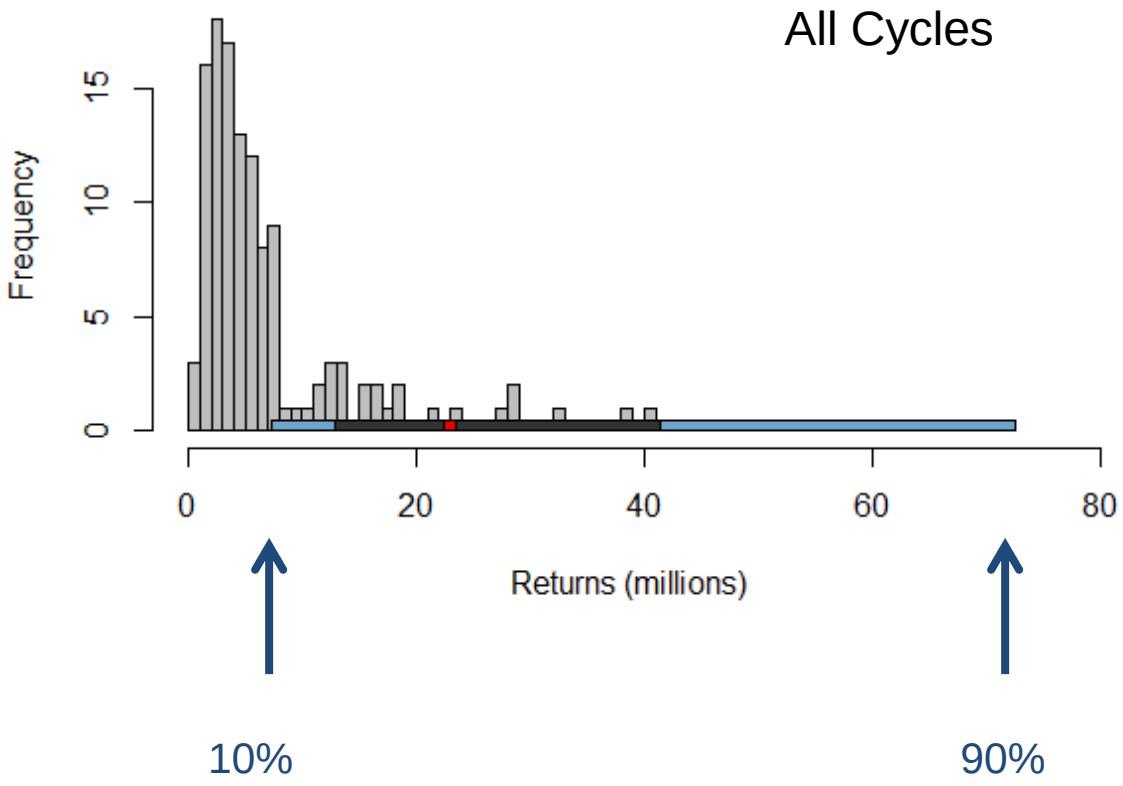
2.1 M – 17.8 M

Late



4.3 M – 37.2 M

2014 Forecast Distribution



Due to uncertainty, upper portion of the forecast distribution falls above any recorded historical returns

Years: 1893 to 2012

Important Messages

- The return in 2014 is generally expected to be above cycle average (nearly 3 in 4 chance the return will be above average)
- The 2014 forecast distribution falls much higher than recorded historical returns at the upper end of the distribution (above the 75% p-level)
- Late Shuswap, Chilko, Quesnel, Scotch, and Seymour make up 85% of the forecasted return
- Forecasts are particularly uncertain for 2014, because for multiple driving stocks forecast models are being extrapolated outside their fitted range
  - However juvenile data support model forms that predict overcompensation at high spawner abundances
  - Sibling data also provide some support for forecasts

DFO CSAS Special Science Response

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