

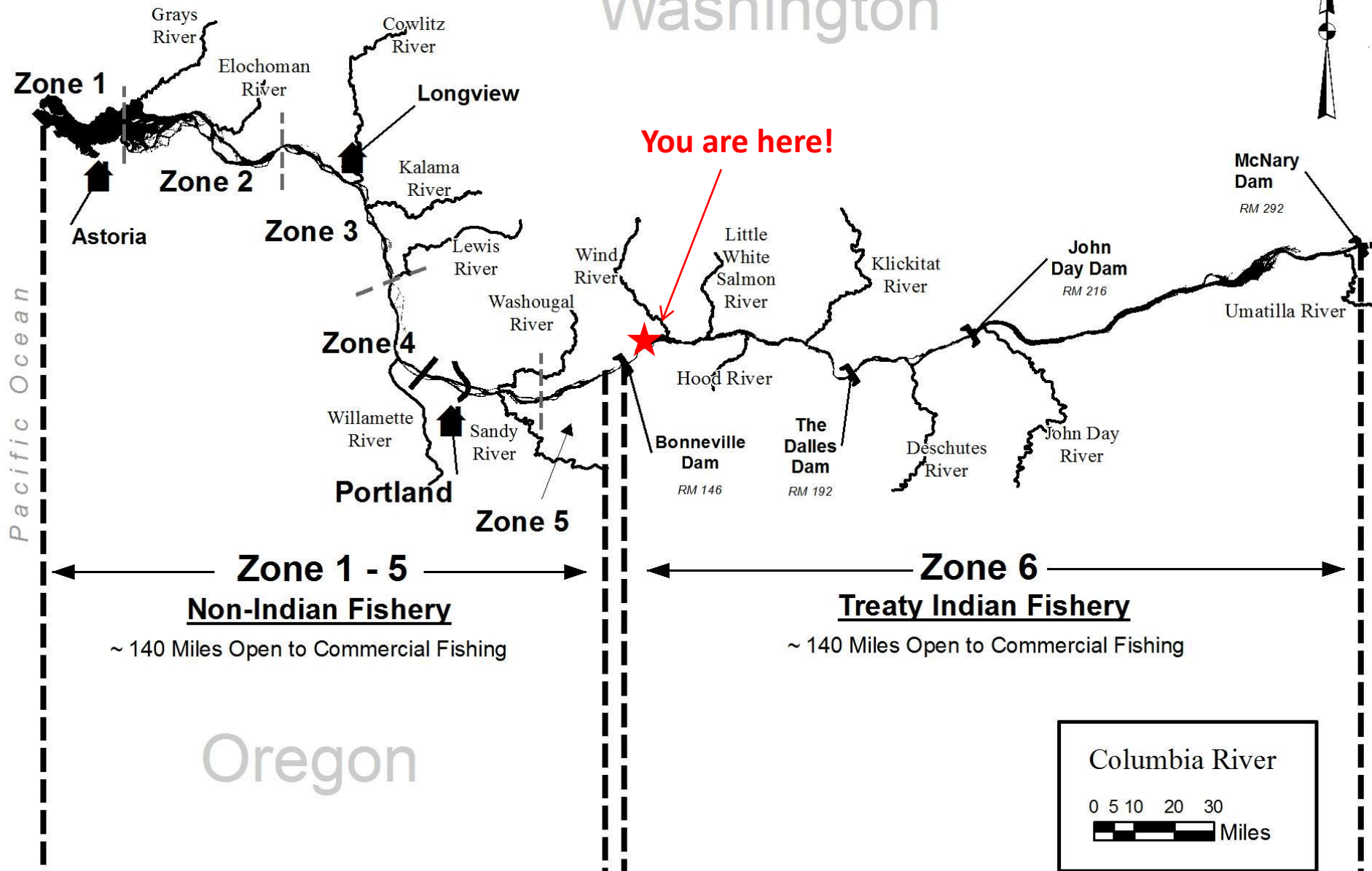
A genetic analysis of the Summer Steelhead stock composition in the 2011 and 2012 Columbia River sport and treaty fisheries

- Alan Byrne
- Idaho Department of Fish and Game
- Boise, Idaho

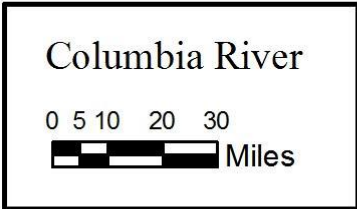
Contributors and Cooperators

- Joe Hymer, Washington Department of Fish and Wildlife
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- Rod French, Oregon Department of Fish and Wildlife
- Eagle Genetics Lab, Idaho Department of Fish and Game
- Hagerman Genetics Lab, Columbia River Inter-Tribal Fish Commission
- And most importantly all the technicians that collected and analyzed the samples

Washington



Oregon



Sport fisheries sampled

- Lower Columbia River – 2011 - 2013
- Downstream of Bonneville Dam
 - Adipose clipped retention only
 - Most Steelhead harvested in July and August
 - Anglers switch to Fall Chinook once they arrive
 - Steelhead retention not allowed in Commercial fisheries
 - Harvest estimated monthly from creel surveys
- Columbia River Zone 6 – 2012 and 2013
- Bonneville Dam to McNary Dam
 - Adipose clipped retention only
 - Most effort in localized areas: mouth of the Deschutes River, Wind River, Drano Lake, John Day Arm
 - Opportunistic sampling. Harvest from catch cards.

Tribal fisheries sampled

- Columbia River Zone 6 – 2011 - 2013

- Bonneville Dam to McNary Dam
- Clipped and unclipped fish are harvested
- Platform, hoop net, hook and line, gill net, drift net
- Commercial fishing targets fall Chinook and Coho but significant numbers of Steelhead are caught
- Commercial retention and sale of Steelhead is allowed
- Most of the Steelhead harvest occurs during the commercial season targeting fall Chinook (late August – early October)
- Fish are kept for personal use, over-the-bank sales, and commercial sales
- Sampled by WDFW in 2011 at commercial buyers
- Sampled by Yakama Nation in 2012 and 2013
- Harvest estimated for clipped and unclipped large and small Steelhead

Study objectives

- Harvest contribution of Snake River hatchery stocks in Columbia River fisheries
- Estimate harvest contribution by hatchery release group and brood year in Columbia River fisheries
- Estimate the Snake River hatchery origin contribution in the unclipped harvest in the tribal Zone 6 fishery
- Estimate the contribution by GSI reporting group in the unclipped harvest in the tribal Zone 6 fishery

Analysis of clipped fish

- Calculate a multinomial proportion of the sampled fish
- Snake River broodstock have been genotyped since BY2008
- Run PBT panel and assign fish to stock, release group, and brood year
- Expand actual release group count by its tag rate ($E_{ib} = A_{ib} / r_{ib}$)
 - this is the expected number of samples that would assign to each group if tag rate = 1. Most stocks are > 0.9
- Sum the expanded count of all groups assigning to the Snake River and then subtract the sample size (N) from this sum to get Other group (non-Snake River stocks)
- Calculate proportions for each group (E_{ib} / N)
- Bootstrap to calculate Confidence Intervals for proportions
- Harvest contribution = total harvest * (E_{ib} / N)

PBT tag rates of Snake River Steelhead

Hatchery Stock (11)	Release group (19)	Tag Rate		
		BY2008	BY2009	BY2010
Dworshak	Dworshak	0.6749	0.9776	0.9680
EF Salmon	EF_Sawtooth	0.9615	1.0000	1.0000
Imnaha	Imnaha	1.0000	1.0000	0.8836
Lyons Ferry	Lyons Ferry	NS	0.9906	1.0000
Oxbow	Oxbow	0.9089	0.8750	0.9580
Pahsimeroi - general production	Pahsimeroi	0.9415	0.9483	0.9703
Pahsimeroi - SBT Indian Creek egg box	SBT_Indian	na	0.9107	0.9524
Pahsimeroi - SBT Panther Creek egg box	SBT_Panther	na	0.9540	0.9615
Pahsimeroi - SBT programs (all releases)	SBT_Pah	0.9938	na	0.8125
Sawtooth - general production	Sawtooth	0.9928	1.0000	0.9952
Sawtooth - SBT Basin Creek egg box	SBT_Basin	1.0000	0.9832	na
Sawtooth - SBT Smolt release at Sawtooth	SBT_Sawtooth	0.9143	na	na
Sawtooth - SBT Yankee Fork egg box	SBT_YF_Egg	na	na	1.0000
Sawtooth - SBT Yankee Fork smolt release	SBT_Yankee	1.0000	1.0000	1.0000
Touchet endemic	LF_Touchet	NS	0.8889	0.6429
Tucannon endemic	LF_Tucannon	NS	0.8750	0.6944
Upper Salmon	Upper Salmon	1.0000	1.0000	0.9600
Wallowa - Cottonwood release	LF_Cottonwood	0.9647	0.9583	1.0000
Wallowa- all other releases	Wallowa	NS	0.9094	0.9761

NS = not sampled na = no release of this group in BY

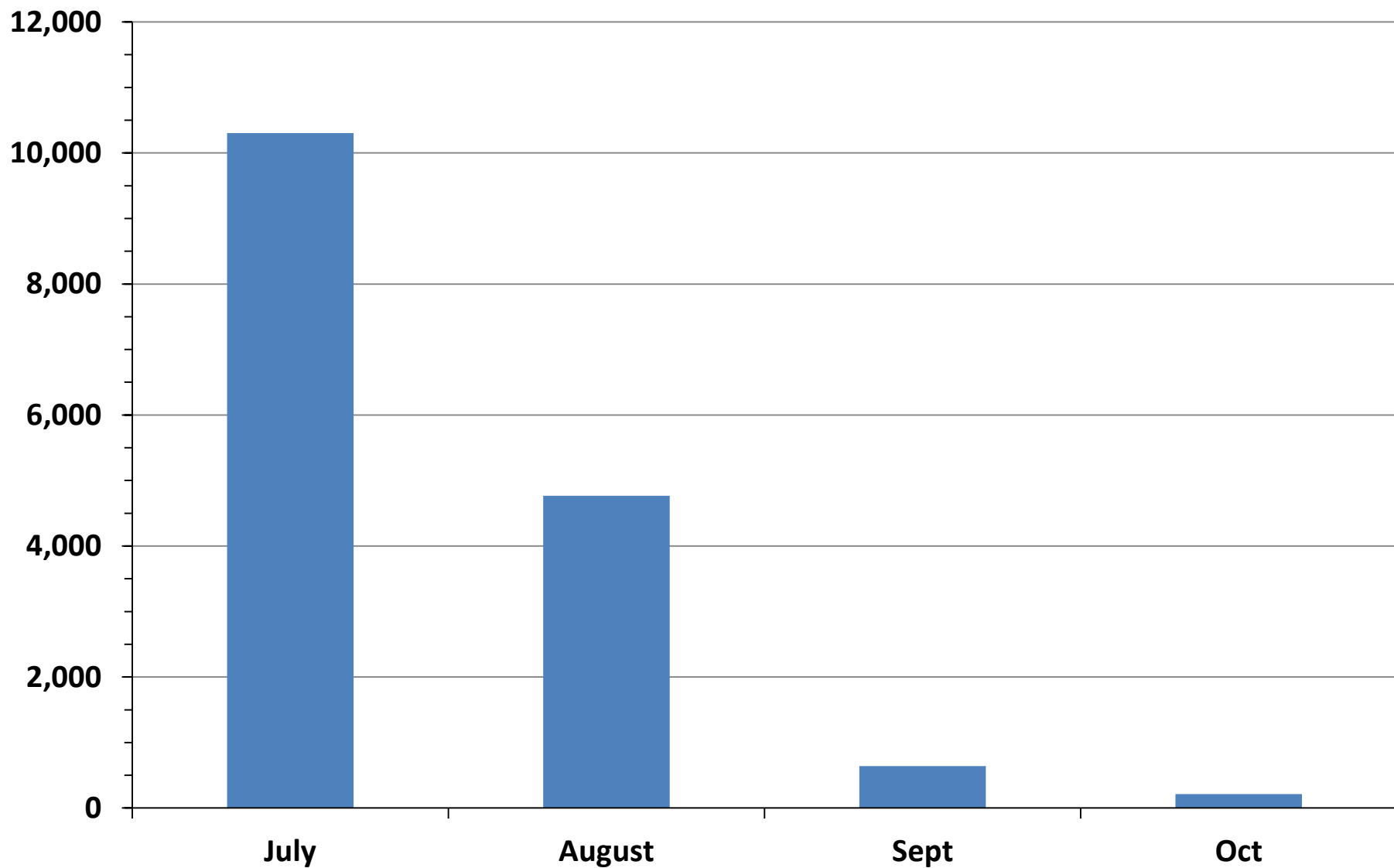
Actual PBT assignments and Expanded counts in 2012 LCR Sport

542 of 828 samples assigned to Snake River hatchery stocks with PBT

Release group (i)	Actual Count of PBT assignment (A_{ib})				Expanded Count (E_{ib})			
	BY2008	BY2009	BY2010	Total	BY2008	BY2009	BY2010	Total
Dworshak	1	26	3	30	1.48	26.60	3.10	31.18
EF_Sawtooth	0	1	0	1	0.00	1.00	0.00	1.00
LF_Cottonwood	0	7	18	25	0.00	7.30	18.00	25.30
LF_Touchet	NS	1	0	1		1.13	0.00	1.13
Imhana	0	8	2	10	0.00	8.00	2.26	10.26
Lyons Ferry	NS	16	34	50		16.15	34.00	50.15
Oxbow	1	110	14	125	1.10	125.71	14.61	141.43
Pahsimeroi	0	53	76	129	0.00	55.89	78.33	134.21
Sawtooth	0	21	76	97	0.00	21.00	76.37	97.37
SBT_Basin	0	1	0	1	0.00	1.02	0.00	1.02
SBT_Yankee	0	7	9	16	0.00	7.00	9.00	16.00
Wallowa	NS	36	21	57		39.59	21.51	61.10
Snake R total:	2	287	253	542	2.58	310.38	257.18	570.15
Other	na	na	na	286				257.85
Total:	2	287	253	828	2.58	310.38	257.18	828

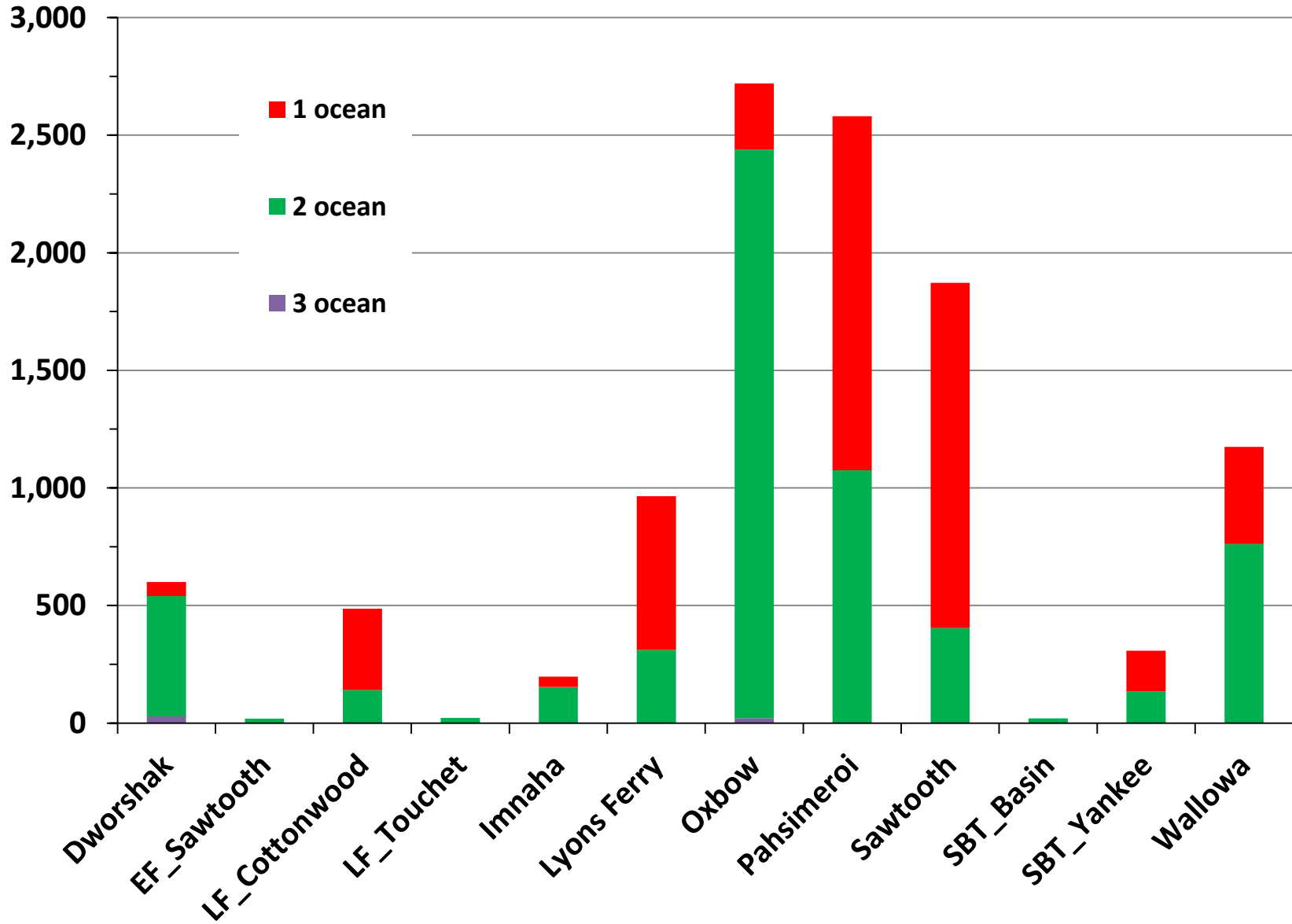
Lower Columbia River – 2012 Sport harvest by month

Total harvest = 15,923



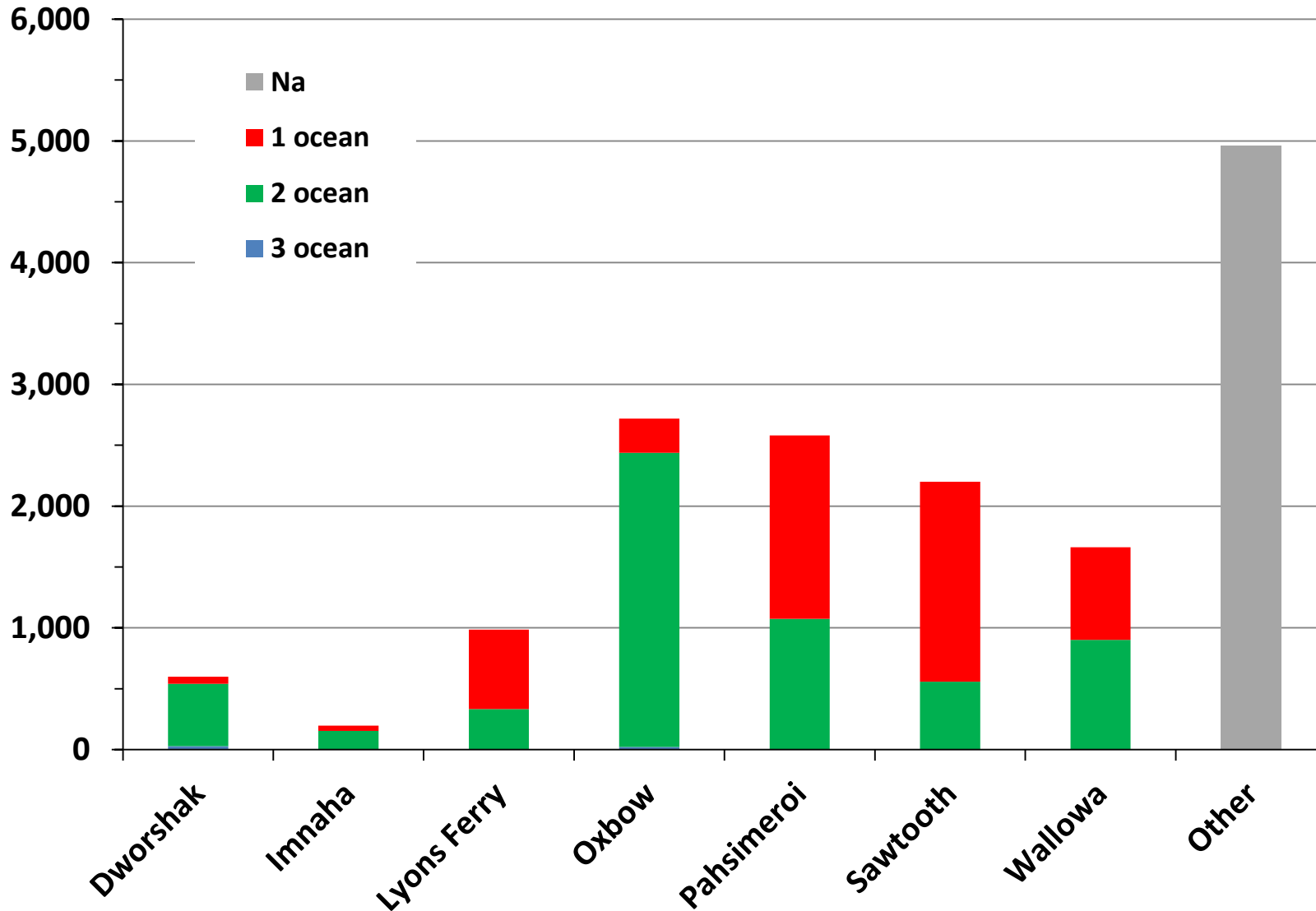
Lower Columbia sport – 2012 by Release group and age

Snake River stocks only, harvest = 10,964



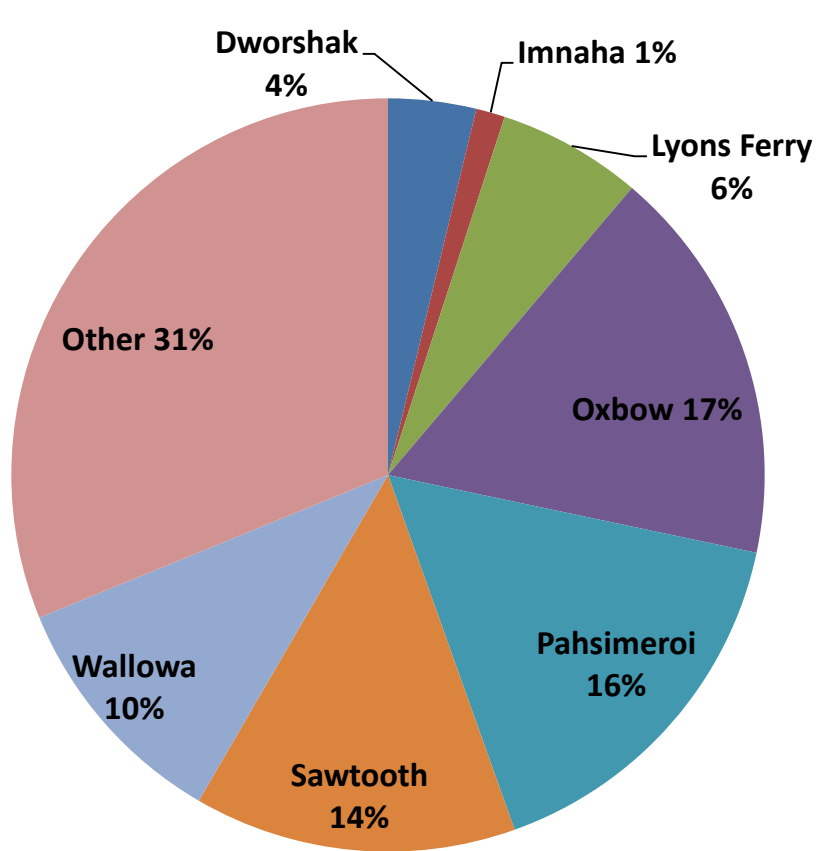
Lower Columbia sport – 2012 by hatchery stock and age

Total harvest = 15,923

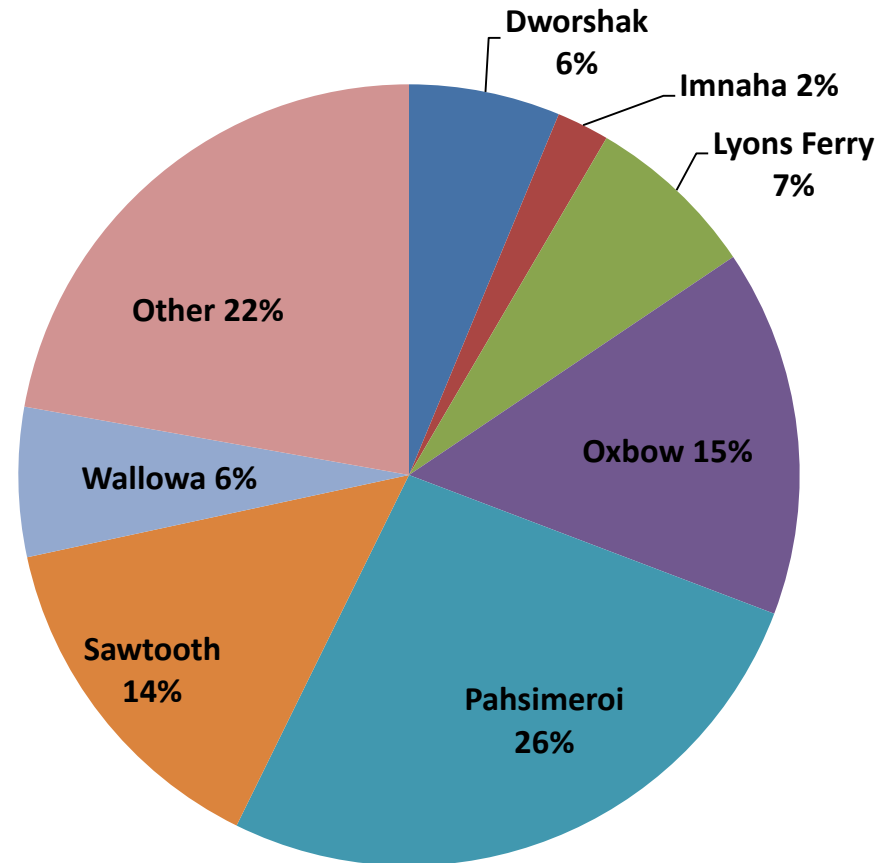


Lower Columbia Sport 2012 (left) & 2011 (right)

July 1 – October 31



2012 Harvest = 15,923
69% from Snake River



2011 Harvest = 20,602
78% from Snake River

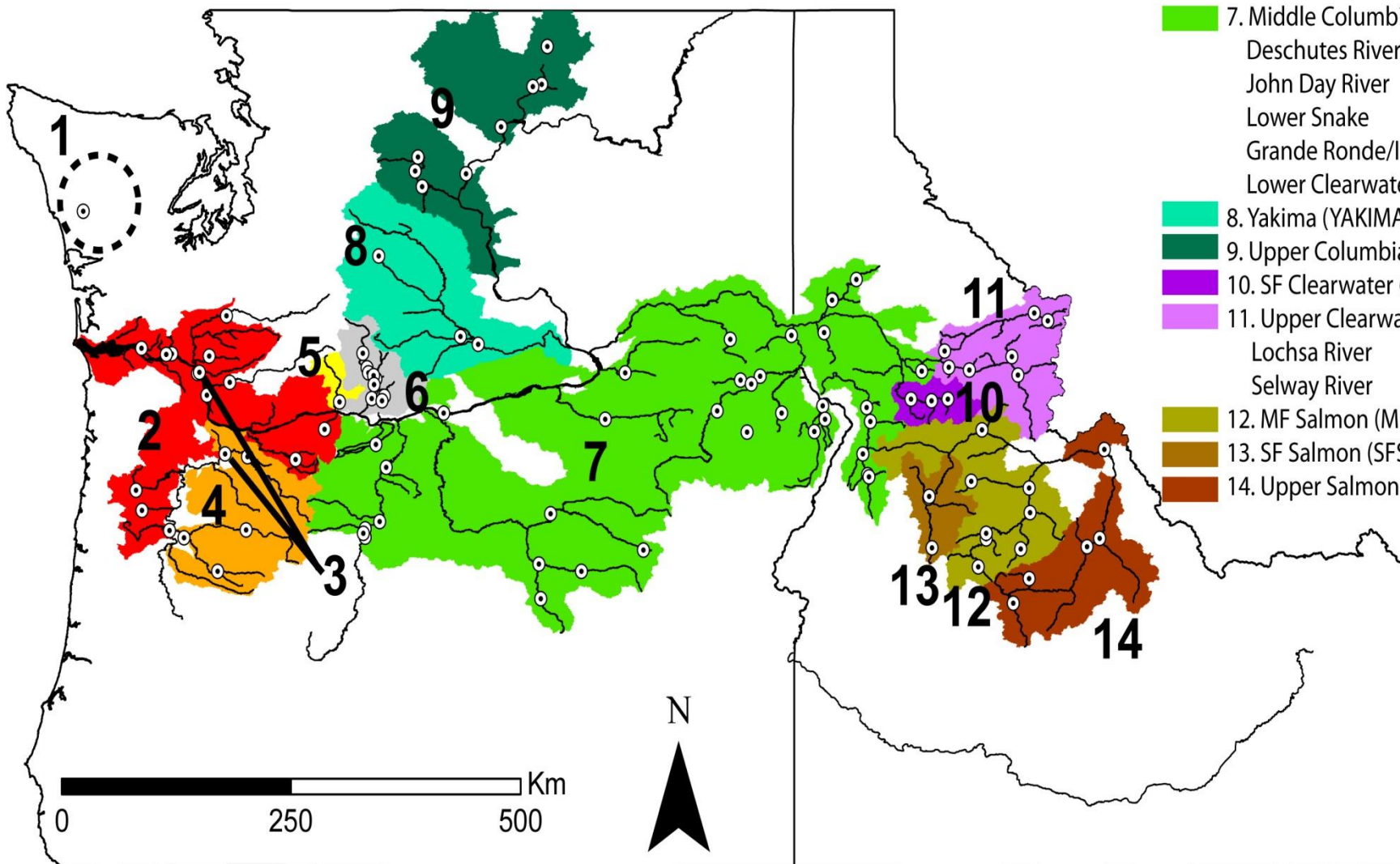
Tribal Fisheries – 2012 Harvest

	Clipped < 78 cm	Unclipped ≤ 78 cm	Clipped ≥ 78 cm	Unclipped ≥ 78 cm	Total Clipped harvest	Total Unclipped harvest	Total harvest
	3,304	1,689	1,643	744	4,947	2,433	7,381
Platform	3,951	2,536	820	523	4771	3,059	7,830
Total	7,256	4,225	2,462	1,268	9,718	5,493	15,211

Steelhead GSI reporting groups

Reporting groups

-  1. Quinault (WCOAST)
-  2. Lower Columbia (LOWCOL)
-  3. Skamania (SKAMAN)
-  4. Willamette (WILLAM)
-  5. Big White Salmon (BWSALM)
-  6. Klickitat (KLICKR)
-  7. Middle Columbia (MGILCS)
Deschutes River
John Day River
Lower Snake
Grande Ronde/Imnaha
Lower Clearwater/Salmon
-  8. Yakima (YAKIMA)
-  9. Upper Columbia (UPPCOL)
-  10. SF Clearwater (SFCLWR)
-  11. Upper Clearwater (UPCLWR)
Lochsa River
Selway River
-  12. MF Salmon (MFSALM)
-  13. SF Salmon (SFSALM)
-  14. Upper Salmon (UPSALM)



Analysis of unclipped fish

- Calculate a multinomial proportion of the sampled fish
- Run PBT and GSI panels
- Assign all fish to GSI reporting group using GSI panel
- Assign unclipped Snake River hatchery fish to stock, release group, and brood year using PBT (A_{ib}). Expand the count of each group by its tag rate to get E_{ib}
- Must subtract $\sum(E_{ib} - Ab_i)$ from GSI reporting groups
 - Determine where hatchery groups assign (% to each GSI group)
 - Subtract $\sum[(t_{ik} * (E_{ib} - A_{ib}))]$ from each GSI group
- Calculate proportions for each hatchery release group (E_{ib}/N) and each GSI report group after subtraction
- Bootstrap to calculate Confidence Intervals

Tribal Zone 6 Unclipped Steelhead 2012; n = 403

102 hatchery origin fish identified with PBT

ID	Date	Location	GSI assignment	PBT release group	BY	Length	Sex
21392	10/23	DRANO	SFCLWR	Dworshak	2009	840	Male
20611	9/21	MARYHILL	SFCLWR	Dworshak	2010	600	Male
4461	10/3	ROOSEVELT	UPSALM	EF_Sawtooth	2009		Female
2357	8/23	MARYHILL	UPPCOL	LF_Tucannon	2009		Female
3414	9/8	PASTURE POINT	UPPCOL	LF_Tucannon	2009		--
20840	10/9	DRANO	UPSALM	Oxbow	2009	720	Male
2917	8/29	DALLES POOL	UPSALM	Pahsimeroi	2009		Male
20857	10/9	DRANO	MGILCS	Wallowa	2009	620	Female
2196	8/22	CELILO	MGILCS				Female
2020	8/22	CELILO	KLICKR				Female
2026	8/22	CELILO	MGILCS				Female
202799	8/22	CELILO	MFSALM				Male

After expanding for tag rate unclipped hatchery total = 108.2

Hatchery release group assignment to GSI groups

Release group (all BY's combined)	Proportion of release group assigning to GSI group (t_{ik})					
	MFSALM	MGILCS	SFCLWR	UPCLWR	UPPCOL	UPSALM
Dworshak	0.0%	4.6%	94.2%	1.2%	0.0%	0.0%
EF_Sawtooth	0.0%	23.5%	11.8%	0.0%	0.0%	64.7%
Upper Salmon	0.0%	23.5%	11.8%	0.0%	0.0%	64.7%
LF_Tucannon	0.0%	63.6%	0.0%	0.0%	27.3%	9.1%
Imnaha	0.0%	63.6%	0.0%	0.0%	27.3%	9.1%
Lyons Ferry	0.0%	63.6%	0.0%	0.0%	27.3%	9.1%
Oxbow	0.0%	33.3%	0.0%	0.0%	0.0%	66.7%
Pahsimeroi	0.0%	42.1%	0.0%	0.0%	5.3%	52.6%
Sawtooth	2.7%	24.3%	0.0%	0.0%	0.0%	73.0%
SBT_Yankee	2.7%	24.3%	0.0%	0.0%	0.0%	73.0%
Wallowa	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%

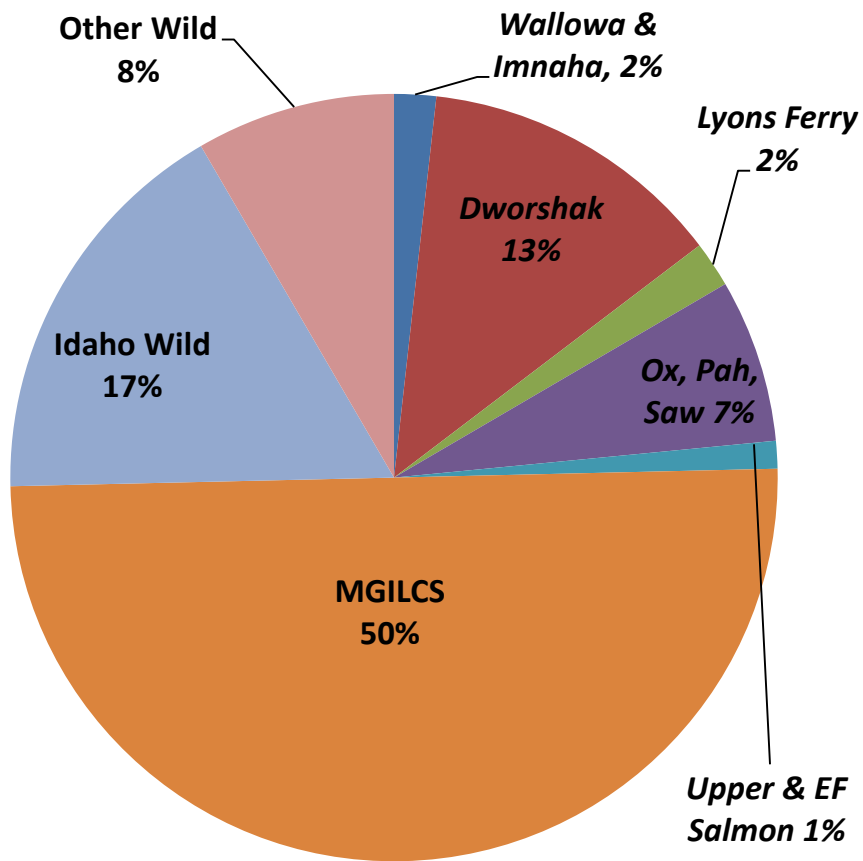
Tribal unclipped steelhead harvest - Zone 6 in 2012

Total harvest = 5,493

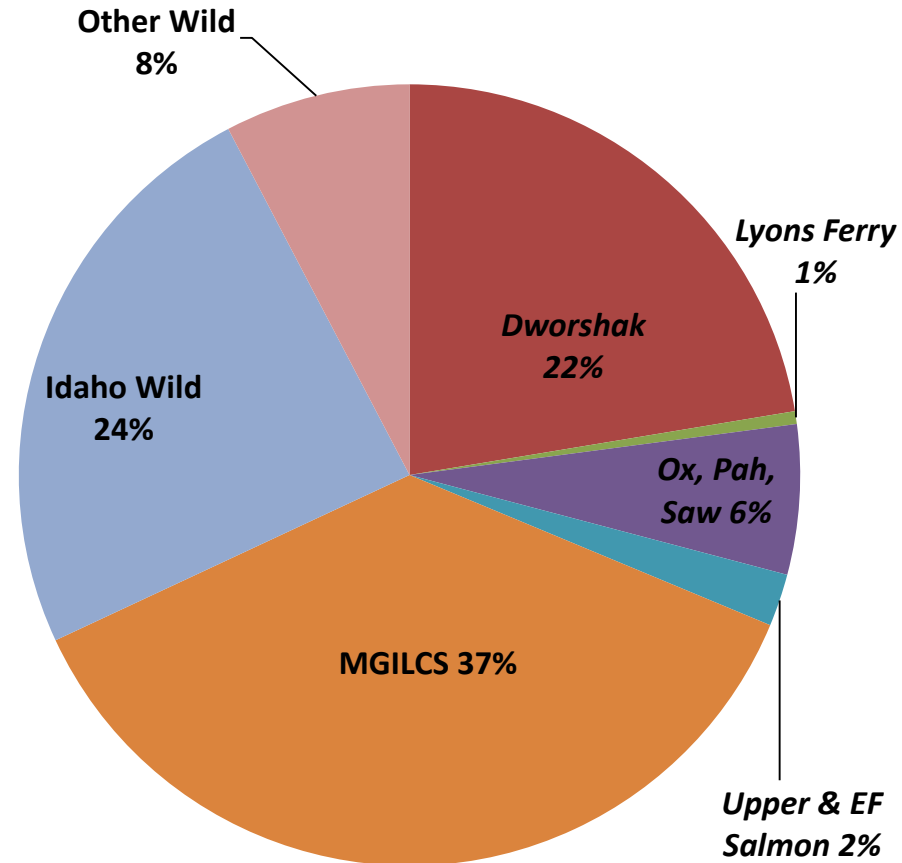
Hatchery Release group (all BY's)	Harvest	GSI Report group	Harvest
Dworshak	708	BWSALM	35
EF_Sawtooth	36	KLICKR	62
LF_Tucannon	88	MFSALM	167
Imnaha	39	MGILCS	2,747
Lyons Ferry	18	SFCLWR	141
Oxbow	90	SFSALM	108
Pahsimeroi	137	SKAMAN	70
Sawtooth	35	UPCLWR	249
SBT_Yankee	116	UPPCOL	232
Upper Salmon	28	UPSALM	267
Wallowa	58	YAKIMA	62
<i>Hatchery total</i>	<i>1,353</i>	<i>GSI total:</i>	<i>4,140</i>

Tribal Unclipped Zone 6 Harvest - 2012 (left) & 2011 (right)

August 1 – end of season



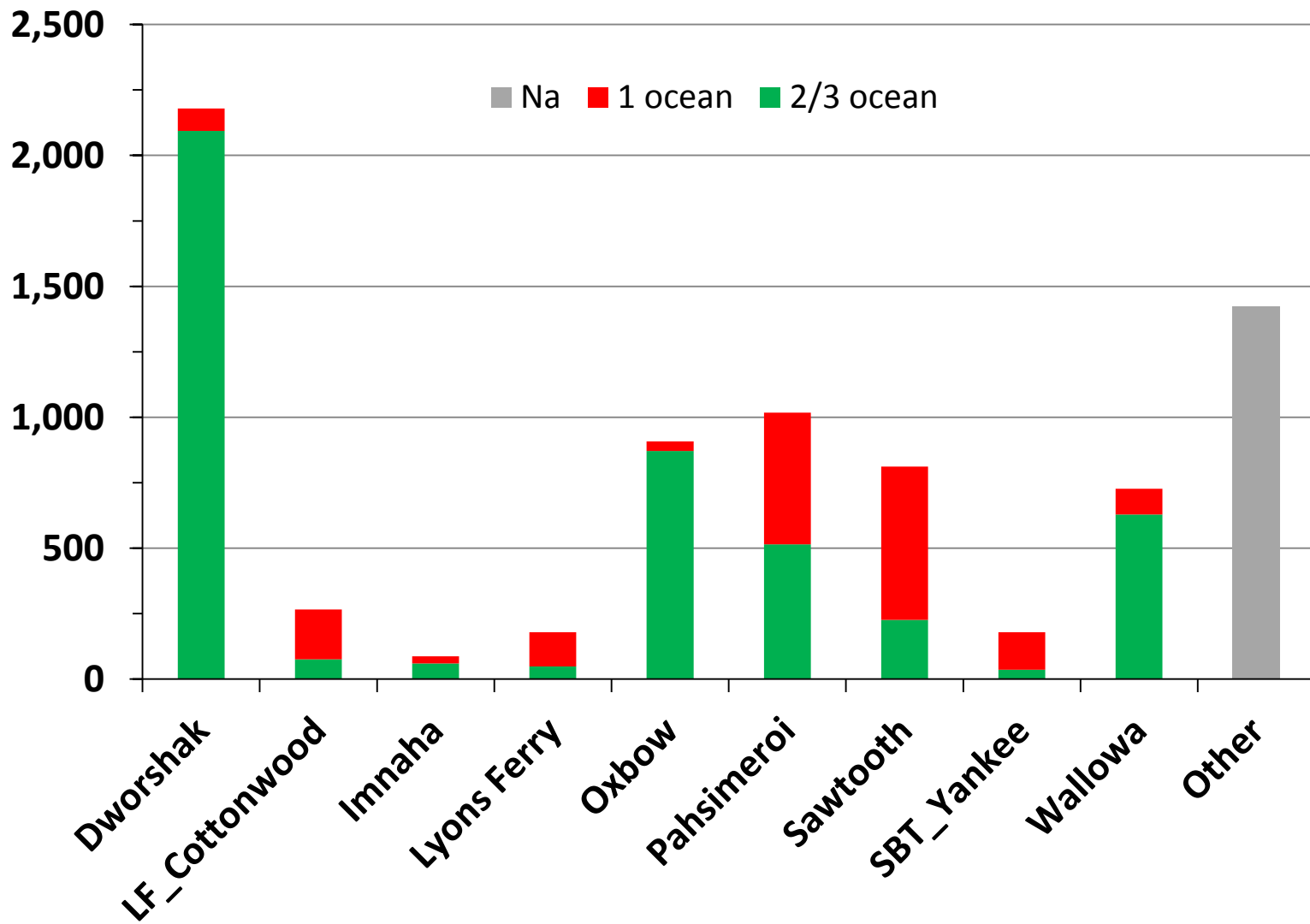
2012 harvest = 5,493
25% Snake River hatchery origin



2011 harvest = 9,295
31% Snake River hatchery origin

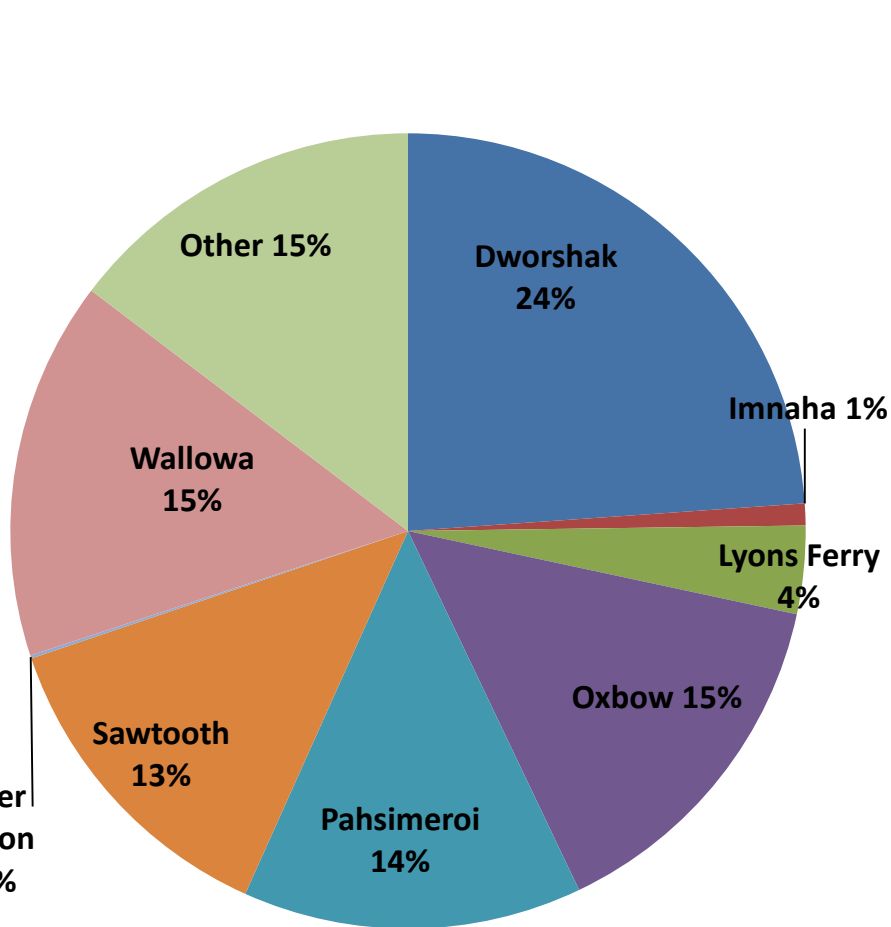
Tribal Zone 6 Clipped Steelhead harvest in 2012

Sample size = 597. Total harvest = 9,718

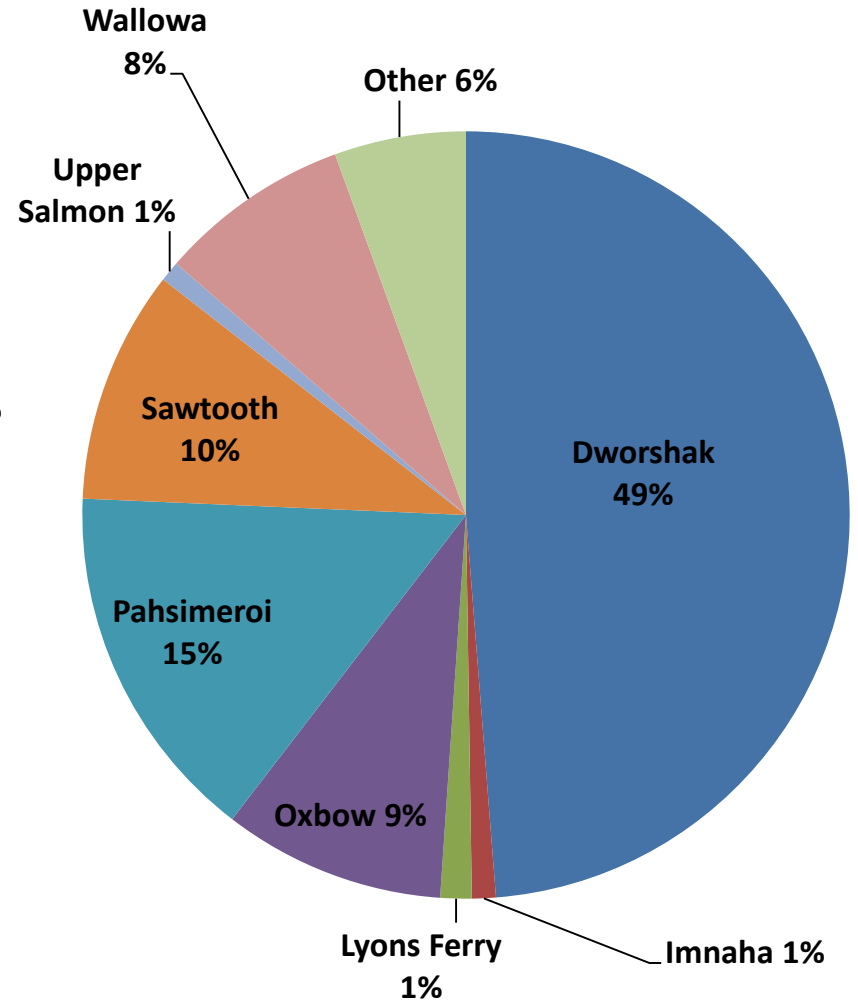


Tribal Clipped Zone 6 Harvest - 2012 (left) & 2011 (right)

August 1 – end of season

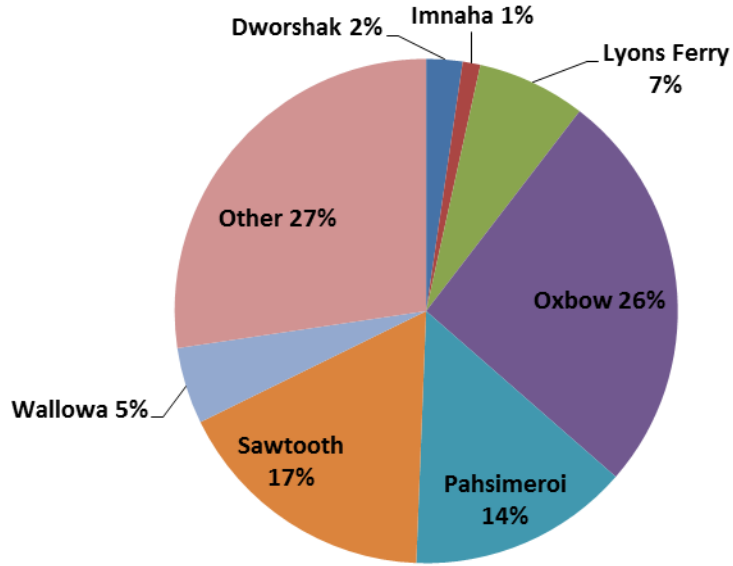


2012 harvest = 9,718
85% from Snake River

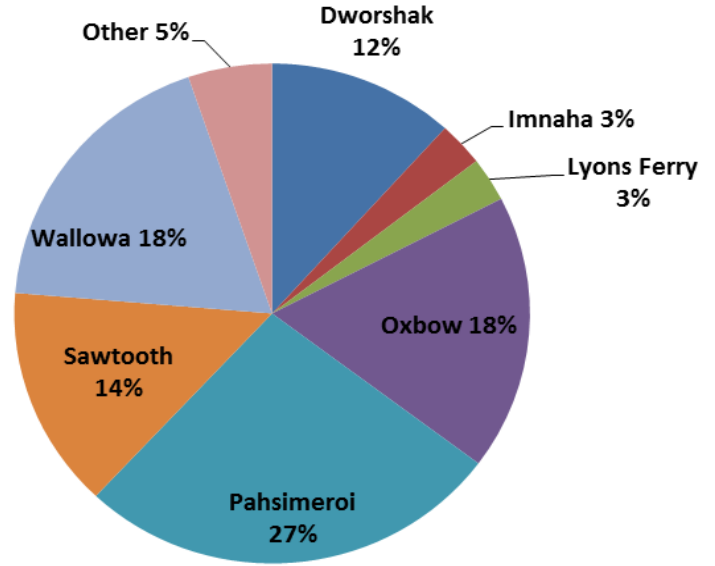


2011 harvest = 18,204
94% from Snake River

Sport in Zone 6 – Summer / Fall 2012

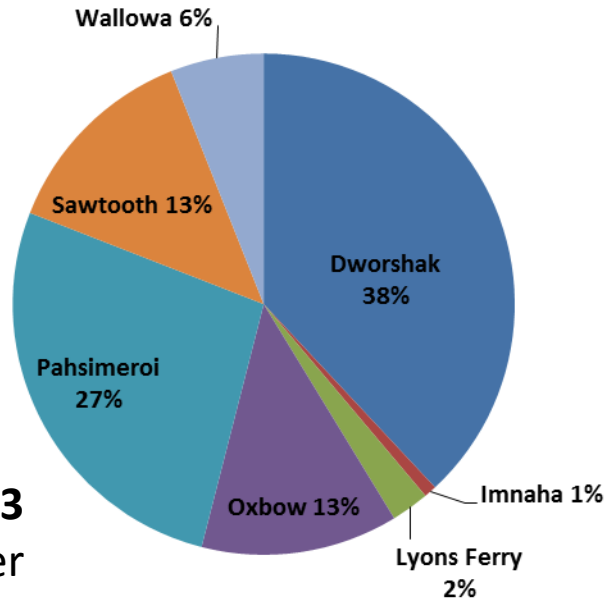


Washington Shore; n = 88
73% from Snake River

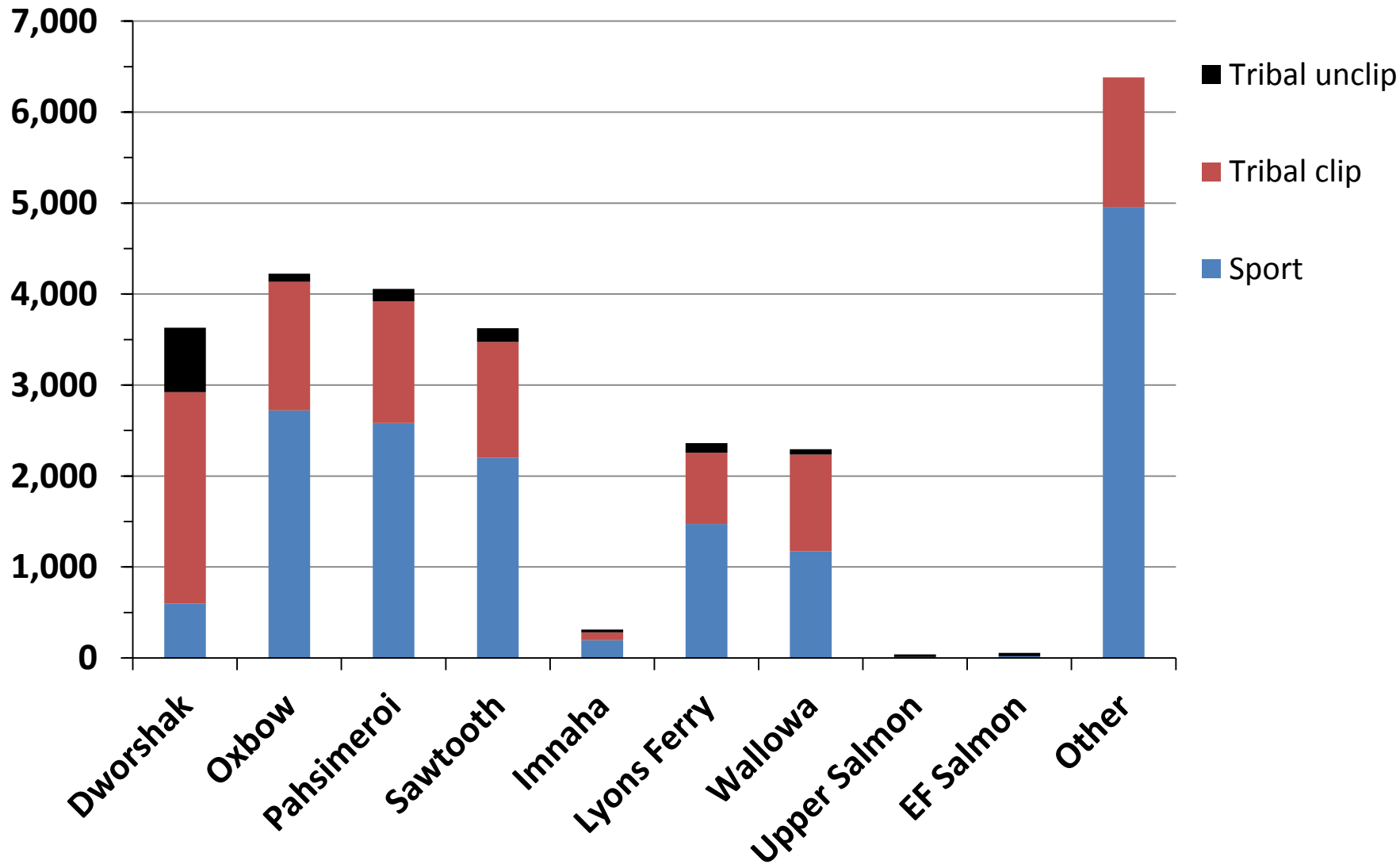


Mouth of Deschutes; n = 70
95% from Snake River

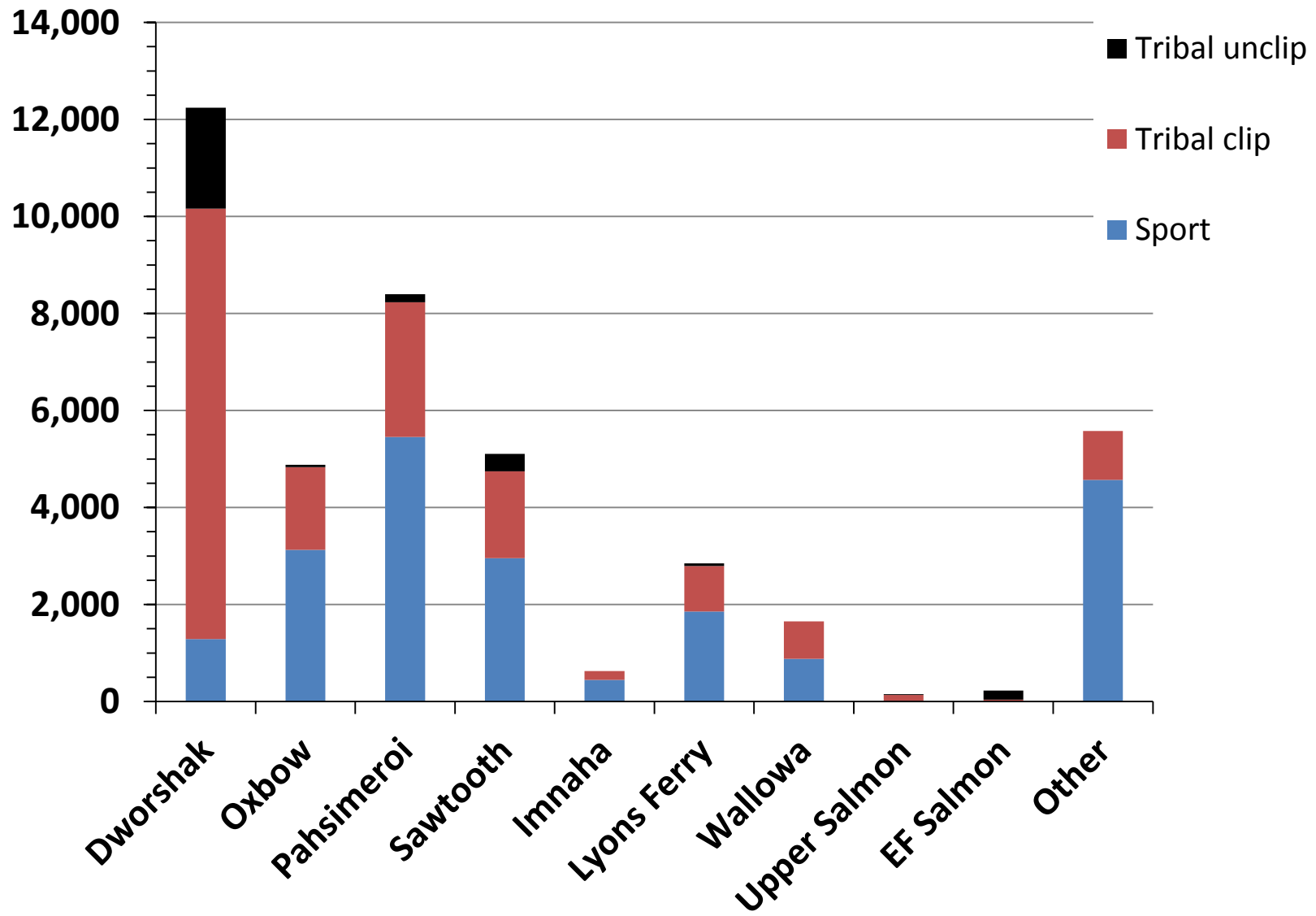
John Day Arm; n = 123
100% from Snake River



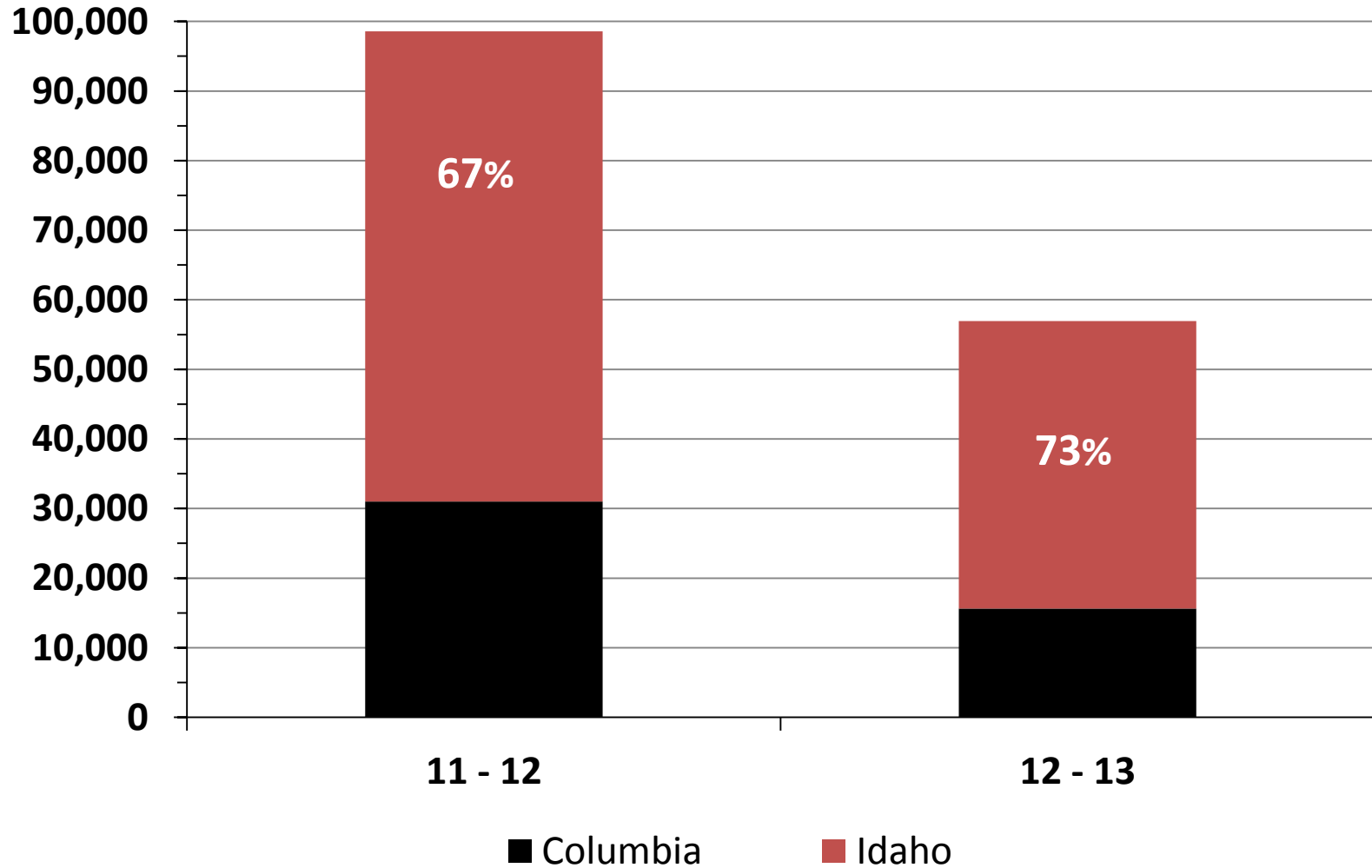
2012 Columbia River Harvest by Hatchery Stock



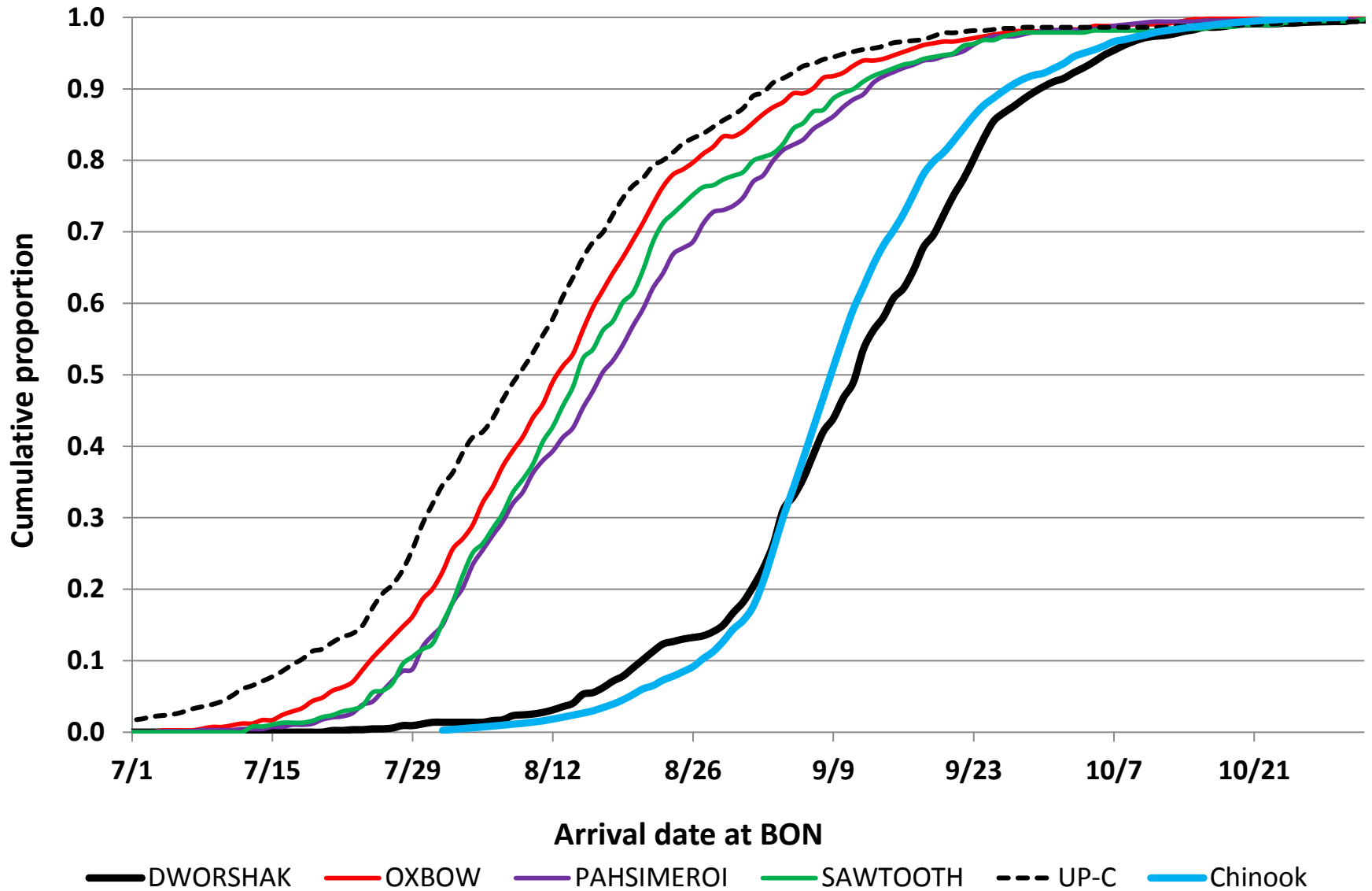
2011 Columbia River Harvest by Hatchery Stock



Idaho hatchery Steelhead harvest



Run timing at BON - 2011



Run timing at BON - 2012

