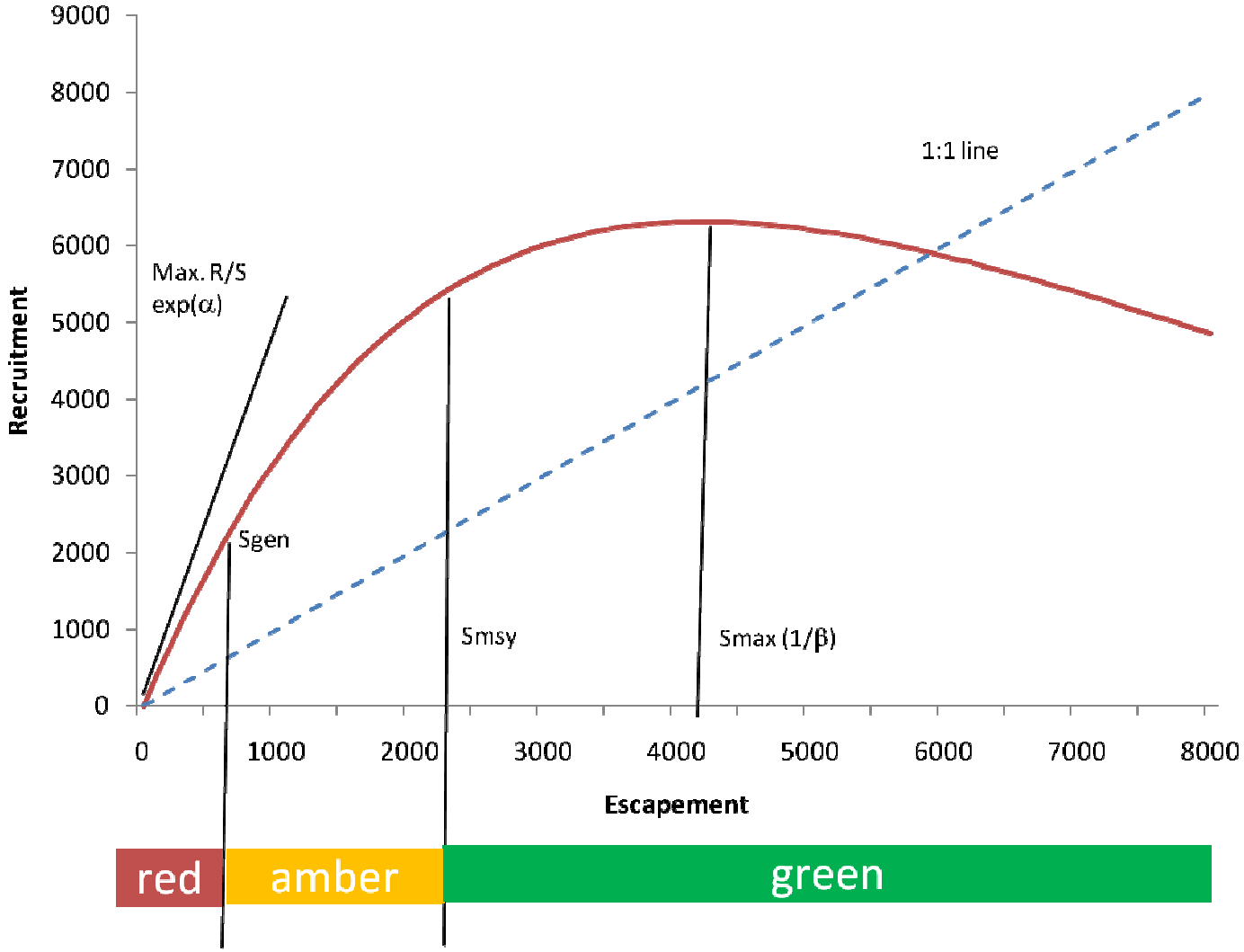
Preliminary Benchmark Analysis for Lake Sockeye Conservation Units (CUs) in the Skeena

Josh Korman

Benchmarks Defined from Stock-Recruitment Relationship



CU Name	N - SR	N - Age	PR-based Smax
Alastair	21	151 (2)	23,437
Aldrich			
Asitika			
Atna			
Azuklotz	13		5,933
Babine	23	17,489 (32)	1,808,245
Bear	6	46 (1)	40,532
Bulkley			
Damshilgwit	3	67 (1)	423
Dennis			
Ecstall/Lower			
Footsore			
Johanson			
Johnston	4		4,125
Kitsumkalum	19		20,531
Kitwancool	3	299 (4)	36,984
Kluatantan			
Kluayaz			
Lakelse	14	194 (1)	35,916
Maxan			
Mcdonell	6		4,072
Morice	15	98 (1)	191,362
Motase	10		1,764
Nilkitkwa			
Sicintine			
Slamgeesh			
Spawning			
Stephens	12		7,069
Sustut			
Swan	10	100 (1)	21,432
Tahlo/Morrison	18		44,587

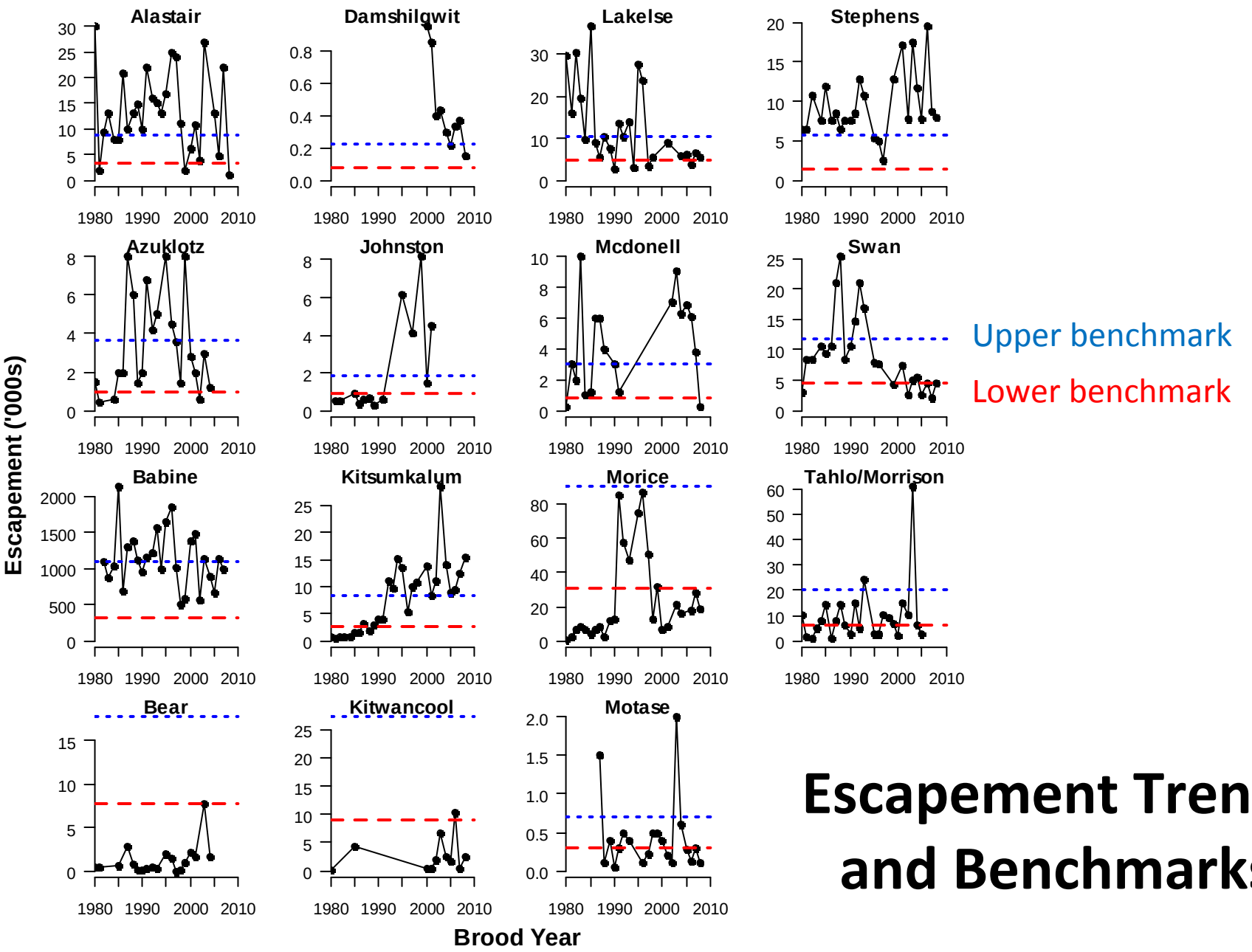
The Data

31 CUs

16 with escapement data

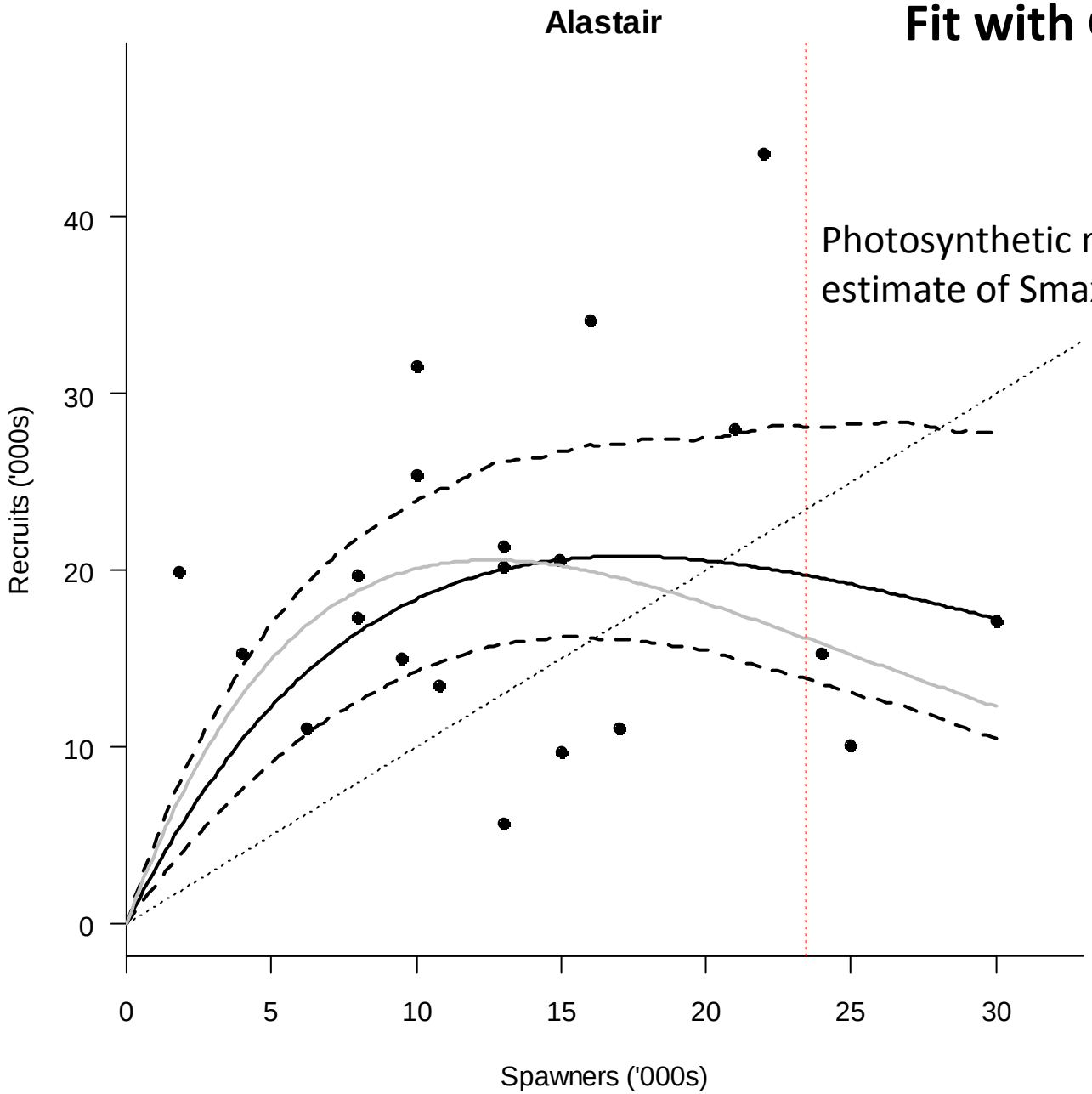
15 have escapement & recruitment data

8 have age data

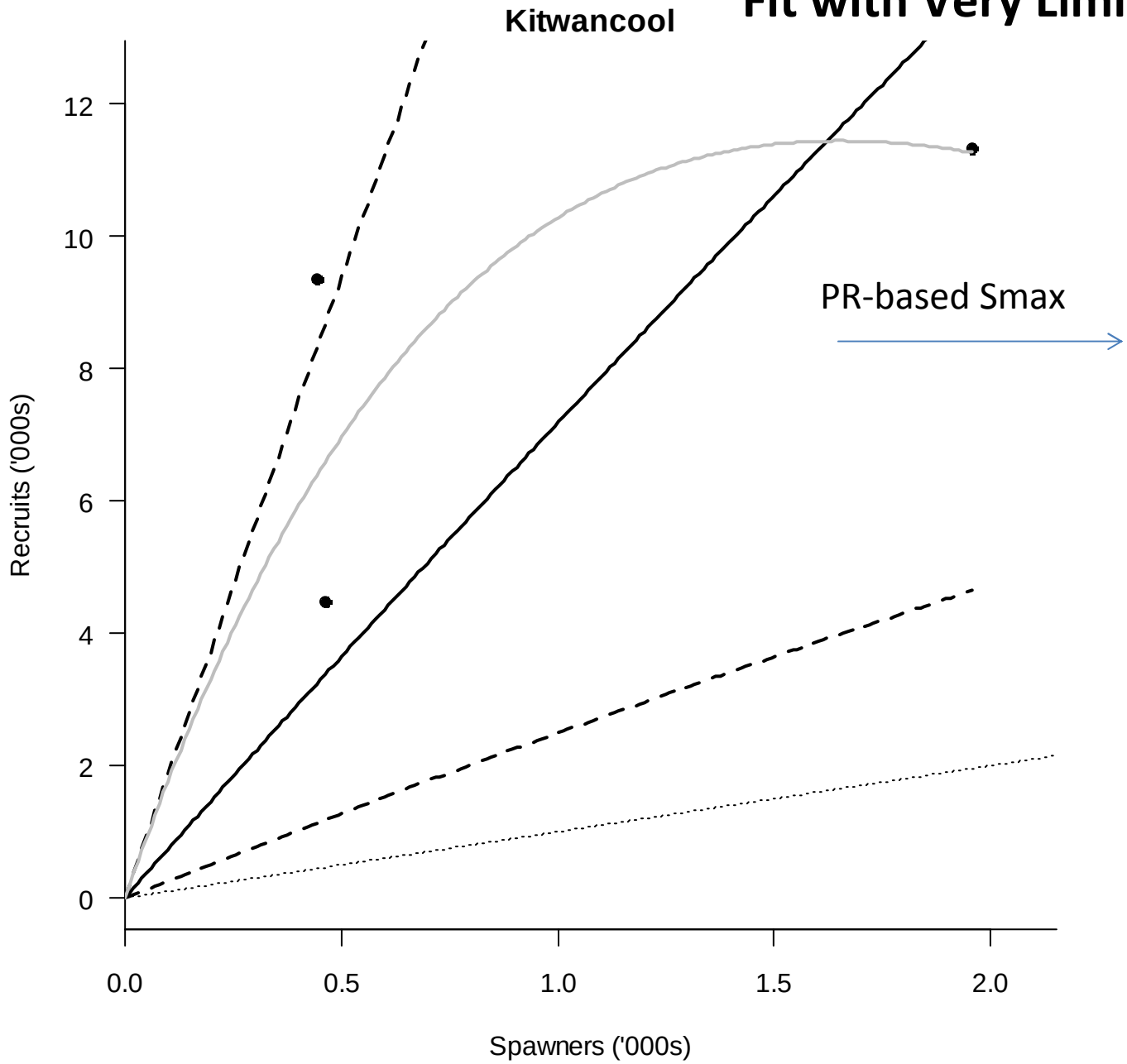


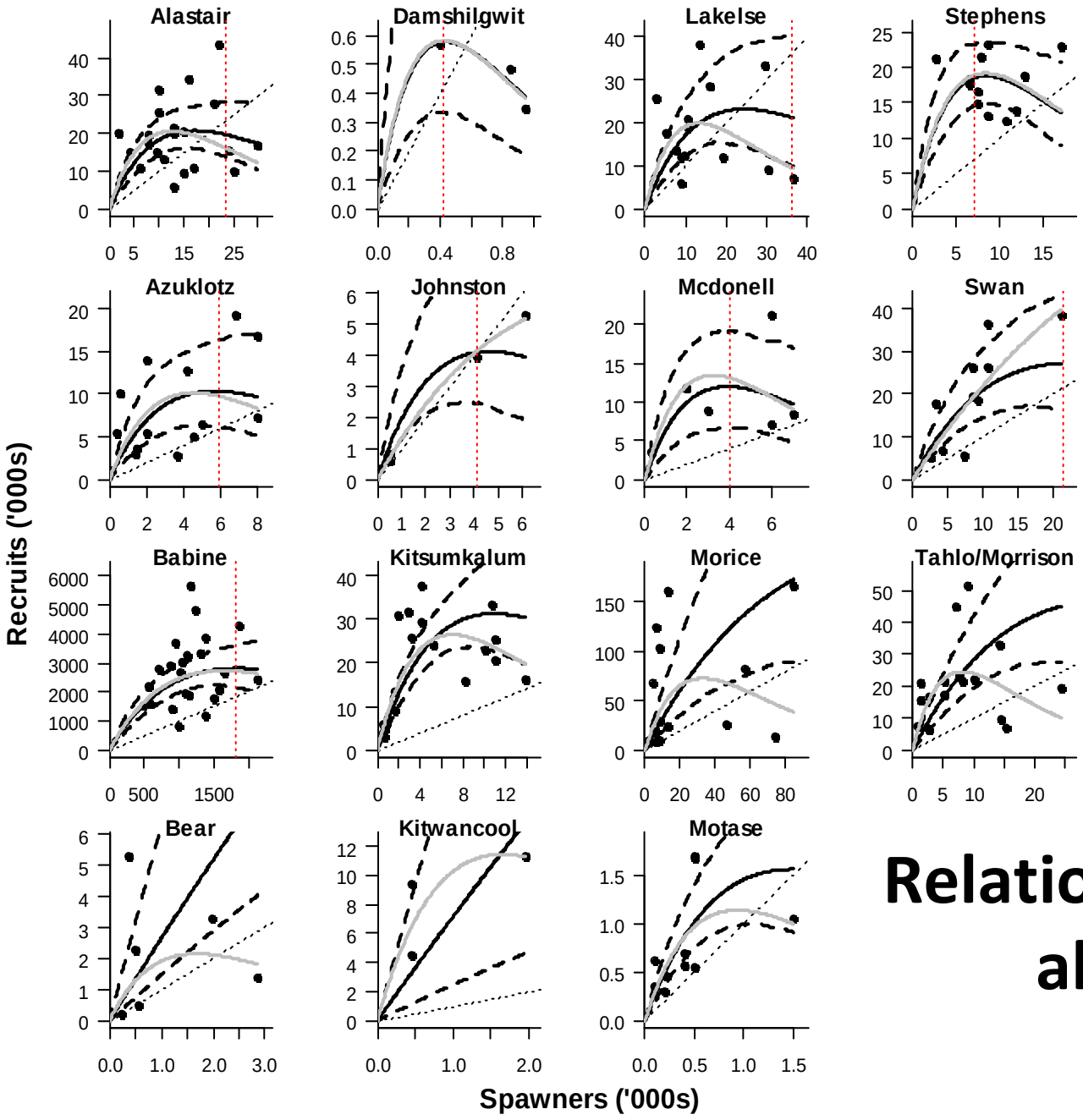
Escapement Trends and Benchmarks

Example of Stock-Recruitment Fit with Good Sample Size

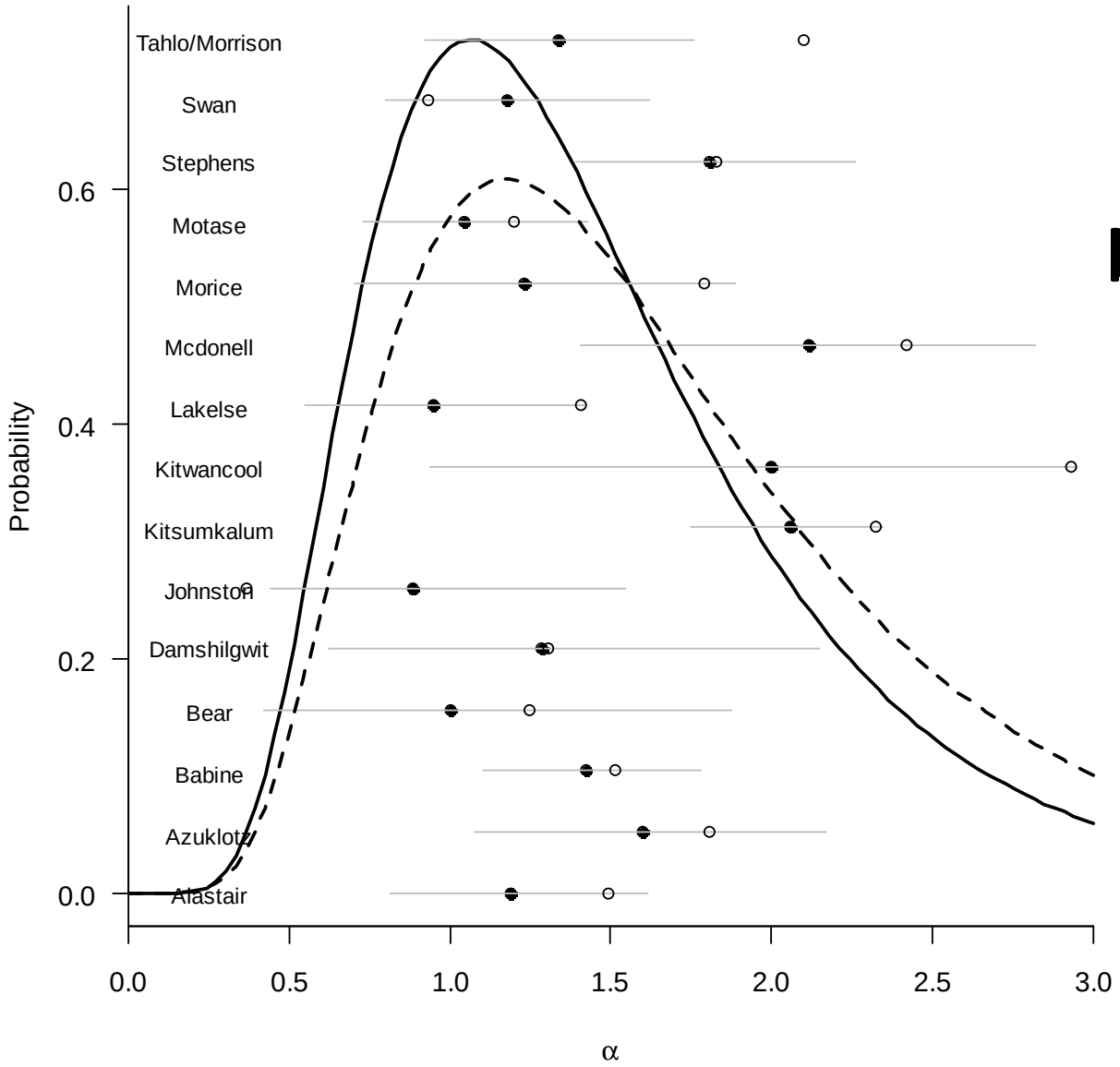


Example of Stock-Recruitment Fit with Very Limited Sample Size



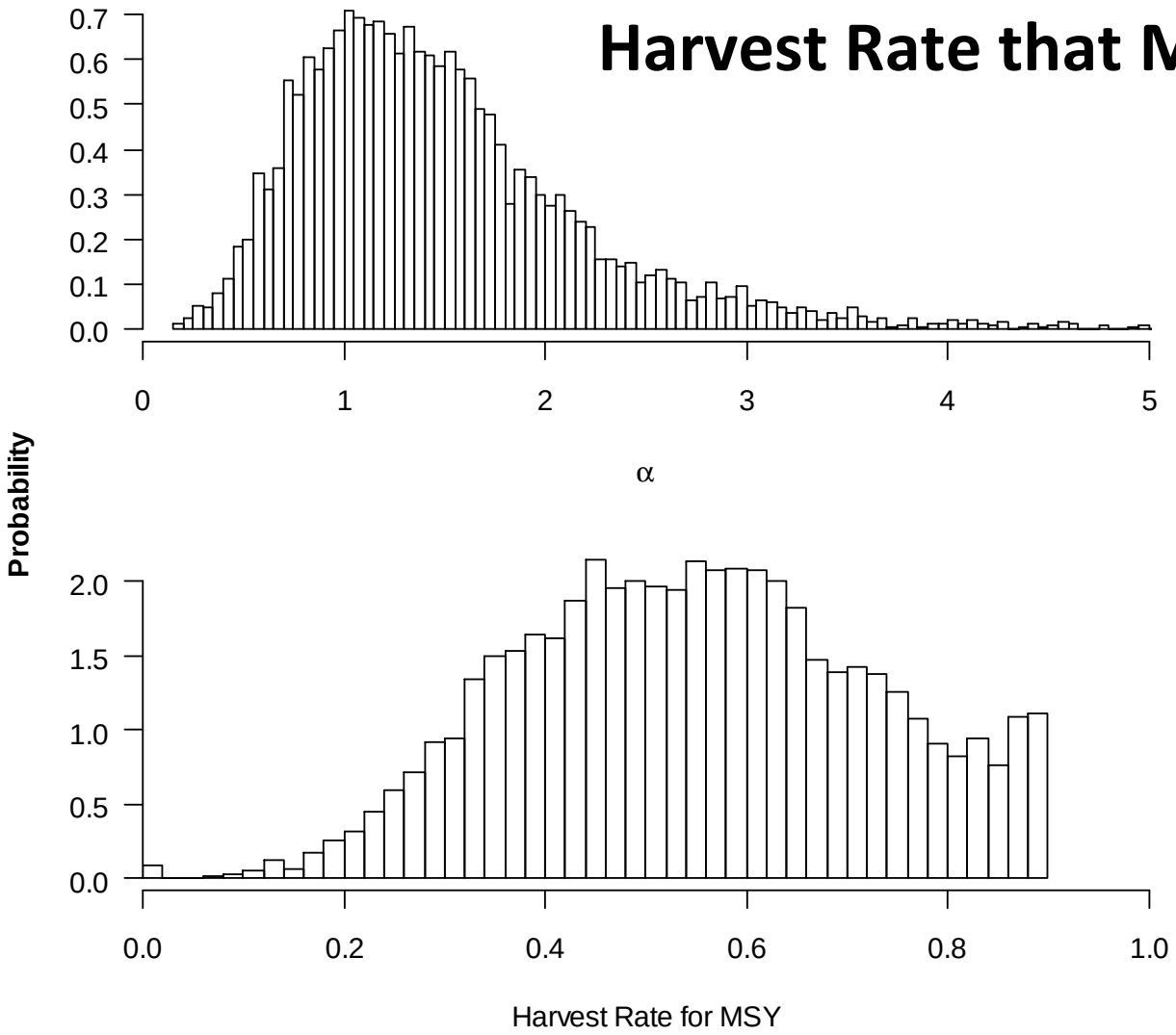


Relationships for all CUs



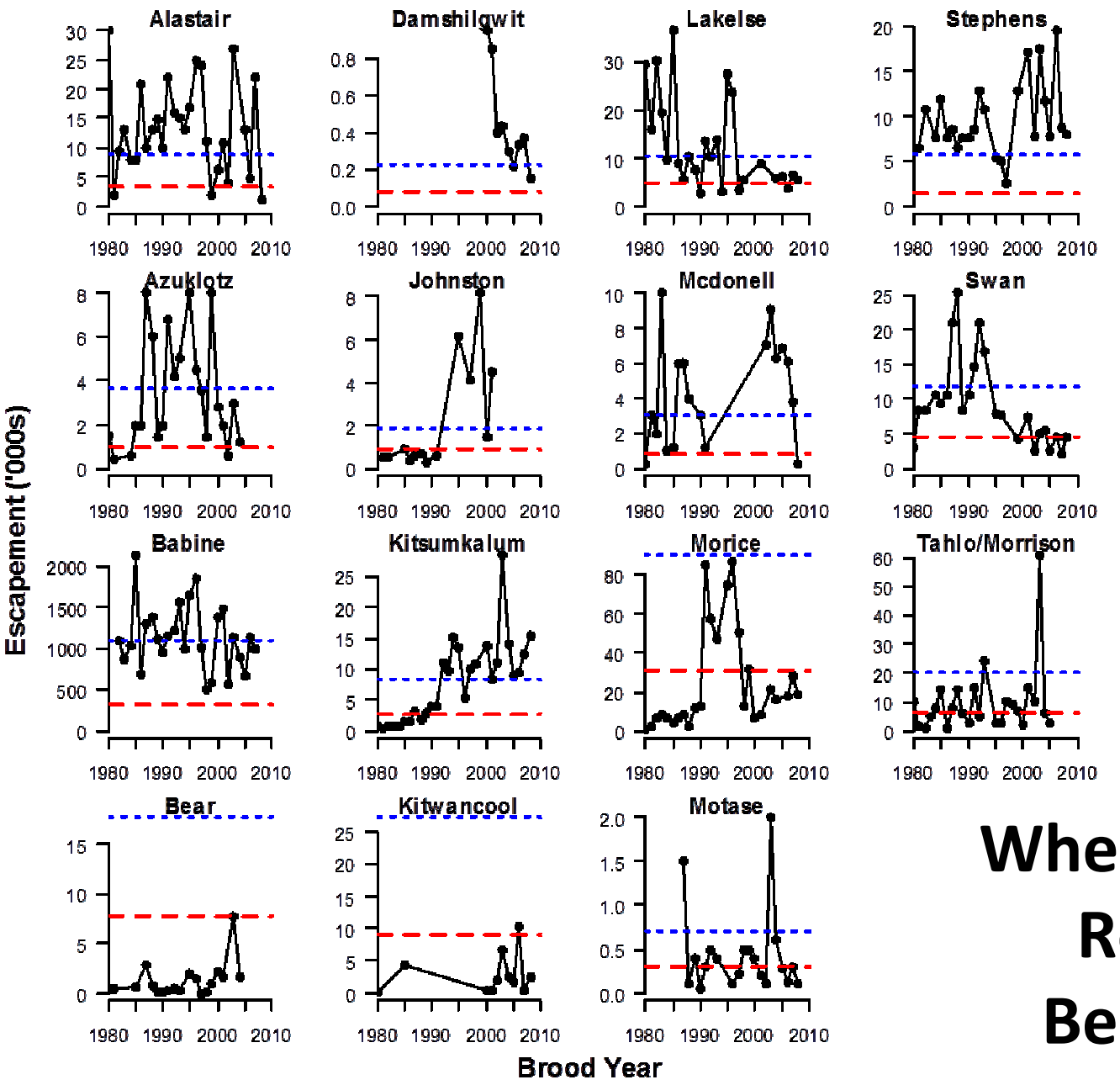
Estimates of log(productivity) by CU and for CUs Without Data

CUs Without Data: Estimates of Log(productivity) and Harvest Rate that Maximizes Catch

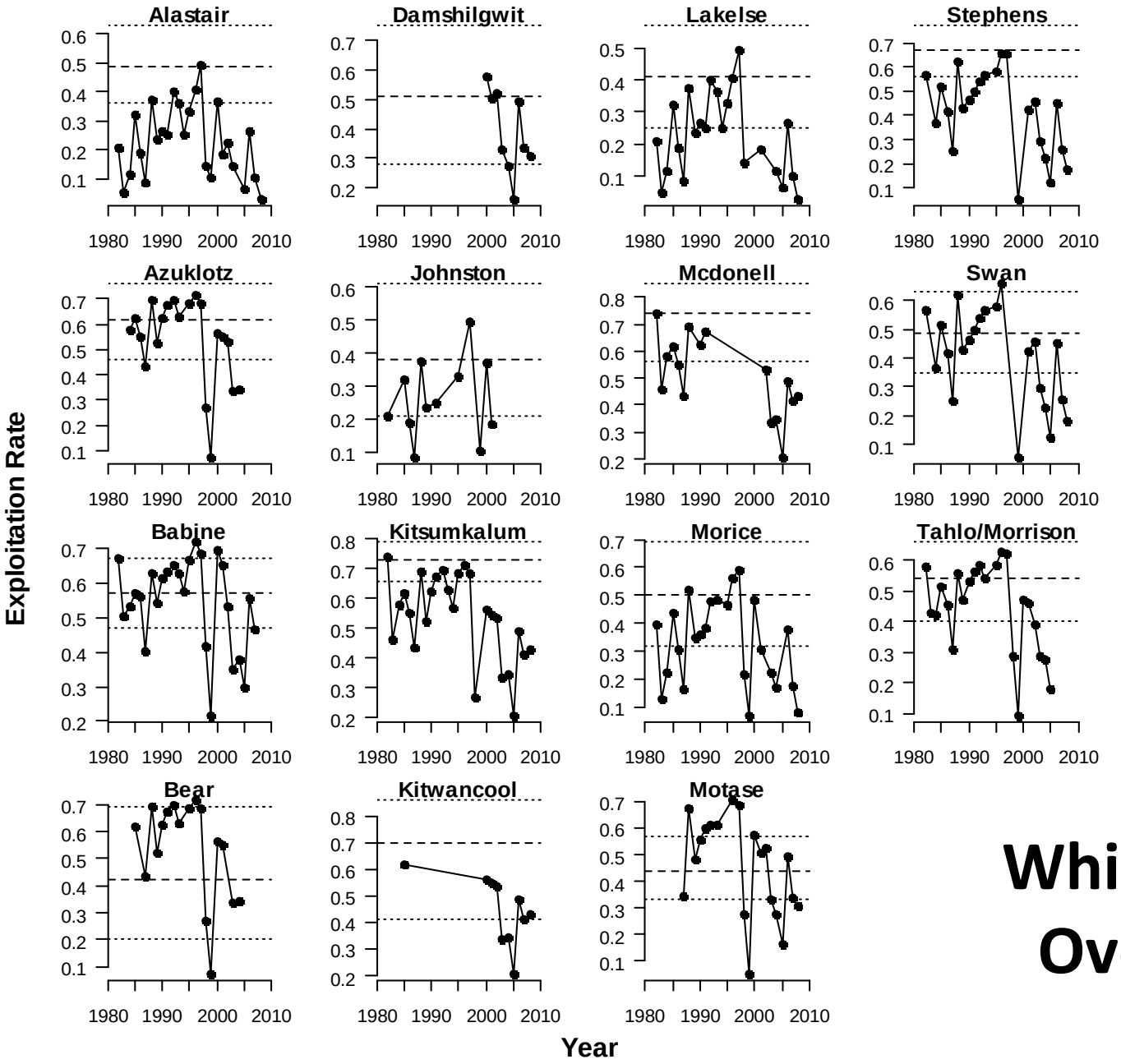


Benchmarks

CU	Benchmark	Mean	LCL	UCL		CU	Benchmark	Mean	LCL	UCL
Alastair	Sgen	3,279	1,738	5,700		Lakelse	Sgen	4,955	2,576	8,254
	Smsy	8,704	6,754	11,843			Smsy	10,479	6,635	17,447
	Smax	18,176	11,614	29,833			Smax	26,489	14,703	44,276
	Prod	3.35	2.30	5.00			Prod	2.65	1.70	4.10
	Uopt	0.49	0.36	0.63			Uopt	0.41	0.25	0.57
Aziklotz	Sgen	954	382	1,716		Mcdonell	Sgen	874	155	12,994
	Smsy	3,665	2,392	5,664			Smsy	3,003	2,100	4,280
	Smax	6,050	3,634	9,932			Smax	4,138	2,648	6,549
	Prod	5.14	2.90	8.80			Prod	8.79	4.10	16.70
	Uopt	0.62	0.46	0.76			Uopt	0.74	0.56	0.85
Babine	Sgen	320,890	158,398	571,466		Morice	Sgen	31,074	14,929	55,472
	Smsy	1,092,050	785,469	1,537,725			Smsy	90,029	40,495	169,725
	Smax	1,959,986	1,201,476	3,112,575			Smax	179,749	95,233	306,141
	Prod	4.21	3.00	5.90			Prod	3.59	2.00	6.60
	Uopt	0.57	0.47	0.67			Uopt	0.50	0.32	0.69
Bear	Sgen	7,771	3,739	14,200		Motase	Sgen	301	161	506
	Smsy	17,735	6,563	36,479			Smsy	701	427	1,148
	Smax	41,933	22,414	75,305			Smax	1,606	920	2,661
	Prod	2.93	1.50	6.50			Prod	2.89	2.10	4.20
	Uopt	0.42	0.20	0.69			Uopt	0.44	0.33	0.57
Damshilgwit	Sgen	81	31	129		Stephens	Sgen	1,371	578	2,207
	Smsy	227	144	316			Smsy	5,762	4,582	7,607
	Smax	456	293	684			Smax	8,707	6,153	12,968
	Prod	3.95	1.90	8.60			Prod	6.24	4.00	9.60
	Uopt	0.51	0.28	0.75			Uopt	0.67	0.56	0.77
Johnston	Sgen	907	461	1,439		Swan	Sgen	4,480	2,197	7,774
	Smsy	1,829	1,006	2,965			Smsy	11,912	7,236	19,206
	Smax	4,935	2,786	7,849			Smax	24,817	14,147	41,719
	Prod	2.54	1.60	4.70			Prod	3.31	2.20	5.00
	Uopt	0.38	0.21	0.61			Uopt	0.49	0.35	0.63
Kitsumkalum	Sgen	2,646	611	35,899		Tahlo Morrison	Sgen	6,397	2,699	12,644
	Smsy	8,473	5,709	14,169			Smsy	20,097	10,767	35,783
	Smax	11,715	7,341	20,555			Smax	37,775	18,997	71,280
	Prod	7.90	5.70	10.40			Prod	3.90	2.50	5.80
	Uopt	0.73	0.66	0.79			Uopt	0.54	0.40	0.66
Kitwancool	Sgen	9,052	1,477	10,366						
	Smsy	27,164	11,472	49,820						
	Smax	38,802	19,462	64,600						
	Prod	8.48	2.60	19.00						
	Uopt	0.70	0.41	0.86						

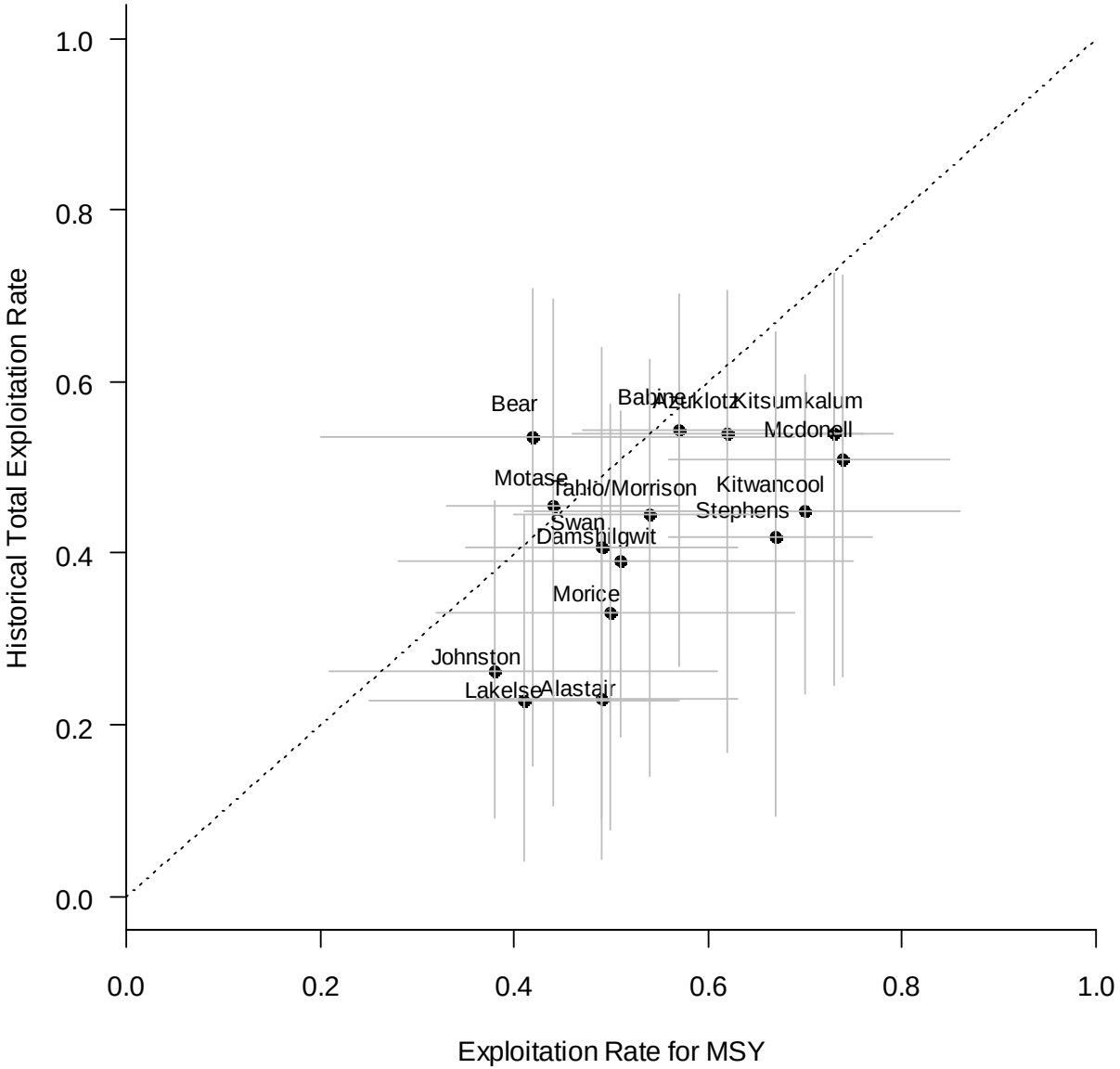


Where Are CUs in Relation to Benchmarks?

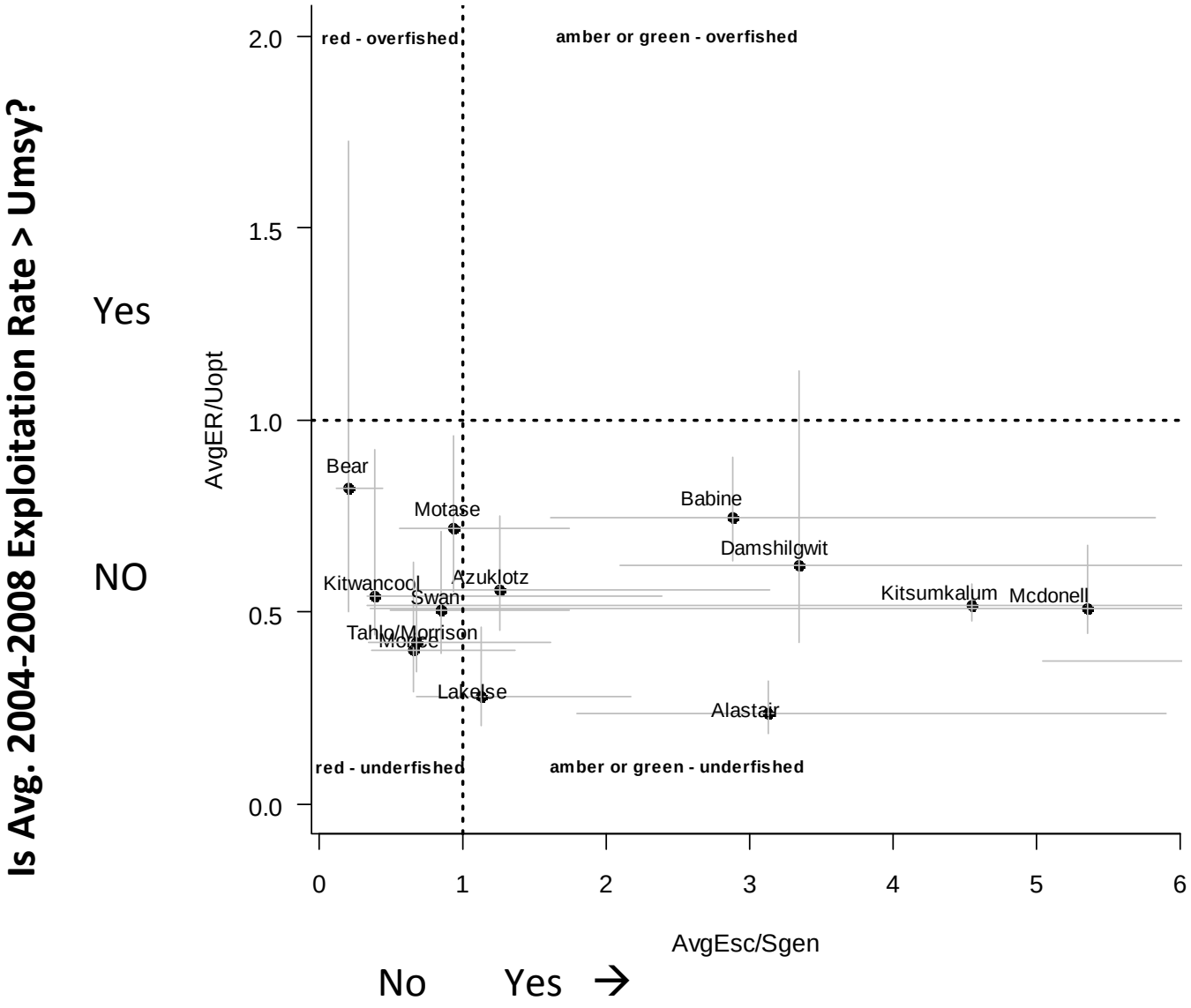


Which CUs are Overfished?

Historical Harvest Rates Have been Conservative for Most CUs



Current Status of 14 CUs



Yes

NO

Is Avg. 2004-2008 Exploitation Rate > Umsy?

No Yes →

Is Avg. 2004-2008 Escapement Above Lower Benchmark?

Effect of Using Average Age Composition on Estimates of Benchmarks

	Average Age Composition			Year-Specific Age Composition		
Babine						
	Mean	**LCL**	**UCL**	**Mean**	**LCL**	**UCL**
Sgen	240,879	141,036	392,949	375,605	131,093	1,151,051
Smsy	898,155	708,519	1,199,148	1,001,734	604,099	2,241,124
Smax	1,539,444	1,083,354	2,270,786	2,090,271	974,564	6,003,034
Prod	4.51	3.50	5.90	3.69	2.30	5.70
Uopt	0.59	0.51	0.67	0.52	0.36	0.66
Nass						
	Mean	**LCL**	**UCL**	**Mean**	**LCL**	**UCL**
Sgen	67,558	13,185	989,525	66,706	12,906	982,925
Smsy	229,575	162,762	355,000	221,080	156,573	352,835
Smax	316,629	198,528	552,986	306,962	194,396	559,613
Prod	8.51	5.00	13.40	8.44	4.90	13.70
Uopt	0.74	0.62	0.83	0.74	0.62	0.83

Conclusions

- 43%, or 6 of 14 CUs where status could be assessed (stock-recruit data and recent escapement data) were in ‘red’ zone.

- Very little evidence of overfishing for any CUs. Current low abundance for some likely caused by recent downturn in productivity.

- Wide variation in productivity among CUs, which leads to big trade-offs between yield and conservation in order to protect weak CUs.