Appendix 2

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
525 NE Oregon Street
PORTLAND, OREGON 97232-2737

June 30, 2004

MEMORANDUM FOR: Brian J. Brown, Assistant Regional Administrator
Hydropower Division

FROM: James D. Ruff, Chief JDR
Federal Columbia River Power System (FCRPS) Branch

SUBJECT: Estimation of Hydro Performance Standards for Snake River (SR) Fall Chinook Salmon.

As part of the FCRPS Branch staff modeling work for the gap analysis under the 2000 FCRPS Biological Opinion remand effort, we have been able to estimate recent juvenile fish survival performance through the Federal hydropower system for SR fall chinook salmon. Using the available empirical reach survival data and the best available dam passage parameters for SR fall chinook salmon, the SIMPAS model was used to estimate both in-river and system survival with "D" through the FCRPS for the years 2000, 2001, and 2003 for juvenile fish migrating as subyearlings.[1] Juvenile fish survival data, and thus estimates of system survival, are unavailable for the 2002 passage season due to poor fish condition.[2]

The 2000 FCRPS Biological Opinion identified three hydro *performance measures*: 1) adult survival through the FCRPS, 2) juvenile in-river survival, and 3) juvenile "system survival" (combined in-river and transportation survival, including 0.24 assumed differential survival of transported fish [D]). Two *performance standards* were specified for each *performance measure*: 1) the post-2000 average should be greater than the 1995-1999 average for each performance measure, and 2) the post-2000 average should indicate steady progress towards achievement of the reasonable and prudent alternative (RPA) survival rate expected by 2010 for each performance measure. The first evaluation is to occur in 2005. Our preliminary understanding of progress towards achieving these performance standards for SR fall chinook salmon is shown in Table 1. The SIMPAS model output summaries in support of the 2000, 2001, and 2003 SR fall chinook salmon juvenile survival estimates are attached. This

[1]Also, not included in this analysis are SR fall chinook salmon migrating as yearlings. Recent data on SR fall chinook salmon suggest that 40% to 50% of the total adult returns to Lower Granite came from fish that migrated as yearlings (W. Connor, USFWS, pers. comm. to P. Wagner, NOAA Fisheries, June 21, 2004). Our SIMPAS modeling analysis does not include these yearling migrants, nor do the performance standards, due to the fact that there are no empirical estimates of juvenile fish survival for the yearling migrants.

[2]In 2002, Lyons Ferry Hatchery fish, which were being used to make a reach survival estimate, suffered an outbreak of bacterial gill disease that stunted fish development (Ferguson 2003). The hatchery fish that were designated for marking for the survival study were in poor condition and thus could not be used in 2002 to provide a valid survival estimate.

information is preliminary and warrants further discussion with the Action Agencies and others regarding derivation and performance standard measurement tools.

Table 1.

	Preliminary Estimates of Adult Survival, in %	**Preliminary Estimates of Juvenile In-River Survival, in %**	**Preliminary Estimates of Juvenile System Survival With D=0.24, in %**
1995-1999 Average	**71.0**	**10.2**	**11.7**
2010 RPA Survival	**74.0**	**14.3**	**12.7**
2000 Estimated	N/A	11.0	9.9
2001 Estimated	92.3	1.5	4.2
2002 Estimated	83.3	N/A	N/A
2003 Estimated	N/A	13.5	11.1

Adult survival estimates through the FCRPS are available in only two years. The adult survival rates for 2001 and 2002 indicate that both the 1994-99 and 2010 performance standards are being met and exceeded for this life stage.

Juvenile in-river survival has been greater than the 1994-99 average in two out of three available years, but was much lower than that average in the 2001 low-flow and reduced-spill year. The 2010 in-river survival performance standard has not yet been met, and is not expected to be met for six more years. However, further improvements in in-river survival will be necessary in future years to achieve the 2010 performance standard.

Juvenile system survival has been below both the 1995-99 and 2010 performance standards in each of the three available years. As described above, the 2010 system survival performance standard is not expected to be met for six more years. Juvenile system survival was close to the 1995-99 average in one year, but was much lower in the 2001 low-flow and reduced-spill year. Continued improvements in system survival will be necessary to achieve the 2010 system performance standard.

The Opinion contemplates that the Action Agencies will be making changes over time to improve juvenile survival. It recognizes that not all of those improvements can be achieved immediately since they may require structural changes at the dams and further research. Progress on the removable spillway weir (RSW) at Lower Granite Dam in recent years, the initial completion and testing of the corner collector at Bonneville Dam and the spillway training wall at The Dalles Dam in 2004, the scheduled completion of an RSW at Ice Harbor Dam in 2005, and the commitment of the Action Agencies to pursue installation of RSWs in the near future at Little Goose and Lower Monumental Dams are the kinds of improvements likely to bring the Action Agencies closer to meeting the performance standards.

Reference

Ferguson, J.W. 2003. Memorandum to B. Brown, NOAA Fisheries, regarding 2002 survival estimates for Lyons Ferry Hatchery fall chinook salmon. Northwest Fisheries Science Center, Seattle, WA. July 22, 2003.

Attachment

Attachment 1

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Enter data in BLUE shaded text only. Check the RED TABS for specific instructions.

Species macros: Ch0=Ctrl A, Ch1=Ctrl B, Sthd=Ctrl C.

The model is set up for fall chinook.

- Click the button to print this
- Click to setup for yearling chino
- Click to setup for subyearling ch
- Click to setup for steelhead.

Fish Stock:	Mixed stock fall chinook. 2000 passage year.											
Scenario:	Retro Operation.											
Input at head of Lower Granite Pool:	1	Input at mouth of Snake River:			1							
FLOW INPUTS	LGR	LGS	LMN	IHR	SR Mouth	MCN	JDA	TDA	Project	BON PI	BON PII	To Salt
FIRST DAILY PERIOD (Typically Night)												
Spill Efficiency	0.0	1.5	0.0	1.1		1.0	1.5	1.6	1.0			
Total Flow	29.3	29.7	35.0	35.0		150.1	151.5	156.0	165.4			
Total Spill Flow	0.0	0.1	0.0	30.1		4.0	83.9	59.5	101.3			
Spill Flow Through Raised Crest	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0			
SECOND DAILY PERIOD (Typically Day)												
Spill Efficiency	0.0	1.5	0.0	1.1		1.0	2.5	1.6	1.0			
Total Flow	37.5	37.9	35.0	35.0		156.5	155.6	156.0	159.4			
Total Spill Flow (standard & raised crest bays)	0.0	0.4	0.0	30.1		7.5	27.6	59.5	87.0			
Spill Flow Through Raised Crest	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0			
PASSAGE AND SURVIVAL INPUTS												
Diel (% of fish passing during first period spill hours)	0.68	0.68	0.83	0.50		0.68	0.80	0.50	n/a			
FGE (Both Periods)	0.53	0.53	0.49	0.54		0.62	0.32	0.03		0.09	0.28	
Sluiceway or Surface Bypass Collector Efficiency	0.00	0.00	0.00	0.00		0.00	0.00	0.27		0.14	0.00	
Bonneville Data ---------->						PH Priority (PH1=1, PH2=2)			1			
Bonneville Data ---------->						Capped Spill Hours			16			
Turbine Survival	0.90	0.90	0.87	0.89		0.82	0.72	0.84		0.90	0.94	
Spillway Survival	0.98	0.98	0.98	0.89		0.95	1.00	0.92	0.98			
Raised Crest Survival	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00			
Bypass Survival	0.98	0.98	0.98	1.00		0.90	0.92			0.82	0.98	
Sluiceway or Surface Bypass Collector Survival	0.00	0.00	0.00	0.00		0.00	0.00	0.93		0.95	0.00	
Pool Predation Adjustment Factor	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00			1.00
Pool Survival	0.506	0.822	0.824	0.978	1.000	0.996	0.797	0.931	0.874			1.000
GBD Mortality			Snake River Reach		0.00					L. Columbia Reach		0.00
Reach Survival (BON to saltwater for transported fish)												1.00
Transport Survival (in barge)												0.98
D Value for Transported Fish				Hatchery D Value:		0.00	Mixed D Value		0.24	Wild D Value		0.00

OUTPUTS	LGR	LGS	LMN	IHR	SR Mouth	MCN	JDA	TDA	BON Project	BON PI	BON PII	System Average
Fish Passage Efficiency (FPE)	0.530	0.534	0.490	0.975		0.633	0.832	0.717	0.662			0.672
Daily average spill	0.000	0.007	0.000	0.860		0.038	0.363	0.381	0.569			0.277
First period average spill	0.000	0.003	0.000	0.860		0.027	0.554	0.381	0.612			0.305
Second period average spill	0.000	0.011	0.000	0.860		0.048	0.177	0.381	0.546			0.253
Turbine Passage	0.470	0.466	0.510	0.025		0.367	0.168	0.283	0.338	0.338	0.000	0.328
Bypass Passage (and/or Collection)	0.530	0.525	0.490	0.029		0.599	0.079	0.009	0.033			0.287
Sluiceway or Surface Bypass Passage	0.000	0.000	0.000	0.000		0.000	0.000	0.108	0.060			0.021
Spill Passage (Normal Bays Only)	0.000	0.009	0.000	0.946		0.033	0.753	0.601	0.568			0.364
Raised Crest Spill Passage	0.000	0.000	0.000	n/a		0.000	0.000	n/a	n/a			0.000

TRANSPORT ESTIMATES	LGR	LGS	LMN	IHR	SRM	MCN	JDA	TDA	BON	To Salt Survival Total	In-River	Transp.
SR pop arriving w/ full transport (LGR, LGS, LMN, MCN)							0.006	0.006	0.004	0.4013	0.0041	0.3972
SR pop arriving w/ 3 collector dams (LGR, LGS, LMN)				0.027	0.024	0.024	0.016	0.014	0.01135	0.3941	0.0107	0.3833
SR pop arriving w/ 2 collector dams (LGR, LGS)			0.062	0.056	0.050	0.049	0.034	0.030	0.024	0.3760	0.0224	0.3535
SR pop arriving w/ 1 collector dam (LGR)		0.176										
SR pop collected at...	0.268	0.092	0.030			0.014						
Cumulative SR pop collected	0.268	0.361	0.391			0.405						
Mid-C pop arriving w/ collection at MCN							0.264	0.232	0.182	0.7574	0.1724	0.5850
Mid-C pop collected at...						0.597						

Total To Salt Survival		
w/D Value Hatchery	w/D Value Mixed	w/D Value Wild
	0.0994	
0.0000		0.0000

INRIVER SURVIVAL ESTIMATES	LGR	LGS	LMN	IHR	SRM	MCN	JDA	TDA	BON	To Salt	Average	Cumulative
Dam plus Pool Survival (Project Survival)	0.477	0.775	0.759	0.869		0.869	0.751	0.836	0.827		0.7704	
Dam Survival	0.9424	0.9427	0.9214	0.8885		0.8723	0.9430	0.8985	0.9458		0.9193	0.5084
Turbine Mortality at Individual Dams	0.047	0.047	0.069	0.003		0.066	0.047	0.045	0.034		0.0447	
Cumulative Survival w/o transport (SR Stocks)	0.506	0.392	0.305	0.274	0.244	0.243	0.169	0.148	0.116	0.1101		
Cumulative Survival w/o transport (Mid-C Stocks)					1.000	0.996	0.692	0.608	0.477	0.4516		
To Salt Survival From Head Of Each Pool w/o transport						0.452	0.520	0.692	0.827			

Enter data in BLUE shaded text only. Check the RED TABS for specific instructions.

Species macros: Ch0=Ctrl A, Ch1=Ctrl B, Sthd=Ctrl C.

The model is set up for fall chinook.

- Click the button to print this
- Click to setup for yearling chino
- Click to setup for subyearling ch
- Click to setup for steelhead.

Fish Stock:	Mixed stock fall chinook. 2001 passage year.											
Scenario:	Retro Operation.											
Input at head of Lower Granite Pool:	1	Input at mouth of Snake River:			1							
FLOW INPUTS	LGR	LGS	LMN	IHR	SR Mouth	MCN	JDA	TDA		BON		To Salt
FIRST DAILY PERIOD (Typically Night)									Project	PI	PII	
Spill Efficiency	0.0	0.0	0.0	0.0		0.0	0.0	1.8	1.0			
Total Flow	23.0	23.9	25.0	25.0		83.0	81.9	91.0	95.7			
Total Spill Flow	0.0	0.0	0.0	0.0		0.0	0.0	18.6	24.9			
Spill Flow Through Raised Crest	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0			
SECOND DAILY PERIOD (Typically Day)												
Spill Efficiency	1.5	1.5	0.0	0.0		0.0	0.0	1.8	1.0			
Total Flow	27.4	27.3	25.0	25.0		97.6	96.1	91.0	98.1			
Total Spill Flow (standard & raised crest bays)	0.3	0.1	0.0	0.0		0.0	0.0	18.6	18.9			
Spill Flow Through Raised Crest	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0			
PASSAGE AND SURVIVAL INPUTS												
Diel (% of fish passing during first period spill hours)	0.68	0.68	0.83	0.68		0.68	0.80	0.50	n/a			
FGE (Both Periods)	0.53	0.53	0.49	0.54		0.62	0.32	0.03		0.09	0.28	
Sluiceway or Surface Bypass Collector Efficiency	0.00	0.00	0.00	0.00		0.00	0.00	0.32		0.06	0.00	
Bonneville Data ---------->						PH Priority (PH1=1, PH2=2)			2			
Bonneville Data ---------->						Capped Spill Hours			16			
Turbine Survival	0.90	0.90	0.87	0.89		0.82	0.72	0.84		0.90	0.94	
Spillway Survival	0.98	0.98	0.98	0.89		0.95	0.96	0.92	0.98			
Raised Crest Survival	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00			
Bypass Survival	0.98	0.98	0.98	1.00		0.90	0.92			0.82	0.98	
Sluiceway or Surface Bypass Collector Survival	0.00	0.00	0.00	0.00		0.00	0.00	0.93		0.82	0.00	
Pool Predation Adjustment Factor	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00			1.00
Pool Survival	0.223	0.811	0.760	0.770	1.000	0.841	0.605	0.854	0.744			1.000
GBD Mortality			Snake River Reach		0.00					L. Columbia Reach		0.00
Reach Survival (BON to saltwater for transported fish)												1.00
Transport Survival (in barge)												0.98
D Value for Transported Fish				Hatchery D Value:		0.00	Mixed D Value		0.24	Wild D Value		0.00

OUTPUTS	LGR	LGS	LMN	IHR	SR Mouth	MCN	JDA	TDA	BON			System
									Project	PI	PII	Average
Fish Passage Efficiency (FPE)	0.532	0.531	0.490	0.540		0.620	0.320	0.583	0.435			0.506
Daily average spill	0.006	0.002	0.000	0.000		0.000	0.000	0.204	0.215			0.053
First period average spill	0.000	0.000	0.000	0.000		0.000	0.000	0.204	0.260			0.058
Second period average spill	0.011	0.004	0.000	0.000		0.000	0.000	0.204	0.193			0.051
Turbine Passage	0.468	0.469	0.510	0.460		0.380	0.680	0.417	0.565	0.000	0.565	0.494
Bypass Passage (and/or Collection)	0.527	0.529	0.490	0.540		0.620	0.320	0.013	0.220			0.407
Sluiceway or Surface Bypass Passage	0.000	0.000	0.000	0.000		0.000	0.000	0.202	0.000			0.025
Spill Passage (Normal Bays Only)	0.005	0.002	0.000	0.000		0.000	0.000	0.368	0.215			0.074
Raised Crest Spill Passage	0.000	0.000	0.000	n/a		0.000	0.000	n/a	n/a			0.000

TRANSPORT ESTIMATES	LGR	LGS	LMN	IHR	SRM	MCN	JDA	TDA	BON	To Salt Survival		
										Total	In-River	Transp.
SR pop arriving w/ full transport (LGR, LGS, LMN, MCN)							0.001	0.001	0.001	0.1715	0.0005	0.1710
SR pop arriving w/ 3 collector dams (LGR, LGS, LMN)				0.008	0.008	0.007	0.004	0.002	0.00156	0.1684	0.0015	0.1669
SR pop arriving w/ 2 collector dams (LGR, LGS)			0.025	0.018	0.017	0.014	0.007	0.005	0.003	0.1581	0.0031	0.1550
SR pop arriving w/ 1 collector dam (LGR)		0.077										
SR pop collected at...	0.117	0.041	0.012			0.004						
Cumulative SR pop collected	0.117	0.158	0.170			0.174						
Mid-C pop arriving w/ collection at MCN							0.159	0.106	0.070	0.5782	0.0671	0.5111
Mid-C pop collected at...						0.521						

Total To Salt Survival		
w/D Value Hatchery	w/D Value Mixed	w/D Value Wild
	0.0416	
0.0000		0.0000

INRIVER SURVIVAL ESTIMATES	LGR	LGS	LMN	IHR	SRM	MCN	JDA	TDA	BON	To Salt	Average	Cumulative
Dam plus Pool Survival (Project Survival)	0.210	0.764	0.700	0.731		0.731	0.475	0.758	0.712		0.6352	
Dam Survival	0.9426	0.9425	0.9214	0.9494		0.8696	0.7843	0.8877	0.9574		0.9069	0.4505
Turbine Mortality at Individual Dams	0.047	0.047	0.069	0.051		0.068	0.190	0.067	0.034		0.0716	
Cumulative Survival w/o transport (SR Stocks)	0.223	0.170	0.122	0.087	0.082	0.069	0.036	0.024	0.016	0.0154		
Cumulative Survival w/o transport (Mid-C Stocks)					1.000	0.841	0.443	0.296	0.196	0.1873		
To Salt Survival From Head Of Each Pool w/o transport						0.187	0.256	0.539	0.712			

Enter data in BLUE shaded text only. Check the RED TABS for specific instructions.

Species macros: Ch0=Ctrl A, Ch1=Ctrl B, Sthd=Ctrl C.

The model is set up for fall chinook.

- Click the button to print this
- Click to setup for yearling chino
- Click to setup for subyearling ch
- Click to setup for steelhead.

Fish Stock:	Mixed stock fall chinook. 2003 passage year.											
Scenario:	Retro Operation.											
Input at head of Lower Granite Pool:	1	Input at mouth of Snake River:			1							
FLOW INPUTS	LGR	LGS	LMN	IHR	SR Mouth	MCN	JDA	TDA	Project	BON PI	BON PII	To Salt
FIRST DAILY PERIOD (Typically Night)												
Spill Efficiency	1.5	0.0	0.0	1.8		0.0	1.7	1.6	1.0			
Total Flow	30.1	30.7	32.0	32.0		128.7	128.9	136.0	136.0			
Total Spill Flow	0.2	0.0	0.0	14.4		0.0	60.0	51.0	106.0			
Spill Flow Through Raised Crest	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0			
SECOND DAILY PERIOD (Typically Day)												
Spill Efficiency	1.5	0.0	0.0	1.8		0.0	1.8	1.6	1.0			
Total Flow	34.1	33.2	32.0	32.0		141.2	136.6	136.0	136.0			
Total Spill Flow (standard & raised crest bays)	0.3	0.0	0.0	14.4		0.0	9.2	51.0	75.0			
Spill Flow Through Raised Crest	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0			
PASSAGE AND SURVIVAL INPUTS												
Diel (% of fish passing during first period spill hours)	0.68	0.68	0.83	0.50		0.68	0.80	0.50	n/a			
FGE (Both Periods)	0.53	0.53	0.49	0.54		0.62	0.32	0.00		0.09	0.28	
Sluiceway or Surface Bypass Collector Efficiency	0.00	0.00	0.00	0.00		0.00	0.00	0.27		0.06	0.00	
Bonneville Data ---------->						PH Priority (PH1=1, PH2=2)			2			
Bonneville Data ---------->						Capped Spill Hours			16			
Turbine Survival	0.90	0.90	0.87	0.89		0.82	0.72	0.84		0.90	0.94	
Spillway Survival	0.93	0.98	0.96	0.96		0.95	0.96	0.92	0.98			
Raised Crest Survival	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00			
Bypass Survival	0.98	0.98	0.98	1.00		0.90	0.92			0.82	0.98	
Sluiceway or Surface Bypass Collector Survival	0.00	0.00	0.00	0.00		0.00	0.00	0.89		0.82	0.00	
Pool Predation Adjustment Factor	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00			1.00
Pool Survival	0.550	0.882	0.889	0.892	1.000	0.983	0.814	0.937	0.886			1.000
GBD Mortality			Snake River Reach		0.00					L. Columbia Reach		0.00
Reach Survival (BON to saltwater for transported fish)												1.00
Transport Survival (in barge)												0.98
D Value for Transported Fish				Hatchery D Value:		0.00	Mixed D Value		0.24	Wild D Value		0.00

OUTPUTS	LGR	LGS	LMN	IHR	SR Mouth	MCN	JDA	TDA	BON Project	BON PI	BON PII	System Average
Fish Passage Efficiency (FPE)	0.535	0.530	0.490	0.913		0.620	0.777	0.701	0.732			0.662
Daily average spill	0.008	0.000	0.000	0.450		0.000	0.261	0.375	0.627			0.215
First period average spill	0.007	0.000	0.000	0.450		0.000	0.465	0.375	0.779			0.260
Second period average spill	0.009	0.000	0.000	0.450		0.000	0.067	0.375	0.551			0.182
Turbine Passage	0.465	0.470	0.510	0.087		0.380	0.223	0.299	0.268	0.000	0.268	0.338
Bypass Passage (and/or Collection)	0.524	0.530	0.490	0.103		0.620	0.105	0.000	0.104			0.309
Sluiceway or Surface Bypass Passage	0.000	0.000	0.000	0.000		0.000	0.000	0.111	0.000			0.014
Spill Passage (Normal Bays Only)	0.011	0.000	0.000	0.810		0.000	0.672	0.591	0.627			0.339
Raised Crest Spill Passage	0.000	0.000	0.000	n/a		0.000	0.000	n/a	n/a			0.000

TRANSPORT ESTIMATES	LGR	LGS	LMN	IHR	SRM	MCN	JDA	TDA	BON	To Salt Survival Total	To Salt Survival In-River	To Salt Survival Transp.
SR pop arriving w/ full transport (LGR, LGS, LMN, MCN)							0.007	0.006	0.005	0.4501	0.0047	0.4454
SR pop arriving w/ 3 collector dams (LGR, LGS, LMN)				0.031	0.029	0.029	0.020	0.017	0.01365	0.4410	0.0132	0.4278
SR pop arriving w/ 2 collector dams (LGR, LGS)			0.078	0.064	0.061	0.060	0.043	0.036	0.029	0.4179	0.0276	0.3903
SR pop arriving w/ 1 collector dam (LGR)		0.208										
SR pop collected at...	0.288	0.110	0.038			0.018						
Cumulative SR pop collected	0.288	0.398	0.437			0.454						
Mid-C pop arriving w/ collection at MCN							0.249	0.210	0.166	0.7580	0.1611	0.5970
Mid-C pop collected at...						0.609						

Total To Salt Survival w/D Value Hatchery	w/D Value Mixed	w/D Value Wild
	0.1116	
0.0000		0.0000

INRIVER SURVIVAL ESTIMATES	LGR	LGS	LMN	IHR	SRM	MCN	JDA	TDA	BON	To Salt	Average	Cumulative
Dam plus Pool Survival (Project Survival)	0.518	0.831	0.819	0.854		0.854	0.732	0.837	0.859		0.7881	
Dam Survival	0.9423	0.9424	0.9214	0.9580		0.8696	0.8990	0.8928	0.9693		0.9243	0.5303
Turbine Mortality at Individual Dams	0.046	0.047	0.069	0.010		0.068	0.062	0.048	0.016		0.0458	
Cumulative Survival w/o transport (SR Stocks)	0.550	0.457	0.383	0.314	0.301	0.296	0.210	0.177	0.140	0.1354		
Cumulative Survival w/o transport (Mid-C Stocks)					1.000	0.983	0.696	0.586	0.464	0.4495		
To Salt Survival From Head Of Each Pool w/o transport						0.450	0.526	0.719	0.859			