A Simple Spreadsheet Model for Chinook Salmon in the San Francisco Bay Estuary

DeltaKeeper

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Model Development

- Developed by Dan B. Odenweller over the end of year holidays in 2002. Openly distributed for review and comment to members of the WRCS PWT during 2003/04.

- Model structure designed to use existing, already accepted elements, to resolve questions about adult population level effects of management actions.

- Due to changes in WRCS baseline, we only have two year pairs to run. I have chosen the 2000-2003 WRCS year pair for this exercise.

The Model Elements

- The OCAP Loss Calculator - Used to calculate the “WRCS OCAP Take” at the pumps.
- The NOAA Fisheries JPE Calculator - Used to calculate the “OCAP Red Light” levels at the pumps.
- The “Pat Brandes” Through Delta Survival Calculator - Ranges between 7 percent and 38 percent survival.
- A “mass balance” term labeled “Ocean Survival.”

- Input terms readily available, coefficients can be modified with ease (a simple spreadsheet).

- Readily modified to increase level of sophistication. Ocean harvest, inland harvest, illegal harvest (poaching) can all be incorporated.

Example 1 - 7 percent cross-delta survival.

2000-2001 (2003) Winter Run Chinook Salmon Mass-Balance Model (Including Ocean Phase)									
Developed by Dan B. Odenweller									
Direct Loss Calculation in the south Delta - 2000/2001									
		CVP -TFPF (USBR)				SWP - JES Delta FPF (DWR)			GRAND TOTAL LOSS
			Loss	Loss			Loss	Loss	
	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	
Count									
Count Duration									
Count Interval									
Expanded Count	264	1669			701	4263			
Screen Loss	0.250		88	556	0.250		234	1421	2299
Arrive at Screens	352	2225			935	5684			
Pre Screen Loss	0.150		62	393	0.750		2804	17052	20311
Arrive at Facility	414	2618			3739	22736			
CHT&R Loss	0.020		5	33	0.020		14	85	138
Released Alive	259	1636			687	4178			
Loss Total			155	982			3052	18558	22748
Loss (OCAP Incidental Take)				1138				21610	22748
Salvage				1933				4964	6897
Take (Arrive at the Facilities)				3032				26475	29507

Indirect Loss Calculation In The Delta		Total
Direct Take		29507
Survival Through Delta	(Value ranges from 0.38 to 0.07, Brandes 2002)	0.07
Leave From The Sacramento River		421526

THE ANSWER TO THE SCENARIO (Due To Delta Loss Reduction)						Draft	06/18/04		
5852	Population Change								
71.95	Percent Change					Ocean/Adult What-If Calculation			
Juvenile Production Estimate - 2000/2001					J-S	P1 J-S		P2 J-S	
		RBDD Count Factors	RBDD Count	Carcass Survey Factors	Carcass Survey	Carcass Survey BY2000		Carcass Survey BY2003	
Adult Spawner Estimate			1352		4343	4343	Total	8133	
Adult Female Estimate		0.52	1261	0.649	2819	2819	Females	4936	
Effective Spawner Population		0.01	1248	0.01	2790	2790			
Estimated Number of Eggs		4700	5867433	4700	13114978	13114978			
Egg Loss Due To High Temperature		0.005	29337	0.005	65575	65575			
Total Viable Eggs			5838096		13049403	13049403			
Estimated Survival - Egg to Smolt		0.1475	861119	0.1475	1924787	1924787			
Estimated Smolt Survival to Delta		0.56	482227	0.56	1077881	1077881		What If?	
Total Natural Production in Delta			482227		1077881	1077881	NatJuvDelta	1077881	
							HatchDelta		
Livingston Stone Release (Date)			0		0				
							TotJuvDelta		
Yellow Light Level (1%Natural + 0.5%Hatchery)									
Red Light Level (2%Natural + 1%Hatchery)						421526	Delta Loss	0	
Loss (OCAP Incidental Take)									
						29507	PumpLoss	0	
TOTAL POPULATION AVAILABLE IN THE DELTA			482227		1077881				
			RBDD Count		Carcass Survey	626848	Enter Ocean	1077881	
							Harvest		
						1.2974	OceanSurv %		
AVAILABLE POPULATION USED			0.874124	Fraction	0.391069				
						98.7026	OceanMort %		
			87.41	Percent	39.11				
						8133	TotalReturn	13985	

THE ANSWER TO THE SCENARIO (Due To Delta Loss Reducti	
5852	Population Change
71.95	Percent Change
	Ocean Commercial Harvest
	Ocean Sport Harvest
	Inland Commercial Harvest
	Inland Sport Harvest
	Hatchery Harvest
	Bycatch
	Total Legal Harvest
	Poaching
	Harvest Total

Example 2 - 38 percent cross-delta survival.

2000-2001 (2003) Winter Run Chinook Salmon Mass-Balance Model (Including Ocean Phase)									
Developed by Dan B. Odenweller									
Direct Loss Calculation in the south Delta - 2000/2001									
									GRAND
		CVP -TFPF (USBR)				SWP - JES Delta FPF (DWR)			TOTAL
				Loss	Loss			Loss	Loss	LOSS
	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	
Count									
Count Duration									
Count Interval									
Expanded Count	264	1669			701	4263			
Screen Loss	0.250		88	556	0.250		234	1421	2299
Arrive at Screens	352	2225			935	5684			
Pre Screen Loss	0.150		62	393	0.750		2804	17052	20311
Arrive at Facility	414	2618			3739	22736			
CHT&R Loss	0.020		5	33	0.020		14	85	138
Released Alive	259	1636			687	4178			
Loss Total			155	982			3052	18558	22748
Loss (OCAP Incidental Take)				1138				21610	22748
Salvage				1933				4964	6897
Take (Arrive at the Facilities)				3032				26475	29507
Indirect Loss Calculation In The Delta									Total
Direct Take									29507
Survival Through Delta		(Value ranges from 0.38 to 0.07, Brandes 2002)							0.38
Leave From The Sacramento River									77650

THE ANSWER TO THE SCENARIO (Due To Delta Loss Reduction)						Draft	06/18/04			
898	Population Change									
11.04	Percent Change					Ocean/Adult What-If Calculation				
Juvenile Production Estimate - 2000/2001					J-S	P1 J-S		P2 J-S		
		RBDD Count Factors	RBDD Count	Carcass Survey Factors	Carcass Survey	Carcass Survey BY2000		Carcass Survey BY2003		
Adult Spawner Estimate			1352		4343	4343	Total	8133		
Adult Female Estimate		0.52	1261	0.649	2819	2819	Females	4936		
Effective Spawner Population		0.01	1248	0.01	2790	2790				
Estimated Number of Eggs		4700	5867433	4700	13114978	13114978				
Egg Loss Due To High Temperature		0.005	29337	0.005	65575	65575				
Total Viable Eggs			5838096		13049403	13049403				
Estimated Survival - Egg to Smolt		0.1475	861119	0.1475	1924787	1924787				
Estimated Smolt Survival to Delta		0.56	482227	0.56	1077881	1077881		What If?	THE ANSWER TO THE SCENARIO (Due To Delta Loss Reducti	
									898	Population Change
Total Natural Production in Delta			482227		1077881	1077881	NatJuvDelta	1077881	11.04	Percent Change
							HatchDelta			
Livingston Stone Release (Date)			0		0					
							TotJuvDelta			Ocean Commercial Harvest
Yellow Light Level (1%Natural + 0.5%Hatchery)										Ocean Sport Harvest
Red Light Level (2%Natural + 1%Hatchery)						77650	Delta Loss	0		Inland Commercial Harvest
Loss (OCAP Incidental Take)										Inland Sport Harvest
						29507	PumpLoss	0		Hatchery Harvest
TOTAL POPULATION AVAILABLE IN THE DELTA			482227		1077881					Bycatch
			RBDD Count		Carcass Survey	970724	Enter Ocean	1077881		Total Legal Harvest
										Poaching
							Harvest			Harvest Total
						0.8378	OceanSurv %			
AVAILABLE POPULATION USED			0.161023	Fraction	0.072039					
						99.1622	OceanMort %			
			16.10	Percent	7.20					
						8133	TotalReturn	9031		

Model Results - Two Examples

- 2000-2003 Year Pair (P1-P2 Brood Years) - Cross-Delta survival set at 0.07 (7 percent)
  - Direct Loss 29,507/1,077,881= 0.027 (2.7%)
  - Indirect Loss 392,019/1,077,881= 0.364 (36.4%)
  - Percent of Adult Population 71.95 percent change (5852 adults)

- 2000-2003 Year Pair (P1-P2 Brood Years) - Cross-Delta survival set at 0.38 (38 percent)
  - Direct Loss 29,507/1,077,881= 0.027 (2.7%)
  - Indirect Loss 77,650/1,077,881= 0.072 (7.2%)
  - Percent of Adult Population 11.04 percent change (898 adults)

Significant at the Adult Population Level?

- I believe both would be significant at the adult population level.
  - 5852 adults in the spawning escapement for Case A
  - 898 adults in the spawning escapement for Case B
- Both the “direct,” and the “indirect” effects need to be considered. ***“You can’t have one without the other!”***