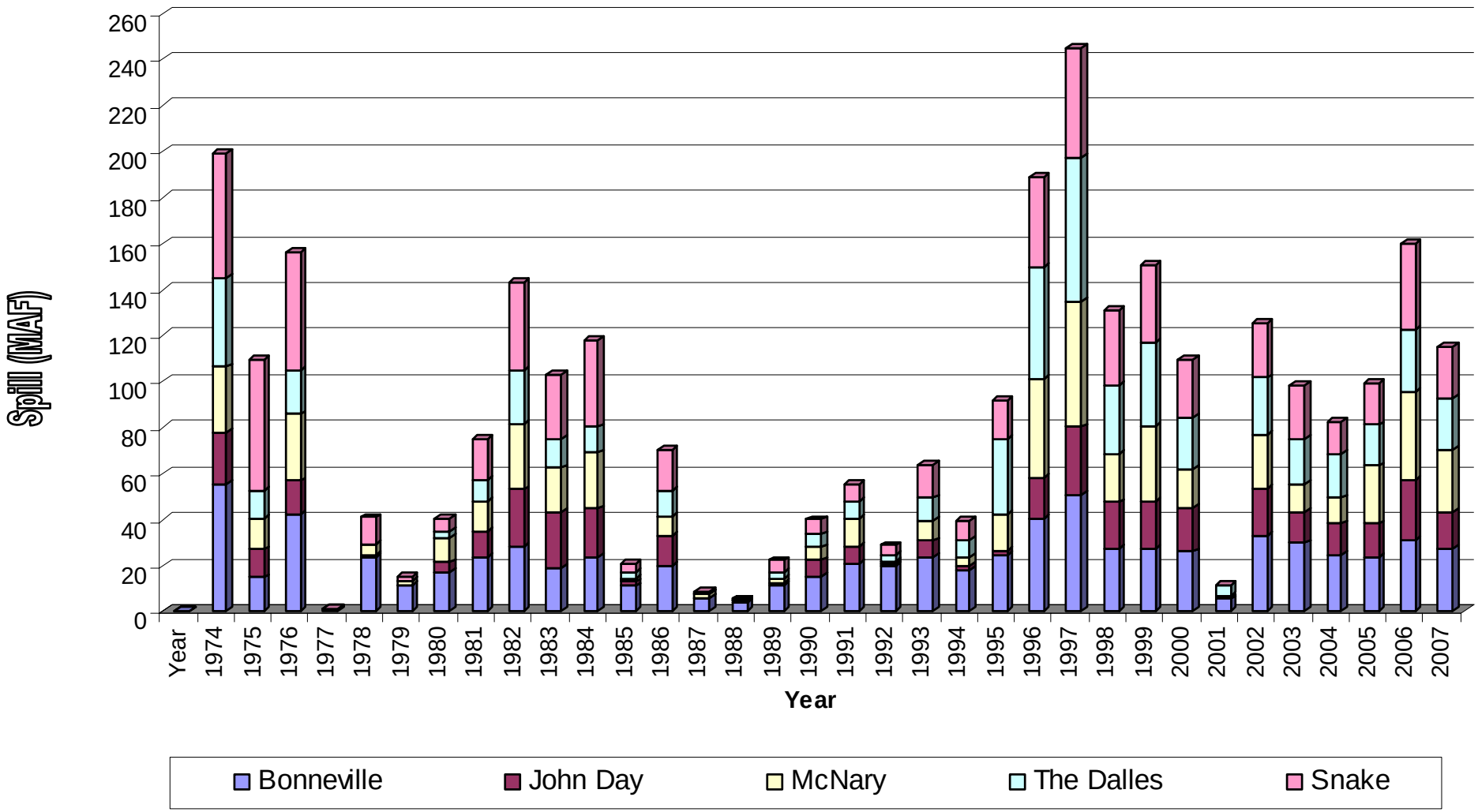
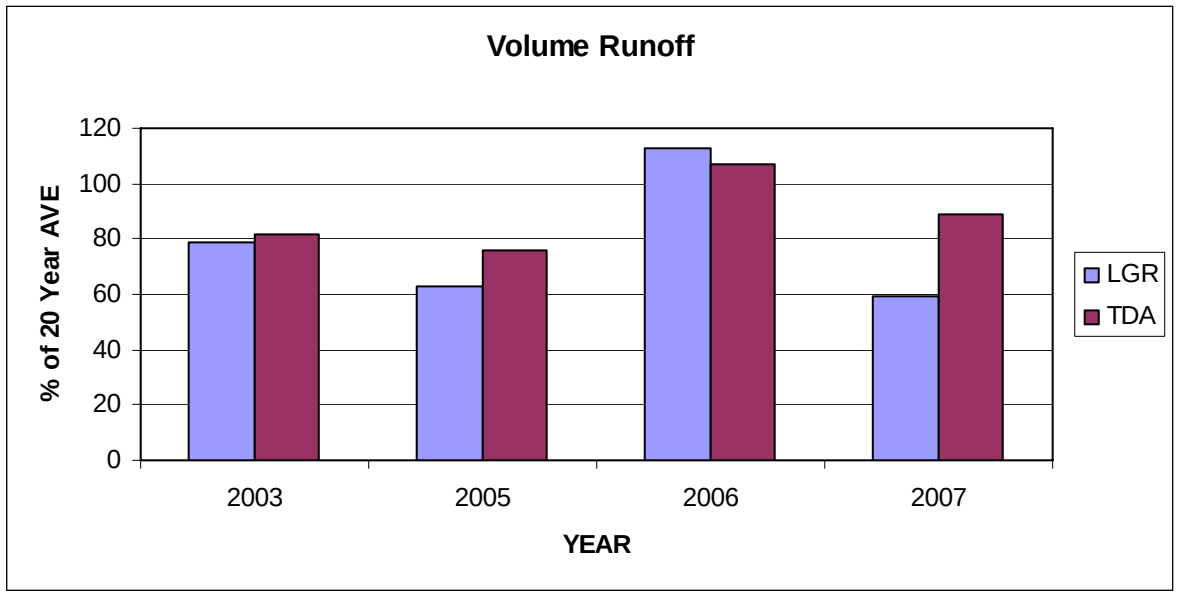
Spill Volume Changes with Use of Tailrace Monitors

Fish Passage Center

Total Spill in Snake and Lower Columbia Rivers 1974-2007 (April 1-August 31)



Runoff Volume Characterization of Four Years used in Analysis



Difficulties Experienced in Analysis

- Changing planned project spill operations among years at many projects and conduct of research. Change in spill patterns affecting gas production.
- Developing curves to depict spill vs TDG hampered by the fact that data collected when projects were managing to 115/120%.

Scenarios

- Modeled four different scenarios:
  - Actual spill (accounting for excess generation spill)
  - Spill that would have occurred if had spilled to 120% cap on days when spill was restricted by the 115% downstream forebay.
  - Spill that would have occurred in that year if all spill was to 120% (limited by planned operations).
  - Spill that would have occurred in that year if no restrictions from meeting the 120% (except for hours of spill).

Spill Volume Methods

- Used TDG Management Plans to determine operations and schedules for each year at each project

Actual Spill (Overgeneration Spill Removed)

- Overgeneration was any volume of spill over what the FPP/TDG management plan called for, or over the 120% Spill Cap from Management Plan
- Did not remove daytime spill if operation called for 12-hrs of spill, unless it was over the 120% spill cap

Methods cont

- Spill if managed to 120% on limited days
  - Extra spill estimated only for days where TDG was >115.1% in downstream forebay but <120% in tailrace, otherwise used Actual Spill Volumes with overgeneration removed
    - **If spill was for set volume, that volume was used during these times (accounting for PH minimums where applicable)**
    - **If spill was for % of flow, spill during those times was the % Flow (accounting for PH minimums and Gas Caps)**
    - **If spill was for Gas Cap, spill was to Gas Cap (FPC estimates) (accounting for PH minimums where applicable)**

Spill Volume Methods Cont'd…

Spill if managed to 120% at all times under actual operations

- Estimated what spill volumes would have been if actual operations were taking place
  - **Example: 2007 Little Goose**

    Spring: Spilled 30% 24 hours (+14 nights gas cap) up to the 120% Spill Cap

    Summer: Spilled 30% 24 hours up to the 120% Spill Cap
- Used same spill caps
- Used same schedule as operations:
  - **If operation called for 12-Hr spill, spilled for 12-Hrs**

    - Exception: If actual spill occurred during times of "no spill", than included actual spill volumes during these times (e.g., MCN 2006, JDA 2006, etc.)
  - **If operation called for 24 hours of spill, spilled for 24 hours**

Spill Volume Methods Cont'd…

Spill if managed to 120% at all times, no other restrictions

- For most projects, used 120% Gas Caps from FPC 2006 Spring Spill Memo
- Exceptions:
  - **IHR – 120% Gas Cap was 100 Kcfs for 2003 (2006 estimate based on bulk pattern, which was not used in 2003**
  - **JDA – 120% Gas Cap was 160 Kcfs (2000 BIOP)**
  - **BON**

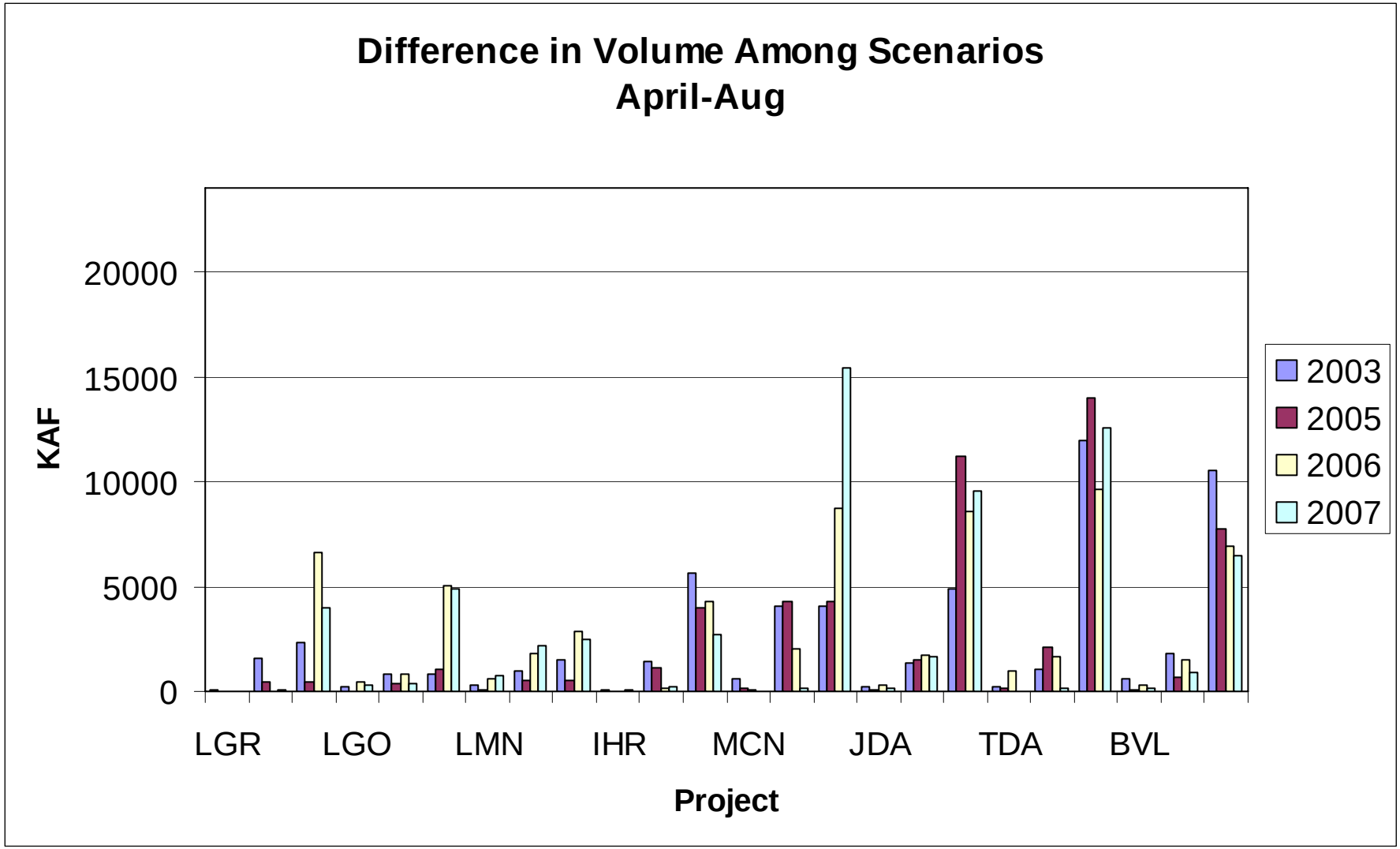
    - For 2005-2007, used 116 Kcfs, based on regression of Avg 12-hr High TDG and 12-Hrs of spill for those hours at CCIW for all three years

    - For 2003, used 155 Kcfs, based on regression of Avg 12-hr High TDG and 12-Hrs of spill for those hours at WRNO in 2003
- Used same schedule as operations:
  - If operation called for 12-Hr spill, spilled for 12-Hrs

    - Exception: If actual spill occurred during times of "no spill", than included actual spill volumes during these times (e.g., MCN 2006, JDA 2006, etc.)
  - If operation called for 24 hours of spill, spilled for 24 hours

Results

- Most difference observed at Little Goose, Lower Monumental and the Lower Columbia projects.



1) 120% on days out of compliance
2) 120% on all days – limited by planned program
3) 120% all days

Methods
Fish Passage Through Spill

- Daily fish collections from the SMP, daily average spill and estimates of spill passage efficiency (SPE) from NOAA's COMPASS Model were used to obtain daily population estimates for CH1, CH0, and ST
  - **No SPE estimates for CH0, assumed same as CH1 at all projects**
  - **Daily population estimates were summed for an estimate of total population (4/3-8/31 at Snake Projects, 4/10-8/31 at Lower Columbia Projects)**
- Daily average spill was then estimated under the four modeled scenarios

Methods
Fish Passage Through Spill

- Daily average spill volumes for the four modeled scenarios were applied to the daily population estimates to determine the population of fish passing through spill under that scenario
  - Daily population estimates were summed for an estimate of total population passing through spill (4/3-8/31 at Snake Projects, 4/10-8/31 at Lower Columbia Projects)
- Proportion passing through spill was then calculated for each scenario

Project	Migration Year	Species	Spill Season Population	Proportion Passing Through Spill For Actual Spill Volume (Over Generation Removed)	Proportion Passing Through Spill For Estimated Spill Volume (If managed to 120% on limited days) A	Proportion Passing Through Spill For Restrictions Scenario (Always Managed to 120% @ Tailrace) B	Proportion Passing Through Spill For Hypothetical Spill Volume (If Always Managed to 120% @ Tailrace) C
LGR	2003	Yearling Chinook	6,036,250	0.47	0.47	0.64	0.70
		Steelhead	8,461,179	0.65	0.65	0.78	0.83
		Subyearling Chinook	2,114,153	0.28	0.29	0.34	0.34
	2005	Yearling Chinook	7,232,368	0.00	0.00	0.00	0.00
		Steelhead	7,753,635	0.00	0.00	0.00	0.00
		Subyearling Chinook	2,456,171	0.10	0.10	0.11	0.11
	2006	Yearling Chinook	6,589,315	0.30	0.30	0.30	0.63
		Steelhead	13,067,516	0.43	0.43	0.43	0.78
		Subyearling Chinook	1,341,378	0.39	0.39	0.39	0.72
	2007	Yearling Chinook	3,825,176	0.49	0.49	0.50	0.83
		Steelhead	4,165,641	0.65	0.65	0.65	0.93
		Subyearling Chinook	618,213	0.62	0.62	0.63	0.86
LGS	2003	Yearling Chinook	2,852,429	0.26	0.26	0.33	0.33
		Steelhead	2,713,159	0.25	0.26	0.29	0.29
		Subyearling Chinook	773,527	0.12	0.14	0.14	0.14
	2005	Yearling Chinook	2,833,956	0.00	0.00	0.00	0.00
		Steelhead	3,034,701	0.00	0.00	0.00	0.00
		Subyearling Chinook	1,487,652	0.08	0.08	0.09	0.11
	2006	Yearling Chinook	4,818,186	0.24	0.29	0.30	0.40
		Steelhead	4,585,326	0.25	0.29	0.31	0.39
		Subyearling Chinook	1,309,600	0.27	0.28	0.30	0.52
	2007	Yearling Chinook	731,724	0.29	0.35	0.36	0.60
		Steelhead	1,927,495	0.30	0.35	0.36	0.62
		Subyearling Chinook	500,930	0.30	0.30	0.31	0.72

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LMN	2003	Yearling Chinook	2,901,598	0.80	0.80	0.82	0.85
		Steelhead	6,136,216	0.74	0.75	0.77	0.79
		Subyearling Chinook	728,541	0.51	0.55	0.59	0.59
	2005	Yearling Chinook	1,070,344	0.01	0.01	0.01	0.01
		Steelhead	1,171,631	0.00	0.00	0.00	0.00
		Subyearling Chinook	426,086	0.46	0.46	0.49	0.49
	2006	Yearling Chinook	3,835,310	0.61	0.66	0.71	0.71
		Steelhead	3,543,760	0.61	0.64	0.69	0.69
		Subyearling Chinook	1,088,640	0.65	0.67	0.74	0.77
	2007	Yearling Chinook	888,394	0.62	0.66	0.82	0.82
		Steelhead	1,866,186	0.62	0.67	0.82	0.82
		Subyearling Chinook	304,248	0.83	0.84	0.90	0.92
MCN	2003	Yearling Chinook	4,135,631	0.33	0.34	0.42	0.42
		Steelhead	567,039	0.35	0.37	0.43	0.43
		Subyearling Chinook	14,125,351	0.11	0.12	0.25	0.25
	2005	Yearling Chinook	3,084,550	0.38	0.38	0.48	0.48
		Steelhead	447,423	0.36	0.37	0.47	0.47
		Subyearling Chinook	12,398,628	0.36	0.36	0.49	0.49
	2006	Yearling Chinook	3,955,169	0.39	0.39	0.43	0.50
		Steelhead	1,015,660	0.40	0.40	0.43	0.48
		Subyearling Chinook	7,663,135	0.43	0.43	0.46	0.64
	2007	Yearling Chinook	5,671,631	0.38	0.38	0.38	0.65
		Steelhead	872,471	0.38	0.38	0.38	0.65
		Subyearling Chinook	11,979,926	0.47	0.47	0.47	0.70

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JDA	2003	Yearling Chinook	4,494,759	0.46	0.47	0.49	0.55
		Steelhead	878,476	0.37	0.39	0.39	0.44
		Subyearling Chinook	6,015,541	0.47	0.48	0.50	0.59
	2005	Yearling Chinook	3,071,919	0.47	0.47	0.53	0.58
		Steelhead	862,082	0.41	0.42	0.48	0.53
		Subyearling Chinook	5,295,250	0.52	0.52	0.53	0.80
	2006	Yearling Chinook	5,661,649	0.62	0.62	0.66	0.66
		Steelhead	2,995,321	0.56	0.56	0.58	0.59
		Subyearling Chinook	6,924,436	0.54	0.55	0.57	0.75
	2007	Yearling Chinook	9,389,570	0.47	0.49	0.53	0.55
		Steelhead	1,552,866	0.40	0.41	0.45	0.47
		Subyearling Chinook	8,403,357	0.51	0.51	0.52	0.78
BON	2003	Yearling Chinook	7,639,411	0.49	0.50	0.53	0.64
		Steelhead	2,056,743	0.43	0.45	0.47	0.58
		Subyearling Chinook	16,177,566	0.53	0.54	0.56	0.76
	2005	Yearling Chinook	4,199,374	0.39	0.40	0.45	0.57
		Steelhead	344,853	0.34	0.35	0.38	0.50
		Subyearling Chinook	7,316,785	0.47	0.48	0.52	0.65
	2006	Yearling Chinook	4,026,733	0.31	0.32	0.34	0.39
		Steelhead	321,665	0.29	0.30	0.31	0.36
		Subyearling Chinook	6,777,882	0.37	0.38	0.41	0.50
	2007	Yearling Chinook	3,210,439	0.40	0.40	0.42	0.47
		Steelhead	316,688	0.39	0.39	0.40	0.46
		Subyearling Chinook	15,075,542	0.47	0.48	0.49	0.60