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MEMORANDUM

TO: FPAC

FROM: Michele DeHart

DATE: November 6, 2006

RE: Estimating transport proportions for spring and summer juvenile migrants and a discussion of 2006 spread-the-risk management

In response to your request, the Fish Passage Center has updated their July 19, 2006 estimates of transport proportions for spring/summer Chinook, steelhead and subyearling fall chinook originating above Lower Granite Dam for consideration relative to spread-the-risk management. In this follow up analysis we used two methods of estimating the portion of populations "destined" for transport, and compared the results to those obtained by NOAA (Appendix A). In addition to estimating the transport proportions we evaluated the 2006 spread-the-risk management relative to the spread-the-risk objectives.

- In 2006 transportation was delayed based on NOAA research on temporal SARs for PIT-tagged spring/summer Chinook that suggested early transportation might be harmful to yearling Chinook. The staggered start of transportation at the downstream dams was an attempt to allow the population of fish arriving at LGR through April 19 to continue in-river past downstream collector dams (the four-day lag was based on average inter-dam travel times of smolts in prior years).
- The estimated proportion of fish destined for transportation arriving at Lower Granite Dam in 2006 was:
    - 61% for hatchery yearling Chinook,
    - 58% for wild yearling Chinook,
    - 76% for hatchery steelhead,
    - 79% for wild steelhead,
    - 56% for hatchery subyearling Chinook,
    - and, 52% for wild subyearling Chinook.
- The updated estimated proportions transported are lower than reported in the July 19, 2006 memo of 70.6% for yearling Chinook and 79.5% for steelhead. This difference is because the original estimates were developed for hatchery and wild

stocks combined and due to the assumption that 10.5% of the yearling Chinook and 9.7% of the steelhead passage distribution occurred before transportation commenced on April 20, 2006. However, based on the updated analysis separating hatchery and wild stocks, an estimated 32% of the wild yearling Chinook passed through the Lower Snake River during bypass operations prior to April 20, which decreased the overall proportion transported.

- During the time period when transportation of collected fish occurred, the probability of spring migrant fish being transported when they reached LGR was estimated at:
    - 71% for hatchery yearling Chinook,
    - 81% for wild yearling Chinook,
    - 88% for hatchery steelhead,
    - and, 92% for wild steelhead.
- The proportion transported in 2006 would have been higher, except that during the 2006 spring migration period, lack-of-market spill and uncontrolled spill resulted in more fish being in-river.
- In 2006 the spread-the-risk strategy relied on bypassing the early part of the migration to affect the proportion transported throughout the passage season. This resulted in some of the components of the run being transported at much higher rates due to the difference in seasonal passage timing of stocks.

Estimates of transportation probability

The FPC has annually produced estimates of the proportion of fish transported using Cormack-Jolly-Seber reach survival estimates, which generate a detection probability at each dam as part of the reach survival estimation. In this model approach, transported fish from Little Goose (LGS) and Lower Monumental (LMN) dams are expanded to LGR-equivalents to account for in-river mortality occurring between LGR and these two downstream transportation sites. The transport probability based on CJS seasonal survival estimation techniques are summarized in Table 1.Those estimates of detection efficiency of PIT-tagged fish were used to estimate the proportion of fish entering the bypass (Table 1). Typically, one estimate for hatchery and wild chinook and steelhead are produced, and then both rearing types are combined for an overall estimate.

Table 1. FPC estimates of the proportion of juvenile salmon originating above Lower Granite Dam transported in 2006.

	Proportion passing during transport	**Estimated seasonal collection efficiency at transport dams**				**Seasonal transport probability**
		LGR	**LGS**	**LMN**	**MCN**	
Wild Steelhead	0.87[a]	0.37	0.66	0.61	na	**0.79**
Hatchery Steelhead	0.87[a]	0.35	0.62	0.53	na	**0.76**
Wild Sp/Su Chinook	0.68	0.32	0.58	0.50	na	**0.58**
Hatch Sp/Su Chinook	0.86	0.24	0.42	0.35	na	**0.61**
Wild fall Chinook (subs)	1.0	0.16	0.30	0.12	0.21	**0.52**
Hatch fall Chinook (subs)	1.0	0.16	0.32	0.18	0.17	**0.56**

[a] Estimated jointly due to inability to distinguish hatchery and wild fish in SMP based on marks

The differences between these estimates and those reported in the July 19th memo are a function of the operational change implemented when transportation was delayed. In the past we used combined data for hatchery and wild groups. However, due to differences in collection efficiency and migration timing between hatchery and wild stocks this method overestimated the proportion transported under this delayed transport management scenario.

Specifically, the estimate of the transport proportion presented in July used a combination of hatchery and wild yearling chinook PIT-tag data. Estimating hatchery and wild yearling chinook groups separately resulted in new collection efficiency estimates for hatchery and wild groups as well as new Lower Granite Passage timing estimates for both groups. The updated collection efficiency data are summarized in Table 2 below.

Table 1. Combined hatchery and wild yearling Chinook estimated CE.

	Combined hatchery and wild yearling Chinook	**Hatchery yearling Chinook**	**Wild yearling Chinook**
Site	Collection Efficiency	Collection Efficiency	Collection Efficiency
LGR	**0.29**	**0.24**	**0.32**
LGS	**0.52**	**0.42**	**0.58**
LMN	**0.42**	**0.35**	**0.50**

The difference in timing used for the July 19th memo is especially significant for wild fish. The original estimate for the run-at-large was based on a modified passage index and resulted in an estimate of 89.5% of yearling Chinook passing Lower Granite Dam after April 20. After estimating daily collection efficiencies using PIT-tags, it was estimated that 86% of hatchery yearling Chinook passed after April 20, while an estimated 68% of wild yearling Chinook passed after that date. The earlier timing of wild fish resulted in a lower estimated proportion transported, despite higher estimated collection efficiencies. For hatchery Chinook, the reduced collection efficiency estimates resulted in a lower estimated probability of being transported. Combining this with slightly earlier timing (86% versus 89% passage after April 20) resulted in a lower overall estimated proportion transported.

The estimated seasonal proportion transported equals the collection efficiency multiplied by the proportion of population estimated to be passing LGR after April 20, (0.795 * 0.895) = 0.711 for combined hatchery and wild chinook, (0.711*0.86) = 0.611 for hatchery yearling Chinook and (0.852*0.68) = 0.579 for wild yearling chinook.

In 2006 the FPC sought to test the validity of calculating the proportion of the population transported using CJS by using an alternate method to develop the estimates and comparing the results. In this alternate method the passage timing for migrants arriving at Lower Granite Dam was estimated using daily estimated collection efficiency. A method similar to Sanford and Smith (2002) was used to estimate daily detection efficiency of PIT-tagged fish at Lower Granite Dam. Separate estimates were derived for both hatchery and wild yearling chinook and hatchery and wild steelhead. From these PIT-tag collection efficiency estimates, the daily collection numbers at Lower Granite Dam were expanded to daily population indices. These indices were used to estimate the proportion of the population that passed prior to and after April 20 at Lower Granite Dam.

Next, estimates of dam-specific transport proportions over the days after transportation commenced at each dam, and estimates of seasonal collection efficiencies, were input to the probabilistic model to obtain the estimated probability of fish being transported once the transportation program began in the Snake River. (As in past years', the seasonal collection efficiency estimates for yearling Chinook and steelhead at LGR were obtained using PIT-tagged fish released above Lower Granite Dam.) The overall proportion transported was computed as the product of the proportion of the run and the transport probability, summed for both the period prior to transportation initiation on April 20th and the period after April 20th. Results for all species and rearing types are summarized in Table 2 and are compared to the recent estimations provided by NOAA Fisheries in their October 20, 2006 memo from John Ferguson to Bruce Suzumoto.

Table 2. Summary of estimates of transport probability of juvenile salmon originating above Lower Granite Dam in 2006

	Estimated Probability of Transport by Method		
	FPC CJS	**FPC Daily Det**	**NOAA Daily Det**
Wild Steelhead	0.79	0.77	0.746
Hatchery Steelhead	0.76	0.76	0.760
Wild Yearling Chinook	0.58	0.58	0.599
Hatchery Yearling Chinook	0.61	0.61	0.623
Wild Subyearling Chinook	0.52	NA[a]	NA
Hatchery Subyearling Chinook	0.56	0.62	NA

[a]Insufficient tags to produce a meaningful seasonal estimate

The analysis suggests that all three methods converge on similar estimates for the proportion transported. In addition the data suggest that the CJS method is appropriate for application if hatchery and wild stocks are estimated independently.

Assessment of the 2006 spread-the-risk management strategy

A primary goal of spread-the-risk is to provide the optimal in-river conditions for fish that are not barged. Primarily, for spring migrants this means passing the maximum number of fish via spill, and as few fish as possible through bypasses or turbines. Therefore, some measure of the proportion of fish passing through spill, turbines and bypasses would be useful for consideration. For example, in 2006, bypassing fish through April 20 at Lower Granite, April 24th and Little Goose and April 28th at Lower Monumental dams, was used to increase the in-river population. Using wild yearling chinook as an example, it is estimated that 32% of the population passed Lower Granite Dam prior to transport. Assuming this population passed Lower Monumental Dam prior to transport, those fish had an 86% probability of being bypassed at least one time in that reach. Conversely, the likelihood of passing in spill (or turbines) through all three projects would have been 14%. If spread-the-risk includes a balance of transportation and passage via spill, then operations in 2006 would have fallen short of providing a balance between the proportion of fish passing through the reach via spill passage compared to those transported.

A spread-the-risk strategy of delaying juvenile transportation until the 20th of April implies that the probability of experiencing any route of migration (i.e. probability of transport, spill, bypass or turbine passage) are experienced equally by all Snake River spring/summer Chinook salmon and summer steelhead. Given that both of these ESU's consist of many individual stocks that spawn and rear in a variety of environments (i.e., from high-desert to near-alpine streams) there is no a priori reason to expect this to be the case. Assuming consistent variation in downstream migration timing exists among populations, early-migrating populations will tend to remain inriver at a higher rate under the 2006 management approach than those arriving later, even when a season-wide estimate of the proportion transported approaches 0.50.

Wild Chinook salmon and steelhead PIT-tag data were used to estimate LGR arrival timing to determine whether specific populations (or groups of populations) are consistently represented in spread-the-risk transportation management. Passage timing statistics were estimated for 25 spring/summer Chinook salmon populations and 17 steelhead populations for migration years 2002-2006. The populations used were selected based on the availability of adequate data from populations spawning in the Salmon and Clearwater basins of Idaho and from the Grande Ronde, Imnaha, and Wallowa basins of Oregon. The tag groups used provide a broad representation of Chinook and steelhead ESUs. The analysis included parr and smolts that were tagged and released in tributaries (i.e., collected at traps and/or using active collection methods) during the migration year in question (up to May 20th) and in the previous autumn (i.e., after September 1st), that were subsequently detected at LGR. For each population, the date of 50% LGR passage and the proportion of the total run passing LGR prior to 20th of April (i.e., the initiation of transportation) were computed.

The analysis of the PIT-tag data demonstrates that significant variation in LGR arrival timing exists among individual populations of Chinook salmon (Table 3;Appendix A). Median passage dates spanned a 7.5-week period across years. The population consistently exhibiting the earliest migration timing was Lookingglass Creek, with 50% LGR passage occurring by April 15th; while the latest-migrating juvenile populations were consistently those rearing in the headwaters of the South Fork of the Clearwater (e.g., Crooked Fork River, 50% passage 7-June). Several populations had less than 10% passage prior to the initiation of transportation on April 20th.

Similar to Chinook, LGR passage timing varied across steelhead populations, but to a lesser degree. The 5-year median date of 50% passage ranged from April 21st (Moose Creek, Selway River Basin) to May 14th (Catherine Creek, Grande Ronde Basin), approximately spanning 3-week range (Table 4; Appendix B). In general, steelhead migrated slightly later and over a narrower time period than did Chinook salmon. While a measurable proportion of steelhead juveniles typically passed LGR prior to April 20th based on aggregate wild collections, several populations experienced little-to-no passage by this date (i.e., 0-7%; Table 4). Across most years, steelhead originating in the lower Lochsa, M.F. Clearwater, lower M.F. Salmon, and lower main Salmon rivers consistently arrived at LGR the earliest (of the populations in question); while stocks from the Grande Ronde Basin and Upper Salmon Basin streams consistently arrived at LGR the latest.

Overall, this analysis illustrates that considerable population-specific variation in outmigration timing exists across spring/summer Chinook salmon and summer steelhead populations spawning and rearing above LGR. Further, outmigration timing varied in such a way that specific populations may be consistently excluded from any benefits arising from a spread-the-risk transportation management strategy based on delaying the initiation of transport.

Table 3. 5-year (2002-2006) median date of 50% LGR passage ('Median') and proportion passing LGR by April 20th ('20-Apr *p*') for individual populations of wild Chinook salmon spawning and rearing in the Snake River Basin, grouped by HUC-6 basin.

Basin	Population	Median	20-Apr *p*
Clearwater, MF	Clear Ck.	26-Apr	0.24
Clearwater, MF	Lolo Ck.	13-May	0.23
Clearwater, SF	American R.	3-Jun	0.04
Clearwater, SF	Crooked R.	7-Jun	0.00
Clearwater, SF	Newsome Ck.	13-May	0.16
Clearwater, SF	Red R.	30-May	0.07
Lochsa	Crooked Fk.	19-May	0.06
Lochsa	Colt Killed Ck.	24-May	0.02
Lochsa	Fish Ck.	3-May	0.21
Selway	Meadow Ck.	28-Apr	0.26
Grande Ronde	Catherine Ck.	22-May	0.06
Grande Ronde	Grande Ronde R.	3-May	0.18
Grande Ronde	Lookingglass Ck.	15-Apr	0.61
Imnaha	Imnaha R.	24-Apr	0.38
Wallowa	Lostine R.	4-May	0.19
Wallowa	Minam R.	5-May	0.24
Lemhi	Lemhi R.	26-Apr	0.28
Pahsimeroi	Pahsimeroi R.	28-Apr	0.19
Salmon, MF	Marsh Ck.	13-May	0.00
Salmon, SF	Johnson Ck.	13-May	0.04
Salmon, SF	Lake Ck.	6-May	0.06
Salmon, SF	Secesh R.	4-May	0.13
Salmon, SF	SF Salmon R.	2-May	0.14
Salmon, Upper	EF Salmon R.	21-May	0.03
Salmon, Upper	Upper Salmon R.	19-May	0.03

Table 3. 5-year (2002-2006) median date of 50% LGR passage ('Median') and proportion passing LGR by April 20th ('20-Apr *p*') for individual populations of wild summer steelhead spawning and rearing in the Snake River Basin, grouped by HUC-6 basin.

Basin	**Population**	**Median**	**20-Apr *p***
Clearwater, MF	Clear Ck.	3-May	0.19
Lochsa	Crooked Fk.	29-Apr	0.27
Lochsa	Colt Killed Ck.	4-May	0.18
Lochsa	Fish Ck.	28-Apr	0.28
Selway	Moose Ck.	21-Apr	0.46
Grande Ronde	Catherine Ck.	14-May	0.02
Grande Ronde	Grande Ronde R.	12-May	0.06
Grande Ronde	Lookingglass Ck.	8-May	0.09
Imnaha	Imnaha R.	7-May	0.05
Wallowa	Lostine R.	11-May	0.07
Wallowa	Minam R.	9-May	0.07
Salmon, Mid/Chamb	Chamberlain Ck.	28-Apr	0.13
Salmon, MF	Camas Ck.	30-Apr	0.16
Salmon, SF	Johnson Ck.	4-May	0.21
Salmon, SF	SF Salmon R.	2-May	0.24
Salmon, Upper	Pahsimeroi R.	12-May	0.02
Salmon, Upper	Upper Salmon	11-May	0.00

Appendix A. Year-by-year estimates of passage timing statistics for select wild Chinook and steelhead populations.

Table A1. PIT-tag-based passage timing statistics ('Median' = date of 50% LGR Passage; '20-Apr *p*' = proportion passing LGR prior to 20-Apr) for individual wild spring/summer Chinook salmon populations, by HUC-6 watershed, for migration years 2002-2006.

		2002			2003			2004			2005			2006		
Basin	**Population**	**n**	**Median**	**20-Apr *p***	**n**	**Median**	**20-Apr *p***	**n**	**Median**	**20-Apr *p***	**n**	**Median**	**20-Apr *p***	**n**	**Median**	**20-Apr *p***
Clearwater, MF	Clear Ck.	58	26-Apr	0.38	49	16-May	0.04	140	30-Apr	0.16	51	26-Apr	0.24	26	21-Apr	0.38
Clearwater, MF	Lolo Ck.	155	13-May	0.33	253	27-May	0.08	1278	16-May	0.07	830	26-Apr	0.32	435	5-May	0.23
Clearwater, SF	American R.	29	17-Jun	0.07	110	11-Jun	0.00	306	3-Jun	0.03	345	11-May	0.07	77	26-May	0.04
Clearwater, SF	Crooked R.	85	18-Jun	0.05	39	14-Jun	0.00	166	7-Jun	0.00	251	9-May	0.08	17	2-Jun	0.00
Clearwater, SF	Newsome Ck.	85	30-May	0.16	103	30-May	0.03	548	13-May	0.04	537	1-May	0.17	268	4-May	0.27
Clearwater, SF	Red R.	73	17-Jun	0.12	115	12-Jun	0.00	646	30-May	0.01	563	12-May	0.07	75	10-May	0.11
Lochsa	Crooked Fk.	92	20-May	0.10	133	24-May	0.06	198	18-May	0.04	86	19-May	0.00	219	9-May	0.10
Lochsa	Colt Killed Ck.	40	24-May	0.10	54	30-May	0.00	65	5-Jun	0.00	87	10-May	0.02	50	8-May	0.18
Lochsa	Fish Ck.	27	28-Apr	0.30	67	4-May	0.13	16	3-May	0.25	0			62	6-May	0.18
Selway	Meadow Ck.	256	4-May	0.28	50	24-May	0.00	496	28-Apr	0.26	815	26-Apr	0.22	905	26-Apr	0.37
Grande Ronde	Catherine Ck.	62	19-May	0.08	203	23-May	0.06	684	25-May	0.01	152	22-May	0.07	68	17-May	0.00
Grande Ronde	Grande Ronde R.	338	3-May	0.34	911	23-Apr	0.34	3948	4-May	0.13	1211	3-May	0.18	1076	30-Apr	0.18
Grande Ronde	Lookingglass Ck.	64	16-Apr	0.58	32	12-Apr	0.81	34	14-Apr	0.65	0			52	27-Apr	0.29
Imnaha	Imnaha R.	674	1-May	0.38	2181	23-Apr	0.37	8834	29-Apr	0.24	2820	24-Apr	0.41	361	22-Apr	0.46
Wallowa	Lostine R.	117	4-May	0.26	268	29-Apr	0.27	852	17-May	0.02	344	2-May	0.19	168	6-May	0.11
Wallowa	Minam R.	72	5-May	0.36	177	28-Apr	0.31	436	5-May	0.09	249	30-Apr	0.24	119	5-May	0.19
Lemhi	Lemhi R.	116	21-Apr	0.42	228	23-Apr	0.27	1354	26-Apr	0.34	352	27-Apr	0.16	433	26-Apr	0.28
Pahsimeroi	Pahsimeroi R.	40	24-Apr	0.38	454	24-Apr	0.20	582	6-May	0.19	461	4-May	0.06	485	28-Apr	0.11
Salmon, MF	Marsh Ck.	104	20-May	0.05	218	22-May	0.03	1712	9-May	0.04	115	13-May	0.00	103	5-May	0.10
Salmon, SF	Johnson Ck.	401	2-May	0.32	657	20-May	0.07	2740	10-May	0.04	2024	6-May	0.03	727	5-May	0.06
Salmon, SF	Lake Ck.	67	24-Apr	0.36	127	25-May	0.13	200	22-May	0.02	246	4-May	0.06	38	28-Apr	0.13
Salmon, SF	Secesh R.	84	2-May	0.30	138	16-May	0.14	174	3-Jun	0.00	308	2-May	0.10	250	26-Apr	0.23
Salmon, SF	SF Salmon R.	79	26-May	0.08	173	26-May	0.03	1154	15-May	0.02	736	21-May	0.01	312	6-May	0.04
Salmon, Upper	EF Salmon R.	7	13-May	0.14	51	19-May	0.00	212	9-May	0.00	97	24-May	0.00	57	30-Apr	0.11
Salmon, Upper	Upper Salmon R.	164	19-May	0.04	613	21-May	0.03	2198	10-May	0.03	940	19-May	0.00	454	6-May	0.03
Clearwater, All	Inclusive	123	10-May	0.39	313	27-Apr	0.27	970	26-Apr	0.32	1360	25-Apr	0.34	112	8-Apr	0.81
Salmon, All	Inclusive	1065	25-Apr	0.37	3097	25-Apr	0.28	6516	27-Apr	0.22	6146	30-Apr	0.08	1699	26-Apr	0.21
Snake, All	Inclusive	225	23-Apr	0.28	148	22-Apr	0.20	602	4-May	0.08	89	26-Apr	0.06	738	29-Apr	0.12

Table A2. PIT-tag-based passage timing statistics (‘Median’ = date of 50% LGR Passage; ‘20-Apr *p*’ = proportion passing LGR prior to 20-Apr) for individual wild summer steelhead populations, by HUC-6 watershed, for migration years 2002-2006.

			2002			2003			2004			2005			2006	
Basin	**Population**	**n**	**Median**	**20-Apr *p***	**n**	**Median**	**20-Apr *p***	**n**	**Median**	**20-Apr *p***	**n**	**Median**	**20-Apr *p***	**n**	**Median**	**20-Apr *p***
Clearwater, MF	Clear Ck.	70	6-May	0.19	223	4-May	0.13	255	3-May	0.16	120	26-Apr	0.37	5	13-Apr	0.80
Lochsa	Crooked Fk.	269	19-Apr	0.52	93	26-Apr	0.29	96	3-May	0.10	113	29-Apr	0.04	187	29-Apr	0.27
Lochsa	Colt Killed Ck.	87	18-May	0.18	39	7-May	0.23	76	4-May	0.01	69	30-Apr	0.03	58	28-Apr	0.36
Lochsa	Fish Ck.	1417	17-Apr	0.60	702	27-Apr	0.28	1584	3-May	0.11	1451	2-May	0.06	1433	28-Apr	0.34
Selway	Moose Ck.	68	21-Apr	0.46	65	18-Apr	0.58	171	1-May	0.21	136	30-Apr	0.08	67	16-Apr	0.61
Grande Ronde	Catherine Ck.	135	21-May	0.08	105	24-May	0.02	225	14-May	0.02	120	8-May	0.01	72	1-May	0.18
Grande Ronde	Grande Ronde R.	258	21-May	0.16	329	25-May	0.06	756	10-May	0.01	715	12-May	0.01	348	2-May	0.14
Grande Ronde	Lookingglass Ck.	114	3-May	0.38	186	24-May	0.09	303	9-May	0.05	431	8-May	0.06	88	30-Apr	0.23
Imnaha	Imnaha R.	637	16-May	0.05	1884	13-May	0.06	3670	7-May	0.02	2524	7-May	0.02	774	3-May	0.07
Wallowa	Lostine R.	125	21-May	0.14	164	25-May	0.07	98	11-May	0.00	111	8-May	0.04	48	30-Apr	0.17
Wallowa	Minam R.	58	18-May	0.21	136	18-May	0.07	54	9-May	0.00	68	9-May	0.01	67	1-May	0.09
Salmon, Mid	Chamberlain Ck.	133	27-Apr	0.35	104	28-Apr	0.29	123	7-May	0.04	110	7-May	0.00	110	27-Apr	0.13
Salmon, MF	Camas Ck.	0			65	20-Apr	0.49	132	8-May	0.05	166	4-May	0.04	37	26-Apr	0.27
Salmon, SF	Johnson Ck.	148	25-Apr	0.32	32	11-May	0.22	114	5-May	0.05	143	4-May	0.03	111	27-Apr	0.21
Salmon, SF	SF Salmon R.	20	19-Apr	0.50	25	2-May	0.24	57	6-May	0.09	111	4-May	0.06	57	24-Apr	0.35
Salmon, Upper	Pahsimeroi R.	33	21-May	0.15	71	19-May	0.04	43	12-May	0.02	80	12-May	0.00	18	1-May	0.00
Salmon, Upper	Upper Salmon	41	17-May	0.07	56	22-May	0.00	102	10-May	0.03	47	11-May	0.00	14	2-May	0.00
Clearwater, All	Inclusive	0			167	12-May	0.11	520	2-May	0.20	1029	30-Apr	0.11	7	10-Apr	1.00
Salmon, All	Inclusive	96	23-Apr	0.26	101	4-May	0.15	147	6-May	0.05	177	6-May	0.01	92	29-Apr	0.15
Snake, All	Inclusive	607	10-May	0.24	397	14-May	0.11	1458	9-May	0.02	912	9-May	0.07	152	28-Apr	0.11