POSEIDON WATER

Appendix FFF
Revised APF Calculations

Renewal of NPDES CA0109223
Carlsbad Desalination Project

May 31, 2018

Mr. Peter MacLaggan
Poseidon Water
Delivered via Email

Appendix FFF – Review of the Calculation Methods Used in Carlsbad Desalination Plant
Entrainment Analysis

Dear Peter,

The purpose of this Appendix FFF, is to review the calculation methods used to establish the
Area of Production Foregone (APF) estimates for the Carlsbad Desalination Plant (CDP)
provided in Appendix K of the Report of Waste Discharge.

Table 2 of Appendix K presents two sets of APF estimates. The first set is labeled "With P_s in
accordance with Appendix E", while the second set is labeled "Without P_s in accordance with Dr.
Raimondi's CCC".

The Science Advisory Panel's (SAP) letter dated May 20, 2018 (the "SAP May 20 Memo")
recommends Empirical Transport Model (ETM) calculations for estimating the entrainment
impacts for the CDP that are consistent with the entrainment impact assessment conducted for
the Encina Power Station (EPS) in January 2008 and the Carlsbad Desalination Plant in 2008.

The calculation methods used to derive the APF estimates in accordance with the SAP
recommendations are summarized in Attachment 1. The ETM and APF estimates for the Flow
Augmentation (FA 171 MGD) and Reverse Osmosis (RO, 127 MGD) presented in Appendix K
(MBC 2015) were recalculated using Equations 2 and 4 in the SAP May 20 Memo. I also
calculated the APF for the complete intake (298 MGD) to be consistent with the charge to Dr.
Raimondi for his review of Appendix K. It should be noted that mathematical rounding occurring
during the calculations resulted in slightly different values for FA+RO vs the complete intake.
The revised calculation methodology indirectly followed the methodology used in the "Without P_s
in accordance with Dr. Raimondi's CCC" estimates reported in Appendix K, and yielded the
same results. The SAP May 20 Memo is included as Attachment 2, and a copy of Appendix K is
included as Attachment 3.

Please let me know if you have any questions.

Sincerely,

Eric Miller, MS

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1. The RO and FA ETM and APF estimates presented in Appendix K were prepared in two ways
   a. One to try and maintain consistency with the equations detailed in Appendix E of the Ocean Plan Amendment's (OPA) Substitute Environmental Document Appendix E
      i. This approach is titled "With P_s in accordance with Appendix E" APF estimates
   b. A second version (detailed in Steps 3-5 below) was presented to maintain consistency with the prior record for the site
      i. This approach is titled "Without P_s in accordance with Dr. Raimondi's CCC" APF estimates
2. P_e by survey and taxa was derived in the EPS using Equation 2 in the SAP May 20 Memo
   a. The P_e was derived for EPS flow of 857 MGD
      i. The derived P_e captures the adjustments to the source water population described in Equation 2 of the SAP Memo to account for tidal flux through the mouth of Aqua Hedionda Lagoon
3. The entrainment impact analysis was flow-extrapolated meaning the estimated number of plankton entrained is the product of sampled density at the designated intake sampling station multiplied by the intake water flow volume. Therefore it can be proportionally adjusted to other intake flow volumes.
   a. Source water population estimates are not adjusted based on the intake water flow volume. Instead, the P_e reported in EPS for maximum flow volume are scaled to reflect the proposed intake intake flow volume at the CDP, of 298 MGD intake flow (127 RO and 171 Flow Augmentation)
      i. This approach is consistent with Equation 4 in the SAP May 20 Memo
4. APF Calculations reported in Appendix K Table 2 included the following steps
   a. The source water population adjusted for the proposed CDP intake volume of interest (FA or RO) was used in the standard ETM model equation (Equation 1 in the SAP May 20 Memo) using the following steps for each taxon
      i. P_e = [(EPS entrainment survey 857 MGD intake flow entrainment estimate) X (CDP intake flow of interest (FA or RO)/857 EPS maximum intake volume)]/Source Water Population derived in Step 3a above
      ii. d = larval duration reported in EPS
      iii. f_i = as reported in EPS
5. The "Without P_s in accordance with Dr. Raimondi's CCC" estimates in Appendix K Table 2 did not include P_s in the ETM model
6. As a check, I conducted a new ETM and APF analysis for FA and RO in accordance with Equation 4 in the SAP May 20 Memo, reproduced here:
7. $P_m = 1 - \sum_{i=1}^{n} f_i \left(1 - \frac{Flow}{857} Pe\right)^d$
      i. Where:

ii. P_m = proportional mortality

iii. f_i = estimated fraction of total source water larval population present during the ith survey (values presented in the EPS entrainment calculation were used in these new calculations)

iv. *Flow* = proposed Carlsbad Desalination Plant intake flow volume: 127 MGD for RO and 171 MGD for FA

v. *857* = maximum intake flow volume in MGD reported in EPS entrainment calculation

vi. P_e = estimated proportional entrainment (maximum intake flow volume derived in EPS entrainment calculation used)

vii. *d* = larval duration in days (values presented in EPS entrainment calculation were used in these new calculations)

8. All APF estimates represent the total APF at the 95% confidence level without any mitigation scaling applied to account for the productivity of the impacted habitat versus the productivity of the proposed mitigation habitat.

    a. Mean and standard error were calculated for each habitat group

    b. The mean and standard error were used with the MS-Excel function Norm.INV to calculate the 95% confidence level APF estimate

    c. CIQ Goby, Combtooth Blennies, Garibaldi were included in the estuarine habitat group

    d. Engraulidae (including Northern Anchovy), White Croaker, California Halibut, Spotfin Croaker, and Queenfish were included in the open coast habitat group

9. The results of the analysis detailed in Step 5 above ("Without P_s in accordance with Dr. Raimondi's CCC") and Step 7 above (in accordance with the SAP May 20 Memo) resulted in identical APF estimates for FA and RO, which are presented in Tables 1 and 2 below.

Table 1. Area of production forgone estimates (acres) derived for Reverse Osmosis (127 MGD), Flow Augmentation (171 MGD), and Total Intake (298 MGD) derived in the methods detailed above and shown in Appendix K Table 2 under the heading "Without Ps in accordance with Dr. Raimondi's CCC".

Habitat Group	Reverse Osmosis	Flow Augmentation	Total Intake
Estuarine	27	36	59
Open Coast	31	41	72
Total	58	77	131

Table 2. Area of production forgone estimates (acres) derived for Reverse Osmosis (127 MGD), Flow Augmentation (171 MGD), and Total Intake (298 MGD) using Equation 4 of the SAP May 20 Memo.

Habitat Group	Reverse Osmosis	Flow Augmentation	Total Intake
Estuarine	27	36	59
Open Coast	31	41	72
Total	58	77	131

From: Peter Raimondi, member of the independent review panel for Poseidon Carlsbad

Date: 5-29-2018

Estimation of APF for Stand Alone operations of Poseidon Carlsbad facility based only on intake entrainment operations

I have done a series of calculations to determine the area of production foregone (APF) for stand-alone operation at the Poseidon Carlsbad desalination facility. The following is for intake operations affecting intake entrainment only and is meant to be shared with the review panel and agencies as part of the review process. The intent is to provide Poseidon with an opportunity assess the approach prior to the final review. The following are the assumptions used in the calculations

1) I used ETM approach used in the Encina 316B (EPS316B) to determine proportional entrainment (Pe). This includes the use of a mixed water mass in the development of Pe. Proportional mortality values (Pm) are based on these estimates of Pe.
2) Total Sources Water Bodies (TSWB) are the same as was done for the original Poseidon evaluation and are based on EPS316B Ps values.
3) The APF value used is the 95% confidence limit based on the mean and standard error for each group of species (estuarine, open coast). This estimate is provided using a normal inverse function with standard error replacing standard deviation. This is consistent with the Ocean Plan Amendment.

Calculations of Pm in Appendix K are based on equation 1.

$$(1) \quad Pm = 1 - \sum_{i=1}^{n} f_i (1 - Ps_i Pe_i)^d$$

This approach led to estimates of APF (which is based on the product of Pm and TSWB) shown in Table 1 (Table 2 in Appendix K)

Taxa Category	RO	FA	Diffuser
With Ps in accordance with Appendix E			
Estuarine	27	36	2
Ocean	9	12	65
Total	36	48	67
Without Ps in accordance with Dr. Raimondi's CCC			
Estuarine	27	36	2
Ocean	31	41	372
Total	58	77	374

Table 1: "THE CALCULATED AREA OF PRODUCTION FOREGONE (IN ACRES) AS A FUNCTION OF THE POTENTIALLY AFFECTED HABITAT FOR REVERSE OSMOSIS (RO) ASSUMING 127 MILLION GALLONS PER DAY (MGD), FLOW AUGMENTATION (FA) ASSUMING 171 MGD, AND MULTIPORT DIFFUSER (DIFFUSER) ASSUMING 217 MGD."

This table is basis for table 13 in Appendix ZZ (shown below as table 2)

Table 13 Mitigation Calculation Alternative 1						
Type of Impact Measured	**Impacted Area (Acres)**	**Impacted Habitat**	**Impacted Area By Habitat Type (Acres)**	**Mitigation Ratio**	**Required Mitigation (Acres)**	**Mitigation Area Habitat Type**
Intake	83.44	Estuarine	62.58	1:1	62.58	Estuarine
		Open Water	20.86	10:1	2.09	Estuarine

Table 2: Only the Intake entrainment section is shown

Note that the value 83.44 is equal to the (rounded) sum of 36 (RO) and 48 (FA) acres based on "With Ps in accordance with Appendix E". This calculation was found to be not consistent with the original EPS316B approach. Note also that the open water acreage (20.86) was "converted" to Estuarine mitigation acreage using a 10 to 1 ratio, yielding 2.09 acres. This is consistent with what was done in the original Poseidon Carlsbad assessment. This leads to a combined acreage of 64.67 acres.

I redid the analyses using the Pe values in the EPS316B, which explicitly utilizes a mixed water body for estimation. An excel worksheet is attached so that the approach can be assessed. Table 3 below shows the results of this analysis. I based the analysis on two similar estimates of stand-alone intake volumes (298 and 304 MGD) as both have been used in support documents.

		Pm Calculated				
		MGD	MGD		APF	APF
Type	species	304	298	SWB (acres)	304	298
Estuarine	Blennies	0.085507	0.08388	302.00	25.82	25.33
Estuarine	Gobies	0.215512	0.2119	302.00	65.08	63.99
Estuarine	Hypsopops	0.065375	0.06411	302.00	19.74	19.36
Open Coast	White Croaker	0.00137	0.00134	33365.25	45.72	44.81
Open Coast	Northern Anchovy	0.00165	0.00162	15570.45	25.69	25.19
Open Coast	California Halibut	0.001513	0.00148	27477.26	41.57	40.75
Open Coast	Queenfish	0.003656	0.00358	20309.28	74.25	72.79
Open Coast	Spotfin Croaker	0.006371	0.00625	13738.63	87.53	85.81
Average Estuarine		0.122132	0.11996		36.88	36.23
Average Open Coast		0.002912	0.00285		54.95	53.87
SE Estuarine		0.047051	0.04632		14.21	13.99
SE Open Coast		0.00096	0.00094		11.3	11.08
95% Estuarine					60.26	59.24
95% Open Coast					73.54	72.09
95% Open Coast with 10-1 conversition ratio					7.354	7.209
Total APF					133.8	131.3
Total APF usinng 10-1 ratio					67.61	66.45

Table 3: Estimated of Pm and APF for Estuarine and open coast species using both 304 and 298 MGD as intake volumes.

The total APF based on intake related entrainment is 133.8 (304 MGD) or 131.3 (298 MGD). This represents a 50.36 (304 MGD) or 47.86 (298 MGD) increase from estimates given in Appendix K and ZZ. Using the 10-1 mitigation ratio produces a 2.94 (304 MGS) or 1.78 (298 MGD) acre increase from the estimates given in Appendix K or ZZ.

I want to note that although one source of difference between my estimates and those made by Poseidon in appendices K and ZZ has been accommodated -the use of the mixed water body approach to Pe rather than equation 1, I have one additional area of concern that I would like to figure out before proceeding with the review. I cannot get the Poseidon estimates of entrainment to even roughly align with my calculations. For example the estimated entrainment of CIQ gobies on page 3-31, section 3.3.2.3 of EPS 316B, for maximum flow, was 2.77 billion larvae over the sampling period (June 2004 – May 2005). Converting this to 304 MGD (from 857) yields a total of ~ 976,000,000 (see table 4 below, Tabl3 3-10 in EPS 316B). However, in appendix 3A in Appendix K (see below table 5) the sum of the entrainment value for CIQ gobies is 18.7 million. Similar discrepancies exist for all species.

Table 3-10. Results of *AEL* modeling for CIQ goby complex larvae based on a) actual flows and b) maximum flows. The upper and lower estimates are based on a 90% confidence interval of the mean. *AEL* estimates were also calculated using the upper and lower confidence estimates from the entrainment estimates.

Parameter	Mean	Std. Error	AEL Lower Estimate	AEL Upper Estimate	AEL Range
a) Actual Flows					
AEL Estimate	1,632,666	1,834,554	257,124	10,366,994	10,109,870
Total Entrainment	2,215,477,217	86,364,408	1,527,970	1,737,363	209,392
b) Maximum Flows					
AEL Estimate	2,039,250	2,291,244	321,199	12,946,922	12,625,723
Total Entrainment	2,767,198,570	101,030,008	1,916,775	2,161,725	244,949

Table 4: Table 3-10 from EPS 316B. Note total entrainment from maximum flow (857 MGD) is ~2.7 billion larvae.

APPENDIX 3A. FLOW AUGMENTATION EMPIRICAL TRANSPORT MODEL AND AREA PRODUCTION FOREGONE MODEL PARAMETERS FOR EACH TAXON USED IN THE ANALYSIS. SURVEY = SURVEY IDENTIFIER FROM ENCINA POWER STATION 316(B) STUDY, ENTRAINMENT (ESTIMATE), SWP = SOURCE WATER POPULATION, P_E = PROPORTION ENTRAINED, DURATION = NUMBER OF DAYS THE LARVAE ARE EXPOSED TO ENTRAINMENT, P_M = PROPORTIONAL MORTALITY, AREA = SOURCE WATER AREA IN ACRES, F_I = WEIGHTING FACTOR, AND P_S = LONGSHORE-CROSS SHELF CURRENT SCALING FACTOR.

Survey	Entrainment	SWP	P_e	Duration	P_m	Area	f_i	P_s
CIQ Goby								
EPSEA001	1,333,379	293,477,734	0.004543	11.5	0.05102	302	0.116	
EPSEA002	1,050,423	146,640,669	0.007163	11.5	0.079349	302	0.0316	
EPSEA003	2,365,748	143,505,301	0.016485	11.5	0.174002	302	0.07955	
EPSEA004	4,525,063	177,952,299	0.025429	11.5	0.256369	302	0.18595	
EPSEA005	1,462,671	94,586,619	0.015464	11.5	0.164081	302	0.06335	
EPSEA006	724,020	68,450,670	0.010577	11.5	0.115105	302	0.04577	
EPSEA007	266,152	43,014,350	0.006188	11.5	0.06889	302	0.02347	
EPSEA008	151,148	49,901,581	0.003029	11.5	0.034284	302	0.02729	
EPSEA009	170,435	54,370,974	0.003135	11.5	0.035461	302	0.03878	
EPSEA010	763,455	245,900,000	0.003105	11.5	0.035128	302	0.14489	
EPSEA011	1,748,311	161,690,423	0.010813	11.5	0.117524	302	0.11674	
EPSEA012	1,715,525	82,917,234	0.02069	11.5	0.213707	302	0.0369	
EPSEA013	2,431,519	172,827,046	0.014069	11.5	0.150361	302	0.08971	

Table 5: Appendix 3A from Appendix K. Note values in the column "Entrainment". Sum of entrainment is ~ 18.7 million

incorporating reduced flow (realtive to 857)
298=127+171

Species	Date	Max flow PE	f	d	304 Survival	298 Survival	Type	species	MGD 304	MGD 298	SWB (acres)	APF 304	APF 298
Blennies	10-Jun-04	0.07156	0.29923	2.7	0.279161465	0.279549094	Estuarine	Blennies	0.085507	0.083878	302.00	25.82	25.33
Blennies	24-Jun-04	0.03786	0.12245	2.7	0.118060395	0.118146057	Estuarine	Gobies	0.215512	0.211895	302.00	65.08	63.99
Blennies	6-Jul-04	0.0463	0.13375	2.7	0.127901435	0.128015277	Estuarine	Hypsopops	0.065375	0.064114	302.00	19.74	19.36
Blennies	13-Aug-04	0.14813	0.26395	2.7	0.228154589	0.228829508	Open Coa	White Croaker	0.00137	0.001343	33365.25	45.72	44.81
Blennies	23-Sep-04	0.17257	0.05771	2.7	0.048660842	0.048830115	Open Coa	Northern Anchovy	0.00165	0.001618	15570.45	25.69	25.19
Blennies	21-Oct-04	0.25027	0.00319	2.7	0.002481858	0.002494765	Open Coa	California Halibut	0.001513	0.001483	27477.26	41.57	40.75
Blennies	18-Nov-04	0.15199	0.00523	2.7	0.004503119	0.004516807	Open Coa	Queenfish	0.003656	0.003584	20309.28	74.25	72.79
Blennies	16-Dec-04	0.31413	0.00035	2.7	0.000254411	0.000256114	Open Coa	Spotfin Croaker	0.006371	0.006246	13738.63	87.53	85.81
Blennies	13-Jan-05	0.74564	0.00004	2.7	1.74517E-05	1.77881E-05							
Blennies	24-Feb-05	0	0.00001	2.7	0.00001	0.00001	Average Estuarine		0.122132	0.119962		36.88	36.23
Blennies	23-Mar-05	0.12817	0.00327	2.7	0.002883935	0.002891261	Average Open Coast		0.002912	0.002855		54.95	53.87
Blennies	21-Apr-05	0.07043	0.00885	2.7	0.008265626	0.008276918	SE Estuarine		#NAME?	#NAME?		#####	#####
Blennies	19-May-05	0.08222	0.10197	2.7	0.094137876	0.094288858	SE Open Coast		#NAME?	#NAME?		#####	#####
				PM Calculated	0.085506997	0.083877636	95% Estuarine					#####	#####
							95% Open Coast					#####	#####
Goby	10-Jun-04	0.02277	0.116	11.5	0.105670558	0.105866025							
Goby	24-Jun-04	0.0359	0.0316	11.5	0.027269479	0.027349423							
Goby	6-Jul-04	0.08262	0.07955	11.5	0.056504069	0.056892497							
Goby	13-Aug-04	0.12744	0.18595	11.5	0.109233585	0.110413232							
Goby	23-Sep-04	0.0775	0.06335	11.5	0.045975036	0.046270886							
Goby	21-Oct-04	0.05301	0.04577	11.5	0.036793592	0.036953955							
Goby	18-Nov-04	0.03101	0.02347	11.5	0.020666656	0.020718889							
Goby	16-Dec-04	0.01518	0.02729	11.5	0.025647049	0.025678582							
Goby	13-Jan-05	0.01571	0.03878	11.5	0.036366168	0.036412451							
Goby	24-Feb-05	0.01556	0.14489	11.5	0.135955059	0.136126425							
Goby	23-Mar-05	0.05419	0.11674	11.5	0.0933856	0.093801873							
Goby	21-Apr-05	0.10369	0.0369	11.5	0.023980689	0.024189359							
Goby	19-May-05	0.07051	0.08971	11.5	0.067039988	0.067431376							
				PM Calculated	0.215512474	0.211895026							
Hypsopops	10-Jun-04	0.07797	0.62469	2.2	0.587308767	0.588034395							
Hypsopops	24-Jun-04	0.07085	0.05168	2.2	0.048865571	0.048920289							
Hypsopops	6-Jul-04	0.03922	0.17163	2.2	0.166420702	0.16652267							
Hypsopops	13-Aug-04	0.13331	0.04004	2.2	0.035992264	0.036069882							
Hypsopops	23-Sep-04	0	0	2.2	0	0							
Hypsopops	21-Oct-04	0	0	2.2	0	0							
Hypsopops	18-Nov-04	0	0	2.2	0	0							
Hypsopops	16-Dec-04	0	0	2.2	0	0							
Hypsopops	13-Jan-05	0	0	2.2	0	0							
Hypsopops	24-Feb-05	0	0	2.2	0	0							
Hypsopops	23-Mar-05	0	0	2.2	0	0							
Hypsopops	21-Apr-05	0.17053	0.01825	2.2	0.015909061	0.015953572							
Hypsopops	19-May-05	0.19366	0.09371	2.2	0.080128492	0.080385358							
				PM Calculated	0.065375143	0.064113834							
White Croaker	10-Jun-04	0	0.00001	26.5	0.00001	0.00001							
White Croaker	24-Jun-04	0	0.00187	26.5	0.00187	0.00187							
White Croaker	6-Jul-04	0	0.00989	26.5	0.00989	0.00989							
White Croaker	13-Aug-04	0.00033	0.02103	26.5	0.020964861	0.020966144							

Species	Date		PM Calculated	Surv max		
White Croaker	23-Sep-04	0.00007	0.35414	26.5	0.353907044	0.35391164
White Croaker	21-Oct-04	0	0.03043	26.5	0.03043	0.03043
White Croaker	18-Nov-04	0.00012	0.07183	26.5	0.071749018	0.071750615
White Croaker	16-Dec-04	0.0004	0.00574	26.5	0.005718456	0.005718881
White Croaker	13-Jan-05	0.00029	0.04775	26.5	0.047620001	0.047622563
White Croaker	24-Feb-05	0.00028	0.13805	26.5	0.137687103	0.137694257
White Croaker	23-Mar-05	0.00005	0.26954	26.5	0.269413342	0.269415841
White Croaker	21-Apr-05	0.00084	0.04449	26.5	0.04414003	0.044146911
White Croaker	19-May-05	0	0.00523	26.5	0.00523	0.00523
			PM Calculated		0.001370146	0.001343147
Anchovy	10-Jun-04	0.00054	0.02259	7.7	0.022556702	0.022557359
Anchovy	24-Jun-04	0.00059	0.00187	7.7	0.001866989	0.001867048
Anchovy	6-Jul-04	0.00131	0.02319	7.7	0.023107152	0.023108785
Anchovy	13-Aug-04	0.00081	0.01464	7.7	0.014607641	0.014608279
Anchovy	23-Sep-04	0.00005	0.03618	7.7	0.036175059	0.036175157
Anchovy	21-Oct-04	0.00014	0.01157	7.7	0.011565576	0.011565664
Anchovy	18-Nov-04	0.00117	0.01404	7.7	0.013995194	0.013996077
Anchovy	16-Dec-04	0	0.00011	7.7	0.00011	0.00011
Anchovy	13-Jan-05	0.00009	0.00834	7.7	0.00833795	0.00833799
Anchovy	24-Feb-05	0.00117	0.0123	7.7	0.012260747	0.012261521
Anchovy	23-Mar-05	0.00035	0.42247	7.7	0.422066293	0.422074257
Anchovy	21-Apr-05	0.00049	0.42965	7.7	0.4290753	0.429086636
Anchovy	19-May-05	0.05437	0.00305	7.7	0.002625274	0.00263313
			PM Calculated		0.001650122	0.001618096
Halibut	10-Jun-04	0.00016	0.03876	31.1	0.038691643	0.038692991
Halibut	24-Jun-04	0	0.03912	31.1	0.03912	0.03912
Halibut	6-Jul-04	0	0.2564	31.1	0.2564	0.2564
Halibut	13-Aug-04	0.0001	0.08947	31.1	0.08937135	0.089373296
Halibut	23-Sep-04	0.00009	0.36188	31.1	0.36152087	0.361527955
Halibut	21-Oct-04	0.00033	0.04843	31.1	0.048253998	0.048257466
Halibut	18-Nov-04	0.00024	0.01426	31.1	0.014222293	0.014223036
Halibut	16-Dec-04	0.00077	0.00498	31.1	0.00493787	0.004938698
Halibut	13-Jan-05	0.00188	0.00915	31.1	0.00896212	0.008965792
Halibut	24-Feb-05	0.00033	0.04461	31.1	0.044447881	0.044451075
Halibut	23-Mar-05	0.00008	0.06386	31.1	0.063803664	0.063804775
Halibut	21-Apr-05	0.00117	0.01923	31.1	0.018983335	0.018988173
Halibut	19-May-05	0.00072	0.00985	31.1	0.009772061	0.009773594
			PM Calculated		0.001512916	0.001483149
				Surv max		
Queenfish	10-Jun-04	0.00035	0.15001	21.6	0.149608228	0.149616148
Queenfish	24-Jun-04	0	0.23205	21.6	0.23205	0.23205
Queenfish	6-Jul-04	0	0.12955	21.6	0.12955	0.12955
Queenfish	13-Aug-04	0.0022	0.03996	21.6	0.039291798	0.039304883
Queenfish	23-Sep-04	0.0007	0.4408	21.6	0.438441826	0.438488253
Queenfish	21-Oct-04	0.00608	0.00522	21.6	0.004982151	0.004986743
Queenfish	18-Nov-04	0	0	21.6	0	0
Queenfish	16-Dec-04	0	0	21.6	0	0
Queenfish	13-Jan-05	0	0	21.6	0	0
Queenfish	24-Feb-05	0	0	21.6	0	0
Queenfish	23-Mar-05	0	0	21.6	0	0
Queenfish	21-Apr-05	0	0.00242	21.6	0.00242	0.00242
Queenfish	19-May-05	0	0	21.6	0	0
			PM Calculated		0.003655996	0.003583973
spotfin	10-Jun-04	0.00013	0.27272	11.4	0.272576664	0.272579493
spotfin	24-Jun-04	0.00014	0.15573	11.4	0.155641857	0.155643597
spotfin	6-Jul-04	0.003	0.1705	11.4	0.168442967	0.168483346
spotfin	13-Aug-04	0.00074	0.06863	11.4	0.06842907	0.06842895
spotfin	23-Sep-04	0.0029	0.33239	11.4	0.328512769	0.328588892

spotfin	21-Oct-04	0	11.4	0	0
spotfin	18-Nov-04	0	11.4	0	0
spotfin	16-Dec-04	0	11.4	0	0
spotfin	13-Jan-05	0	11.4	0	0
spotfin	24-Feb-05	0	11.4	0	0
spotfin	23-Mar-05	0	11.4	0	0
spotfin	21-Apr-05	0.00003	11.4	0.00003	0.00003
spotfin	19-May-05	0	11.4	0	0
	PM Calculated			0.006370835	0.006245723