Huntington Beach Desalination Plant Response to RCF22 - Revised

Estimated Area of Production Foregone for each Station Sampled in 2003-2004

Poseidon Water Huntington Beach Desalination Plant

Huntington Beach, California
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Introduction

The Santa Ana Regional Water Quality Control Board's letter dated May 23, 2017 requested additional information from Poseidon Water in regards to their proposed Huntington Beach Desalination Plant (HBDP). Of these, RCF22 requested that an Area of Production Foregone (APF) estimate be derived for each of the seven sampling stations (Figure 1) used by MBC and Tenera (2005) for the 2003-2004 sampling period. During a related phone conversation, the California State Water Resources Control Board staff (Staff) asked that the list of species included in the APF be expanded to the extent possible. This report provides the response to the written RCF22 request and incorporates the Staff's request to expand the analyzed species list to the extent possible. In this instance, extent was defined as what the available data could support in a defensible scientific approach. Measurements of larval body length were the limiting factor in this analysis as the densities per taxa in each net sample for all stations were recorded. To avoid including data overly influenced by an anomalous size, we designated 20 measurements as a minimum sample size needed to incorporate a taxon into the analysis.

The current Huntington Beach Generating Station (HBGS) intake location is proposed to serve as the screened intake for the Huntington Beach Desalination Plant (HBDP) (referred to as Site 1G in previous site analyses). Of the seven sampling stations shown in Figure 1, Sampling Station E was positioned as close to the HBGS intake as possible to allow safe sampling of waters near the point of intake. Sampling Stations U2 and U4 are situated upcoast of the HBGS intake nearest to the Bolsa Chica State Marine Conservation Area (see Figure 1). The Bolsa Chica State Marine Conservation Area was designated after the wetlands restoration project was completed and was opened to tidal influence for the first time in over 100 years on August 24, 2006, nearly two years after the plankton sampling effort offshore of HBGS (MBC and Tenera 2005). Sampling Stations D2 and D4 were positioned downcoast of the HBGS intake near the mouth of Talbert Marsh and the Santa Ana River mouth. Talbert Marsh was opened to tidal exchange in 1989 and remained open during the sampling events conducted by MBC and Tenera (2005). Additional portions of the Huntington Beach Wetland complex have been restored since that time and continue to benefit from tidal exchange though the mouth at Talbert Marsh (HBwetlands 2017). Sampling Stations O2 and O4 extend directly offshore of the HBGS intake location and Sampling Station E.

Data Collection and Analysis

Materials and Methods

Taxa selected for inclusion in the analysis were those from the 2003-04 sampling period and used in prior entrainment analyses (Tenera 2015; MBC 2016), with new taxa from the 2003-04 sampling period added based on the availability of requisite morphometric data. A minimum of 20 notochord/standard (based on larval stage) length measurements was designated *a priori* as the threshold for sufficient coverage of the entrained size classes for inclusion in the analysis. For invertebrate larvae, stage description and published age estimates per stage were obtained prior to inclusion in the analysis. Sampling results by station from MBC and Tenera (2005) were used to generate entrainment and source water population density estimates for each analyzed taxon.

Per the 2015 Ocean Plan Amendment (OPA), the Empirical Transport Model (ETM) as described by Steinbeck et al. (2007) and Area of Production Foregone (APF) calculation per Raimondi (2011) were executed to develop metrics to compare the seven sampling stations. A mitigation ratio was applied to all results consistent with prior analyses to account for differences in likely source habitat productivity. It is important to note that per Raimondi (2011), the APF derives an estimate of habitat needed to compensate for entrainment losses rather than "the wrong idea that APF means that existing habitat has been lost" (pg. 15 in Raimondi 2011). Parameters for the ETM and APF which are derived independently of estimated entrainment rates were compiled for each analyzed taxon from prior reports, when possible. For those previously analyzed, ETM and APF parameters were compiled from Tenera (2010) to remain consistent with Tenera (2015). The requisite parameters for those previously unanalyzed taxa were derived per Steinbeck et al. (2007) and Raimondi (2011). Northern Anchovy (*Engraulis mordax*) was excluded from this analysis for the same reasons as described in the Davis et al. (2006) report on behalf of the California Energy Commission's technical advisory committee commissioned to advise the MBC and Tenera (2005) study and conclusions.

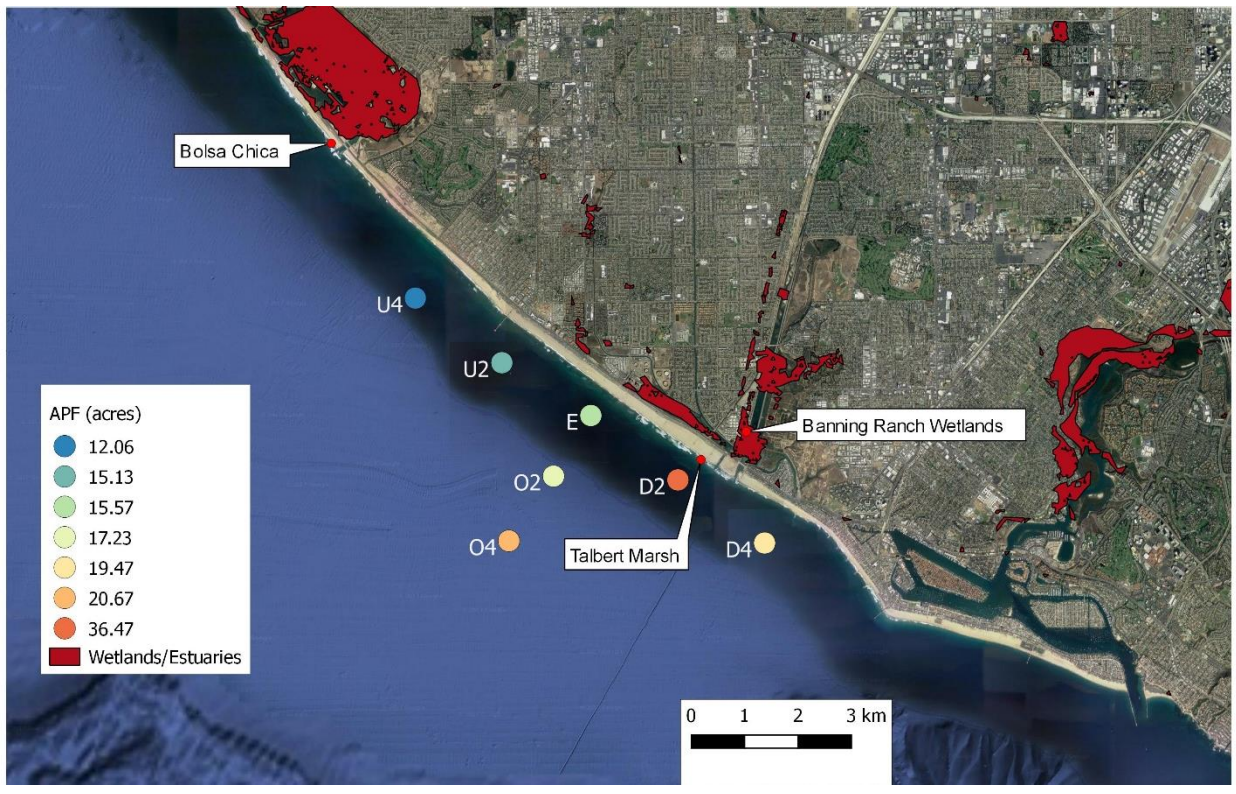

Figure 1. Sampling Stations Used in 2003-2004 Entrainment Station and Wetlands in the Huntington Beach Desalination Plant Area. Sampling Station Markers are Colored to Represent Area of Production Foregone Estimates (APF in Acres)

Results and Discussion

In addition to the eight taxa analyzed in previous reports, three taxa were added after determining that sufficient morphometric information was recorded during the 2003-2004 sampling effort. These included two fish – Jacksmelt (*Atherinopsis californiensis*) and Salema (*Haemulon californiensis*), and one invertebrate – mole crab (*Emerita analoga*). Consistent with prior analyses (MBC and Tenera 2005), the 95th percentile lengths were calculated for each taxon, when available. The 95th percentile lengths for Jacksmelt and Salema were 9.00 and 2.25 millimeters, respectively. Available age at length information in the scientific literature suggest Jacksmelt were eight days old (Midddaugh et al. 1990) and Salema were two days old (Saksena and Richards 1975) based on larval growth in White Grunt (*Haemulon plumieri*). Nearly all mole crabs were Stage 1 zoea or approximately three days old per Rees (1959) and his assessment of *Emerita talpoida*. As noted in MBC and Tenera (2005), an estimated Stage 1 zoea stage duration for laboratory-reared mole crab of 34 days (Johnson and Lewis 1942) was likely a result of poor culturing as all zoea died after transitioning to Stage 2 zoea. Poor survival at stage transition is an indication of retarded development that likely does not reflect natural conditions. Rees (1959) did not report similar mortalities after zoea passed Stage 1 at a rapid pace (compared to Johnson and Lewis 1942). Therefore, the three days estimated for Stage 1 duration were used for the zoea caught during the 2003-2004 HBGS study.

Calculations of the APF resulted in a range of mitigation estimates of 12.06 to 36.47 acres (Table 1). The APF calculated for Sampling Station E differs from previously reported estimates (Tenera 2015) due to the inclusion of additional taxa in the current estimate beyond what was used in prior reports. The highest APFs occurred at Sampling Stations D2 and D4, located downcoast of the intake near the Huntington Beach Wetlands (HBW) mouth and the Santa Ana River mouth with Banning Ranch and its wetlands along the southwest bank of the river. The APFs calculated based on the 2003-2004 survey data were lowest at Stations U2 and U4, but these two stations are nearest the mouth of the Bolsa Chica Ecological Reserve (BC) which opened in 2006 to tidal flushing. The proximity of these two stations to the mouth suggests more larvae spawned in BC would be subject to entrainment at these sites. Consequently, the Regional Board's May 23, 2017 letter Attachment A entitled Huntington Beach Desalination Project -Alternative Sites for Further Analysis states, *"Further analysis of surface intakes at this site (referencing 1E and 1F) is not required due to potential impacts to Bolsa Chica Basin and Bolsa Bay State Marine Conservation Areas."*

The APFs calculated for the alongshore sampling stations (all but O2 and O4) were largely a function of CIQ goby[1] APFs, with 37- 67 percent of these APFs contributed by CIQ goby. This was especially true at Sampling Stations D2 and D4, where the CIQ goby APF accounted for 67 percent and 65 percent of the total, respectively. The offshore sampling stations (O2 and O4) were dominated by the open coast/soft bottom taxa APF contributions, as CIQ goby contributed less than 10 percent of each sampling station total. Unlike the alongshore sampling stations where CIQ goby were the most common fish larvae, California Halibut (*Paralichthys californicus*), Diamond Turbot (*Paralichthys guttulatus*), and White Croaker (*Genyonemus lineatus*) were the most substantial contributors at the two offshore sampling stations. All three of these taxa dominating the offshore sampling station larval catches are open coast/soft bottom taxa and therefore eligible for mitigation scaling.

Table 1. Area of Production Foregone (APF) for Analyzed Taxa by Sampling Station. Each Sampling-Station APF is Unique to That Sampling Station and Representative of Mitigation needed for a Surface Intake Located at That Sampling Station.

Taxa	Sampling Station						
Estuarine	U4	U2	E	D2	D4	O2	O4
CIQ goby	3.98	3.30	5.03	10.34	18.92	0.93	0.21
Standard Error	1.27	0.69	1.10	1.61	2.90	0.23	0.10
95% Confidence Interval	6.08	4.44	6.84	12.99	23.70	1.31	0.38
Open Coast/Soft Bottom							
Black Croaker	69.15	25.33	8.48	60.76	43.71	32.03	82.19
California Halibut	55.57	75.22	15.08	38.95	24.68	177.38	555.96
combtooth blennies	35.27	20.44	9.26	17.21	9.82	38.02	54.09
Diamond Turbot	0.54	0.54	30.96	0.54	0.54	232.21	0.54
Jacksmelt	41.17	116.67	42.45	34.99	67.97	11.91	8.94
mole crab	35.18	14.83	22.22	5.49	5.49	3.30	3.26
Queenfish	181.74	83.83	52.32	146.24	384.71	79.80	77.92
cancer crab megalops	45.84	92.40	253.67	39.18	47.00	80.34	51.26
Salema	2.28	3.86	0.00	0.00	0.00	54.55	49.84
Spotfin Croaker	84.54	62.29	10.44	50.71	26.29	8.33	5.56
White Croaker	112.71	83.48	58.04	55.50	89.71	339.81	270.27
Mean	60.36	52.63	45.72	40.87	63.63	96.15	105.44
Standard Error	18.36	14.37	25.30	14.56	39.00	38.35	59.25
95% Confidence Interval	90.55	76.26	87.34	64.82	127.78	159.23	202.89
10:1 Scaling	9.06	7.63	8.73	6.48	12.78	15.92	20.29
Total APF*	15.13	12.06	15.57	19.47	36.47	17.23	20.67

*The estimated Total APF does not include the 1% credit allowed for use of a 1-mm screened intake.

[1] CIQ goby is a complex of *Clevelandia ios* (Arrow Goby), *Ilypnus gilberti* (Cheekspot Goby), and *Quietula y-cauda* (Shadow Goby).

Application to the Alternative Sites Analysis

In their May 23, 2017 letter, the Santa Ana Regional Water Quality Control Board Staff under RCF22 requested this expanded APF analysis also describe which of the 2003-2004 sampling stations would represent each of the alternative sites where a surface intake is under consideration. For clarification, the APF is sensitive to the taxa used in the analysis, rather than just the total larval density independent of taxonomic composition. Therefore, some sampling stations used for each alternative site may differ from what was used in the previously submitted alternative sites analysis (Dudek 2017) where total mean larval density was evaluated. The following analysis reviews each remaining alternative site individually in northwest to southeast order. For reference, the existing intake location (Alternative Site 1G) is represented by Sampling Station E with an APF of 15.57 acres.

Alternative Site 1D

A surface water intake supporting Alternative Site 1D is currently proposed between the Alamitos Bay entrance jetty, San Gabriel River mouth, and the Anaheim Bay entrance jetty offshore a sandy beach that extends out and becomes the seafloor extending past the proposed intake location. In the alternative sites analysis, the mean larval density across all sampling stations (460.52 larvae/1000 m^3) was used in acknowledgement of the variety of habitats represented by Site 1D. If basing the evaluation on APF, however, Sampling Stations D2 and D4 would be more representative of the Alternative Site 1D area. The areas represented by Sampling Stations D2 and D4 include the mouth of Talbert Marsh and the Santa Ana River mouth. These coastal features more closely resemble those features surrounding Alternative Site 1D. The APFs for Sampling Stations D2 and D4 were 19.47 acres and 36.47 acres, respectively, or an average of 27.97 acres.

Alternative Site 1E

The surface water intake supporting Alternative Site 1E is currently proposed to be located just downcoast of the BC mouth. In the previously submitted alternative sites analysis, the mean larval density calculated from Sampling Stations U2 and U4 was used in acknowledgement of the location. The APF, however, due to its incorporation of taxa-specific parameters would likely be best represented by Sampling Stations D2 and D4, or their average APF (27.97 acres) as detailed for Alternative Site 1D.

Alternative Site 1H

The surface water intake supporting Alternative Site 1H is currently at approximately the location of Sampling Station D2. In the previously submitted alternative sites analysis, the mean larval density calculated from Sampling Stations D2 and D4 was used in acknowledgement of the location and possible variability in the final location of the intake in the general area represented by Sampling Stations D2 and D4. The average APF for Alternative Site 1H is 27.97 acres, or the average of the APFs calculated for Sampling Stations D2 and D4 as detailed for Alternative Site 1D.

Alternative Site 2A

The surface water intake supporting Alternative Site 2A is proposed for a location approximately one kilometer downcoast of Sampling Station D4 and therefore likely influenced by larvae exported from both Talbert Marsh and the Santa Ana River mouth. In the previously submitted alternative sites analysis, the mean larval density calculated from Sampling Stations D2 and D4 was used in acknowledgement of the location and possible variability in the final location of the intake in the general area represented by Sampling Stations D2 and D4. The average APF for Alternative Site 2A is 27.97 acres, or the average of the APFs calculated for Sampling Stations D2 and D4 as detailed for Alternative Site 1D.

Conclusions

Evaluating the 2003-2004 HBGS entrainment study data as a function of how much mitigation would be required to offset HBDP impacts depending on the location of the ocean intake using the APF highlights informative patterns. CIQ goby was the dominant taxa at each alongshore sampling station, but as the only estuarine-related taxon, it was assumed to require a 1:1 mitigation ratio.

This, in turn, substantially impacted the APF estimates at each alongshore station. The APF estimates from sampling stations near wetlands or estuaries, such as Sampling Stations D2 and D4, were especially influenced by CIQ goby. The proximity to such a source will likely continue to influence the plankton community and thus influence the APF estimate. As indicated by the 2003-2004 survey results, entrainment for intakes located near a wetland or estuary mouth where tidal flushing occurs will likely result in increased mitigation requirements when compared to stations located further from the mouth. This is potentially true for Sampling Stations U2 and U4 and their proximity to the now-open BC. Using the GIS wetlands shapefile available from the California Department of Fish and Wildlife (CDFW 2017), BC has > 900 acres of wetland habitat while the combination of the HBW and Santa Ana River has > 250 acres. Assuming the CIQ goby distribution pattern remains consistent, the larval fish community susceptible to entrainment at the areas represented by the U and D sampling stations would be at least similar. The U sampling stations may have higher CIQ goby densities resulting from the potentially higher volume of CIQ goby larvae exported from BC.

It is important to note that while the results presented above indicate variations in the amount of mitigation needed to compensate for calculated impacts at each station. In accordance with the cautions Raimondi (2011) described, APFs do not represent an environmental impact, rather they represent the mitigation needed to offset the losses. The ETM and APF are limited to a subset of entrained taxa as a function of logistical realities.

At the request of the Water Board staff, several taxa were included in this iteration of the APF presented above that were not included in prior ETM and APF calculations carried out for either HBDP or HBGS for several reasons. First, if a taxon is caught only at either an entrainment or source water station it provides no analytical value in determining overall ecological impacts. For example, Salema larvae became so common in the last two sampling events in 2004 that it ranked among the ten most abundant taxa entrained by HBGS. The analytical difficulties this created were because of the mixture of sampling efforts used in 2003-2004. Weekly sampling at only the entrainment station (Sampling Station E) caught Salema larvae in high densities on August 24, but no corresponding sampling occurred at the source water Sampling Stations D2, D4, U2, U4, O2, and O4. Therefore, these data could not be included in the ETM analysis as a source water population estimate was not available. The survey beginning on August 30 caught substantial densities of Salema at Sampling Stations O4, O2, U2, and U4, but no individuals were caught at Sampling Station E. Therefore, this survey likewise did not support an ETM analysis as no entrainment occurred while the local population was susceptible to entrainment. Situations like this described for Salema limits which taxa could be included in prior ETM/APF analyses. They were included here as all the sampling stations were used as a possible intake location and taxa like Salema were included for all sampling stations to maintain consistency in the analyzed taxa list and application of the ETM/APF analyses across all sampling stations.

Three taxa were added to the analysis in comparison to each of the prior ETM/APF analyses because the aforementioned entrainment point (intake)-location specific issues were alleviated by examining all sampling stations in a uniform manner. Accurate measurements and or larval stage assignments are more critical to whether or not a taxon is included in the ETM/APF. While the ETM is largely life-history independent, an estimate of larval age is required to inform several parameters for both the ETM and APF. The larval body length or stage (for invertebrates) is needed to estimate the approximate age for all larvae. While this process is methodologically simple, it is complicated, from a logistical standpoint, to accurately compile sufficient morphometric data (fish larvae) or stage assignments (invertebrate larvae). Therefore, acquired length measurements must be mated with length at age estimates for that particular taxon or a closely aligned surrogate to derive an estimated age. This estimated age serves as input for three parameters in both the ETM and APF, and is therefore a critical component that cannot be accurately described for all taxa. More than sampled densities, the availability to derive an age estimate was the limiting factor on which taxa could be added to this ETM/APF analysis for each of the sampling stations.

As noted in MBC (2017), many taxa occurring at Sampling Station E, or any of the alongshore sampling stations, were reflective of taxa whose populations are believed to be healthy and robust due, in large part, to a lack of substantial fishery pressure. Meanwhile, those taxa caught at the two offshore sampling stations (O2 and O4) were more representative of fished species, including some overfished species. No special status species were caught in the 2003-2004 sampling, but several larvae were from species with stocks reportedly depleted by fishing pressure, such as California Halibut and sea basses such as Kelp Bass (*Paralabrax clathratus*) and Barred Sand Bass (*P. nebulifer*). The California Halibut stock is reportedly at 14 percent of its unfished biomass (Maunder et al.

2011), while sea basses, especially Barred Sand Bass, have declined due to overfishing (Erisman et al. 2011). These, and others, were more common at Sampling Stations O2 and O4 in comparison to Sampling Station E. In addition to the taxonomic differences between the alongshore and offshore sampling stations, the lack of a statistically significant difference in total larval density between Sampling Stations E and O2 (MBC 2017) should also be included in any comparison of the APF at each of these locations. The estimated entrainment, or the average larval density multiplied by the proposed intake volume, is the first parameter in the ETM. Therefore, statistically insignificant differences between the means could lead to minor differences in the final APF estimate. This was evident in the 0.49 acre difference between the APFs for Sampling Stations E and O2.

After calculating the ETM/APF and reviewing the resulting acres of mitigation needed for each sampling station reaffirms the prior conclusion of MBC (2017). The present intake location, accounted for by Sampling Station E or Alternative Site 1G, is the best site to minimize impacts to all forms of marine life.

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