POSEIDON WATER

Huntington Beach Desalination Project

Informational Meeting – April 13, 2018

ETM/APF CALCULATIONS FOR THE PROPOSED HUNTINGTON BEACH DESALINATION PROJECT

Meeting's Purpose

- *To reach shared understanding of Poseidon's ETM/APF approach by addressing perceived inconsistencies in Poseidon's data usage, methods, and assumptions, and by conducting stepwise analyses of Poseidon's calculations.*

Inconsistencies between CCC and Poseidon Analyses

1. Ocean current data
2. Taxa selection
3. Larval duration
4. Source water habitat and classification
    - Use of the National Wetland Inventory (NWI)
    - Alongshore displacement

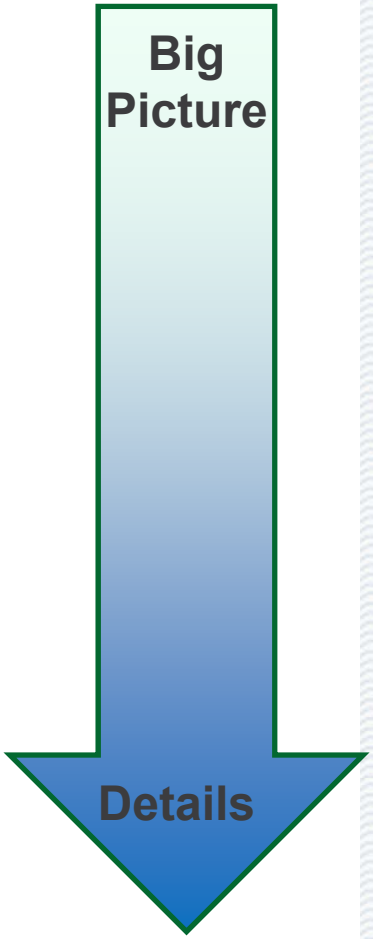
Roadmap for Today's Meeting

<u>What we hope to accomplish</u>

- Describe evolution of the science over the 12+ years
- Describe how Poseidon APF calculations were done
- Describe chronology of HB marine life reports
- Address issues raised in Agenda and Attachment A
- Answer questions and resolve outstanding issues

Topics to be Covered

- Answer the questions in the **Agenda** and **Attachment A** throughout the PPT
- First, need to start at the beginning
- Four main sections
  1. Impact assessment history resulting in ETM and APF in CA
  2. What guidance does the OPA/SED provide?
  3. Support for the Poseidon calculations
  4. ETM/APF Details (tables)



HOW TO CALCULATE THE ETM AND APF

Entrainment Impact Assessment

- Began in 1970's with concerns over power plant cooling water withdrawals from the Hudson River
- Evaluating entrainment impacts has evolved since first sample was taken
  - Raw estimated entrainment = big numbers that do not represent impacts to standing stock population
  - Demographic models not favored in CA because of life history limitations = restricted to very few species/taxa
  - CA came to prefer proportional mortality models = % of available larvae lost to entrainment
    - Fewer life history data inputs needed

Source Water Body Definition

- It is important to understand the difference in the source water body definitions before moving forward
- ETM Source Water Body (SSWB in Agenda 2)
  - Stations sampled surrounding the intake representing the source waters containing larvae susceptible to entrainment during sampling
- APF Source Water Body (TSWB in Agenda 2)
  - Area of habitat that could have produced the entrained larvae
    - Substantially larger than the ETM source water body

Empirical Transport Model (ETM)

- Developed to calculate entrainment as a measurement of the percentage of the local population lost to entrainment
  - Proportional model preferentially used in CA
  - Reduces need for life history information
- Based on model developed by Dr. Alec MacCall of NOAA Fisheries Southwest Fisheries Science Center 1980's
- Requires sampling at intake and the surrounding source waters
- End result of the model is the proportional mortality (P_m) or the fraction of the local population lost to entrainment

Area of Production Foregone (APF)

- Converts proportional mortality resulting from the ETM to an estimate of the area of habitat needed to replace the biological production (organic material) lost to entrainment
- Not originally derived as a tool used to measure impact but instead:
  - Estimates mitigation to create habitat that will produce the biological production lost to entrainment
- Multiply P_m by the APF source water body

Mechanics of APF

- Per Raimondi 2011

$$APF_i = P_{M_i}(SWB_i)$$

- In other words, the ETM result (P_m) is multiplied by the APF source water area (TSWB)
  - Example: P_m = 0.1%, SWB = 20,000 acres
    - APF = 0.001 x 20000 = 20 acres
- The math is simple
- Source water estimation and taxa selection is not as clear cut

APF SWB Calculation Precedents

- Coastal taxa = average daily current displacement over the year times the median age of entrained larvae
  - Displacement (km/d) x Age (d) for each taxon

- Estuarine Taxa = Estuarine/wetland habitat within the range of current displacement
  - Use the coastal taxa current displacement SWB estimation to identify possible source estuaries
  - Estimate APF SWB for source estuaries using National Wetland Inventory
  - April 2, 2018 letter from John Steinbeck of Tenera Environmental
    - Details the evolution of using the National Wetland Inventory

OPA & SED GUIDANCE

OPA-SED ETM & APF Calculation Instructions

- Review
  - Considerations for Sampling and Processing (E-104)
    - Superseded by OPA text
  - Fundamentals of the ETM (E-136)
  - Mechanics of deriving the APF (E-139)

HB Sampling Complied with OPA Sampling Requirements

- OPA - *The study period shall be at least 12 consecutive months*
  - Sampling in support of the ETM at HB was done monthly for 12 consecutive months
- OPA - *Samples must be collected using a mesh size no larger than 335 microns*
  - Bongo net frame fitted with 333-micron mesh nets used in 2003-04
- OPA - *individuals collected shall be identified to the lowest taxonomical level practicable*
  - Taxa selection performed in accordance with agency oversight

HB Analysis Complied with OPA Requirements

- OPA - *The ETM/APF analysis* shall evaluate entrainment for a broad range of species, species morphologies, and sizes under the environmental and operational conditions that are representative of the entrained species and the conditions at the full-scale desalination facility.*
  - The original ETM was done on a range of taxa representing the habitats dominating the area
    - Proportion entrained was calculated in accordance with Steinbeck et al. 2007 Ad Hoc Rule 1 stating that the P_e is derived by dividing the entrainment station density by the source water station density collected during the same 24-hr period
  - All APFs have remained consistent with the original ETM
  - The species list was approved by the CEC Expert Review team of Drs. Davis, Raimondi, Cailliet, and Foster (BRRT)

Fundamentals of the ETM (Agenda 2.1)

- Empirical Transport Model (From Raimondi 2011)
  - We will review each parameter in detail in the following slides
  - Tenera 2010 was conducted in accordance with the regulatory guidance

$$P_M = 1 - \sum_{i=1}^{n} f_i (1 - P_S P_{Ei})^d$$

Where:

P_{Ei} = estimate of the proportional entrainment for the i_{th} survey
P_S = ratio (sampled source water / SWB)
f_i = proportion of total annual larvae hatched during i_{th} survey
d =estimated number of days larvae vulnerable to entrainment

Fundamentals of the ETM

- Proportion Entrained (P_e)
  - Divide the average density of the taxon from the entrainment station by the average density of the taxon from the source water sampling stations
  - E_i = Average Density at Entrainment Station
  - N_i = Average density at source water station
  - I^{th} survey = any single 24-hr survey period when both all stations were sampled within the same 24-hr time block
  - 2003-04 sampling followed this plan

$$P_{E\,i} = \frac{E_i}{N_i} \qquad (1)$$

where

E_i = total numbers of larvae of species entrained during a day during the ith survey; and

N_i = numbers of larvae at risk of entrainment, i.e., abundance of larvae in the sampled source water during a day during the ith survey.

Fundamentals of the ETM

- Each survey needed to be weighted to account for the proportion of the population at risk of entrainment
  - f_i is a weighting factor
  - Weights the surveys in accordance with what proportion of total annual sample (by taxon) was caught in each survey period
  - Example – if 100 larvae were caught over the 12 months and 12 were caught in month 1, then $f_1 = 0.12$
  - The sum of all $f_i = 1.0$

$$f_i = \frac{N_i}{N_T}$$

Where:

N_i = the source population spawned during the ith survey

N_T = the sum of the N_i 's for the entire study period.

Fundamentals of the ETM

- The ETM source water is not capturing the entire population that could be effected by entrainment. So the total source water, or what will become the APF source water, is factored into the ETM.
- Below, L_G = ETM SWA (SSWB) and L_P = APF SWA (TSWB)

$$P_S = \frac{L_G}{L_P} \qquad (4)$$

Where:

L_G = length of sampling area

L_P = length of alongshore current displacement based on the period (d) of larval vulnerability for a taxon

COMPARISON BETWEEN DR. RAIMONDI REVIEW OF CARLSBAD AND HUNTINGTON BEACH ETM/APF

Why Look at Dr. Raimondi's Carlsbad Review?

- Dr. Raimondi's Carlsbad Desalination Plant ETM and APF review can guide application of these models
- Used in conjunction with Davis et al. (2006), Dr. Raimondi's presentation provides a documented record into the appropriate application of the ETM and APF
- These documents provide guidance for subsequent usage of these models in accordance with the State's most commonly used expert on the subject
- In each slide, text under "Dr. Raimondi's Carlsbad Example" is a direct quote from his slide

First Slide of Dr. Raimondi's Presentation for Reference

Review of Carlsbad Seawater Desalinization Project (CDP)

- General comments on report
- Assessment of calculations of Pm
  - Estuarine species
  - Open water species
- Assessment of mitigation alternative using APF calculations
  - Math
  - Habitats

Huntington Beach Impact Assessment

- Dr. Raimondi's Carlsbad Example
  - *The study design was for entrainment sampling included source water sampling is consistent with recent entrainment studies under 316(b) rules*
- Poseidon Approach
  - The 2003-04 HBGS study design included source water sampling consistent with the entrainment studies completed under 316(b) rules

Huntington Beach Impact Assessment

- Dr. Raimondi's Carlsbad Example
  - *Calculations of Pm, SWB (or SWA) and APF are generally consistent with recent studies*
    - *Note additional calculations shown in this presentation for uncertainty and open water species*
- Poseidon Approach
  - Pm, SWA, and APF were all calculated using methods from the recently completed studies Dr. Raimondi notes
    - Poseidon submittals calculated uncertainty for all analyze taxa

Huntington Beach Impact Assessment

- Dr. Raimondi's Carlsbad Example
  - *Proportional mortality (Pm) estimates are calculated using standard methodology*
  - *Source water estimation is complicated for estuarine species (but in my opinion – correct)*
- Poseidon Approach
  - Pm was calculated as described in Appendix E of the SED, which is consistent with the standard methodology Dr. Raimondi refers to.
  - The estuarine species' source water in both Carlsbad and Huntington Beach was representative of wetted estuarine habitat per NWI

Huntington Beach Impact Assessment

- Dr. Raimondi's Carlsbad Example
  - *Source water estimation is standard for open water species*
- Poseidon Approach
  - Source water estimation for open water species at both Carlsbad and HB used the alongshore displacement method

Key Points from Raimondi Carlsbad Presentation

Understanding Proportional Mortality (Pm)

- Pm is the proportion of larvae at risk that are estimated to die as a result of entrainment
- Larvae at risk is determined by source water body (SWB) which differs for estuarine vs open water species
  - For estuarine species, it is generally the area of Agua Hediondo Lagoon that could produce larvae entrained
  - For open water species, it is the area from which larvae could have traveled from and then be entrained
    - Based on age of larvae entrained

Important to note the prescribed, and separate, treatment of the estuarine and open water species. This is consistent with how representative taxa were treated in Poseidon submittals. Taxa classification for HB was done in accordance with prior, peer-reviewed conclusions (Davis et al. 2006)

Key Points from Raimondi Carlsbad Presentation

Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

Species	Pm	Calcuated SE	Ratio SE/ Pm	Source water body *	Units
Estuarine					
Blennies	0.08635	0.1347	1.56	302	Acres
Gobies	0.21599	0.3084	1.43	302	Acres
Garibaldi	0.06484	0.1397	2.15	302	Acres
Open Water					
White Croaker	0.00138	0.0028	2.04	45	Km along shore
Northern Anchovy	0.00165	0.0026	1.56	21	Km along shore
California Halibut	0.00151	0.0024	1.58	37	Km along shore
Queenfish	0.00365	0.0049	1.33	27	Km along shore
Spotfin Croaker	0.00634	0.0153	2.41	19	Km along shore

*The source water body for estuarine species is actually different from this value, however it is assumed that larval production is primarily from 302 acres in Agua Hediondo Lagoon

Important to note the same source water body area is used for all three estuarine species and this area corresponds to the area of Agua Hedionda as derived from the National Wetland Inventory. The open water taxa show species-specific alongshore displacements as the maximum age of each species is different and therefore changes the alongshore distribution distance.

Dr. Raimondi's Comments on Error Calculations

Use of error in calculations

- Use of error to calculate cumulative confidence curves relies on decision as to which estimate of error is appropriate.
- I used a normal cumulative function to generate confidence curves.
  - This relies on mean value and estimate of the standard deviation of the population of means.
  - I concluded that sample standard deviation was inappropriate for use using this function and instead used the sample standard error as an estimate of the standard deviation of the population of means. Hence the calculation was:
    - Prob = ZCF((acres – mean acres)/calculated SE)
    - Where ZCF is the normal cumulative function
  - The use of SE led to more conservative (lower) estimate of (eg) 80% confidence limit than would have been the case if standard deviation was used.
  - This was evaluated using resampling approaches where possible (which make no assumptions about normality).

Huntington Beach Impact Assessment

- Dr. Raimondi's Carlsbad Example
  - *Average the taxon-specific APFs for each habitat group*
  - *Calculate Standard Error for the habitat group*
  - *Calculate the 95% confidence using a normal inverse function*
- Poseidon Approach
  - The Huntington Beach Desalination Project APF calculation followed Dr. Raimondi's steps exactly.

Huntington Beach Impact Assessment

- Dr. Raimondi's Carlsbad Example
  - *Derive the 95% CI estimated APF for each habitat group*
  - *Apply scaling factor (1:10 sandy open water: estuarine/rocky reef)*
  - *Sum the two finals*

- Poseidon
  - Classified taxa
  - Calculated taxon-specific APF
  - Averaged APF by habitat group
  - Calculated Std. Error
    - For single taxon groups, std. err. for Pm was used
  - Calculated 95% CI estimated APF by habitat group
  - Scaled sandy/open water group (1:10)
  - Summed final habitat group APFs

REVIEW INCONSISTENCIES

Inconsistencies between CCC and Poseidon Analyses

- Begin with a review of Huntington Beach site's entrainment impact analysis report history

1. Ocean current data
2. Taxa selection
3. Larval duration
4. Source water habitat and classification
    - Use of the National Wetland Inventory (NWI)
    - Alongshore displacement

HISTORY OF HUNTINGTON BEACH ENTRAINMENT IMPACT ANALYSIS

History of Huntington Beach Marine Life Impact Reports

- 2003-2004 Huntington Beach Generating Station Sampling Survey
  - MBC/Tenera 2005 – First report on the 2003-04 survey
  - Tenera 2006 – First complete APF calculated using modern approach
  - Davis et al. 2006 – CEC Experts review of MBC/Tenera 2005 and Tenera 2006
  - MBC and Tenera 2007a – AES HB 316(b) IM&E Report
  - MBC and Tenera 2007b – AES HB 316(b) Restoration Report
  - Tenera 2010 – IM&E Impact Analysis for Certified EIR
  - Tenera 2011 – IM&E Impact Analysis incorporated in R8-2012-0007
  - Tenera 2015- APF for current proposed HBDP intake
  - HDR 2017 – APF by 2003-04 sampling station to determine best site
  - CCC 2017 – Review of HDR 2017 and attempt to recalculate APF

Report History - ETM/APF and Source Water Habitat (Per Agenda 1.1)

Data Point	MBC and Tenera 2005	Tenera 2006	Davis et al. 2006	MBC and Tenera 2007a	MBC and Tenera 2007b	Tenera 2010	Tenera 2011	Tenera 2015	HDR 2017	CCC 2017
Peer/Regulatory Reviewed	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No
ETM Calculated	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes*	Yes*
APF Calculated	Table ES-2	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Estuary Habitat	LSD**	NWI***	NWI	N/A	NWI	N/A	N/A	NWI	NWI	LSD

- * - The ETM was scaled from published results for Station E and calculated for all other stations.
- ** - LSD = Longshore Displacement
- *** - NWI = National Wetland Inventory

Expert Review of Huntington Beach Desalination Plant APF Estimates

- In Raimondi (2017) SLC SEIR Appendix F1 review of Poseidon's Area of Production Foregone Submittals
  - *"The APF calculations follow approaches that have been vett ed and used routinely (Appendix 1)."*
- Reviewed documents included Tenera 2015
- HDR 2017 was done using Tenera 2015 and Tenera 2010 as main sources of information

INCONSISTENCY 1 - OCEAN CURRENT DATA REVIEW

Ocean Current Update – Review of 1999-2000 Data

- Current mapping technologies evolved between 1999-2000 and 2007-2008
- 1999-2000 currents were mapped using a single point current meter
  - Similar to the S4 current meter that failed
  - Moored at 5 meters below the sea surface offshore of OCSD in the Littoral Cell
  - The 99-00 suspended mooring approach is obsolete by today's standards (ADCP is the current state of the science)
    - The motion of the current meter when disturbed by waves will alias the current meter measurements
    - Therefore the 99-00 data was of limited utility on its own

Ocean Current Update – Review of 2007-2008

- Current mapping technologies evolved between 1999-2000 and 2007-2008
- 2007-2008 currents were mapped using an acoustic doppler current profiler (ADCP)
  - In the source water sampling array within the same Littoral Cell as the 99-00
  - ADCP is the current leading edge state of the science
  - Maps currents from the seafloor through to the surface
  - Trawl-safe mount was located within the source water sampling area near the intake
  - ADCPs provide high resolution on all current trajectories
  - Informs advection across the water column
    - Advection is the movement of water into the area
    - A single point current meter cannot capture the range of subtidal currents moving larvae around the area.

Ocean Current Update

- "*Tenera 2010 relies on data collected by OCSD in 2007-08 which was measured by a more advanced technique using a fixed bottom mounted acoustic Doppler current profiler (ADCP) that scans upwards to measure the vertical current structure throughout the entire water column, thereby allowing Tenera to calculate the vertically integrated net movement of organisms throughout the source water domain*" – Dr. Scott Jenkins, Scripps Institution of Oceanography
- Mr. John Steinbeck, President Tenera Environmental, author on MBC and Tenera 2005, 2007a, 2007b, and Tenera 2010, 2011, 2015 opined that the 2007-08 current data was scientifically the best data available

Ocean Current Year-to-Year Stability

- Currents on the San Pedro Shelf (which covers nearly all of the habitat domain used in the ETM/APF) is dominated by daily natural events (tides and the sea-breeze) which are repeated regularly from year to year with little variation
- Nearshore San Pedro Shelf currents are vertically complex, with current maximums near the surface and bottom and a minimum somewhere in the midwater.
- Along the 15 m isobath, the 99-00 current meter was suspended the midwater likely in the natural current minimum layer
- The 07-08 ADCP data did not suffer from the isolated position
  - It provided depth-integrated measurements across the water column from near bottom to near surface
  - Captured the almost complete water movement in the area

INCONSISTENCY 2 - TAXA SELECTION

Taxa Selection for Inclusion in APF

- No guidance in OPA
- Raimondi (2011) in SED App E (Page E-139)
  - Recommends "*information collected on a group of species having varied life history characteristics can be used to estimate to impact to all entrained species*"
- SED *Appendix C Life History Information for Select California Marine Organism* is incomplete
  - For example, it does not include any of the three gobies in the CIQ goby complex
  - Source is CA Department of Fish and Wildlife and reflects mostly harvested (comm or rec) or charismatic fauna

History of Taxa Selection by Experts

- Experts such as Dr. Peter Raimondi reviewed prior entrainment impact assessment reports that used ETM and APF and concurred with the selected taxa
- In those reports taxa selections were made based on
  - Abundant taxa in sampling
    - Taxa occurring in both entrainment site and source water samples when using a ≤335-micron mesh net as required in the OPA
    - Without co-occurrence in entrainment station and source water sampling stations there is no context for the population level impacts and the P_m is abnormally high or low
      - Example = Salema larvae in HBGS 2003-04
        - None caught at Sta. E, but abundant at source water stations during source water surveys
        - Added to HDR 2017 at the request of State Water Board Staff
- Commercial/recreational fishery target
- Special status taxa

Huntington Beach Taxa Selection

- Two of the three report series cited in Agenda 1.6 & 1.7 have been expert reviewed
  - West Basin/El Segundo Generating Station 316(b) was **not reviewed by outside expert**
  - AES Huntington Beach CEC-based reports, Huntington Beach Desalination Plant reports, and Carlsbad Desalination Plant reports were all reviewed by Dr. Peter Raimondi
    - AES and their consultants collaborated with Dr. Raimondi and Dr. Cailliet (also an expert reviewer used by the CEC) to identify the analyzed taxa list and their subsequent classifications for the APF analysis
    - Poseidon's consultants abided by the experts' opinions on the taxa to be included and their habitat classifications
- HDR 2017 added taxa in response to a direct request from State Water Board Staff during the discussions preceding and following release of the May 23, 2017 request for information letter from SARWQCB to Poseidon

APF Taxa Selection Precedent

- Taxa with some information on growth rate
  - ETM is reliant on estimated age in days
    - Process improved if published growth rate available
    - Can be estimated without published growth but is less accurate
    - Formalin preservation can damage some larval otoliths
      - Otolith = fish ear bone commonly used in age and growth studies

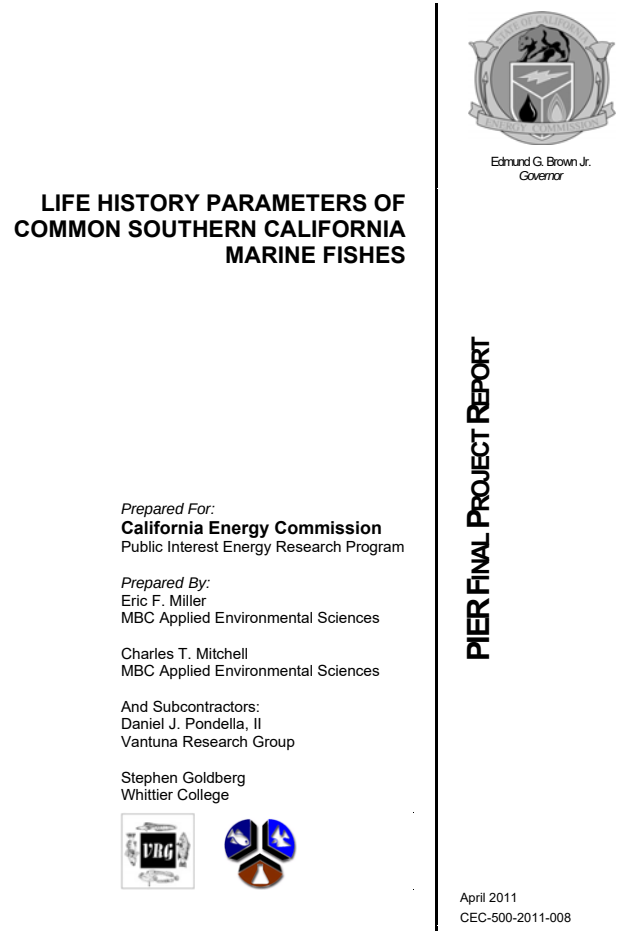
INCONSISTENCY 3 - LARVAL DURATION

Larval Age

- Larval age
- The only demographic parameter in the ETM or APF
- Requires larval measurements and either published age at length curves or the age must be inferred.
  - Measuring larvae is labor intensive even with videomicroscopy and computer image analysis
  - Ageing larval fish is very labor intensive and difficult to obtain usable samples

Larval Age – Life History Studies Agenda 1.2 & 1.4

- Life history information updated between 2005 and 2010
  - Speaks to Agenda Item 2
- The WISER program was initiated to try and address some of the shortcomings in entrainment research
- Miller et al 2011 informed some new demographics
  - 6 Scientific journal articles published the information
- Raimondi 2011 informed APF calculation



Edmund G. Brown Jr.
Governor

LIFE HISTORY PARAMETERS OF COMMON SOUTHERN CALIFORNIA MARINE FISHES

PIER FINAL PROJECT REPORT

Prepared For:
California Energy Commission
Public Interest Energy Research Program

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April 2011
CEC-500-2011-008

Larval Age – Agenda 1.2 & 1.4

- Tenera 2010 benefitted from the substantial increase in information resulting from the series of entrainment studies completed in the Southern California Bight for coastal power plants in 2006 and analyzed in 2007 in response to 316(b)
- These scientific advancements came after Steinbeck et al. (2007) was written
- Among the scientific advancements
  - A wealth of length measurements highlighting that some literature values for hatching length larger than the larvae being collected
  - Evolution in entrainment analyses where pelagic egg stage duration was added to the overall larval duration
    - Attached eggs for gobies, blennies, etc. were not added to the duration estimates as these eggs are not susceptible to entrainment by virtue of being attached to the substrate in some fashion

Invertebrate Plankton Stage Duration

- Prolonged stage durations indicate delayed stage transitions due to stress (starvation, low temperature, etc.)
  - Early studies by Martin Johnson on Emerita indicated a 34-day stage 1 duration via laboratory studies, but all individuals died upon transition to next stage.
    - Indicates highly stressed larvae and prolonged stage duration
    - Validity of 34-day duration is questioned as none of the individuals survived indicating poor fitness
    - Other studies on similar species of Emerita show much shorter stage durations
      - 3-5 days duration

INCONSISTENCY 4 – SOURCE WATER HABITAT AND CLASSIFICATION

Davis et al. 2006

- *The ETM calculations for gobies were revised from those in the Final Entrainment and Impingement Study by using Proportional Entrainment estimates that incorporated both nearshore and estuarine larvae (Tenera Environmental 2006). The estimate of APF for CIQ gobies was based on adult habitat in three Orange County estuarine areas: Anaheim Bay/Huntington Beach Wetlands, Santa Ana River/Talbert Marsh, and Newport Bay. A conservative estimate of APF for CIQ gobies based on the total estuarine areas in these wetlands is 30.69 acres. For Units 3 and 4, the APF for CIQ gobies would be 15.35 acres.*

April 2, 2018 letter from John Steinbeck of Tenera Environmental

- Details the evolution of using the National Wetland Inventory
- *"After determining the potential wetland and estuaries to include, we used the National Wetland Inventory maintained by the United States Fish and Wildlife Service and the United States Geological Survey to get the best available estimate of the representative habitat area in these wetlands and estuaries. This approach was used because the estimates of alongshore displacement cannot be used in estimating the source water for this taxon because the relevant adult habitat does not occur on the open coast where the alongshore displacement was measured"*
- This approach was expert reviewed during the CEC-HB process by Drs. Raimondi and Cailliet (see Davis et al. 2006) and approved
  - Drs. Raimondi and Cailliet (per Davis et al. 2006) further excluded CIQ Goby from the final APF estimate as estuarine habitat was not directly impacted by HB

CONCLUSION

Attachment A Table - Corrected

	2005 AES (MBC and Tenera 2005)		2006 CEC (Davis et al 2006)		2006 Tenera		2007b MBC and Tenera - Restoration Report	Tenera 2010	2013 CCC	2015 Tenera		2017b HDR		2017 CCC
	Att.A (acres)	Table ES-2 (scaled acres)	Att.A (acres)	APF (scaled acres)	Att.A (acres)	APF (scaled acres)	APF (acres)			Att.A (acres)	APF (acres)	Att.A (acres)	Table 2 (acres)	Att.A (acres)
CIQ	156.9	156.9	®®#	6.4	156.90	8.6	6.5	NO APF Calculated. ETM only	NO APF Calculated. ETM only	5.0	5.0	5	5.03	207.6
Diamond Turbot	22.8	25.3	45.4	45.5	25.30	22.9	22.6			31.0	31.0	®®#	30.96	22.2
Blennies	22.8	25.5	45.4	45.5	25.50	22.9	22.8			9.3	9.3	9.3	9.26	22.2
Spotfin Croaker	11.4	12.9	23	22.7	12.90	11.4	11.5			10.4	10.4	10.4	10.44	10.9
Queenfish	122.4	137.9	243.8	243.8	137.90	122.7	123.0			52.3	52.3	52.3	52.32	126.3
Wh Croaker	78.4	88.2	156.2	156.0	88.20	78.5	78.7			58.0	58.0	58	58.04	88.4
Bl Croaker	5.3	6.0	10.2	10.4	6.00	5.2	5.3			8.5	8.5	8.5	8.48	®®#
CA Halibut	17.6	20.0	35.2	35.1	20.00	17.7	17.9			15.1	15.1	15.1	15.08	31.6
Rock Crab	65.3	73.6	129.9	130.0	73.60	65.5	65.6			®®#	253.7	253.7	253.67	®®#
N Anchovy	232.0	232.0	®®#	®®#	232.00	None	None			®®#	®®#	®®#	®®#	200.2
Salema	®®#	®®#	®®#	®®#	®®#	®®#	®®#			NA/0.0#	None	0	0	®®#
Jacksmelt	®®#	®®#	®®#	®®#	®®#	®®#	®®#			®®#	®®#	42.4	42.45	®®#
Emerita	®®#	®®#	®®#	®®#	®®#	®®#	®®#			®®#	®®#	22.2	22.22	57.1
Estimated APF		69.0		43.7		43.5	43.6				17.1		17.1	218.3

- Data as reported in the various reports
- "Scaled acres" = values were scaled from reported AES HBGS entrainment volume analyzed to 106 MGD
- Highlighted cells indicate ≥ 10% difference between scaled acres and Att. A acres

Comparison of Poseidon and CCC

	Raimondi 2011	Poseidon Submittals			CA Coastal Commission Submittal		
Taxa	Classification	SWB	St. E APF	St. O2 APF	SWB	St. E APF	St. O2 APF
CIQ	Estuarine[1]	3,397.78	5.029	0.930	66,878.94	156.9	27.18
Black Croaker	Coastal	60,588.91	8.48	32.03	20,523.70	5.3	Not Included in Table 5[2]
California halibut	Coastal	83,790.83	150.82	177.38	32,731.76	17.6	185.33
combtooth blennies	Coastal	20,123.00	92.57	38.02	13,623.49	22.8	76.60
Diamond Turbot	Coastal	54,321.09	30.96	232.21	17,869.77	22.8	44.48
Jacksmelt	Coastal	30,965.22	42.45	11.91	NA	NA	NA
mole crab	Coastal	8,577.01	22.22	3.30	NA	NA	12.36
Queenfish	Coastal	100,614.98	52.32	79.80	90,056.56	122.4	87.23
rock crab	Coastal	110,291.61	253.67	80.34	28,131.62	65.3	Not Included in Table 5[2]
Salema	Coastal	10,556.33	0.00	54.55	NA	NA	NA
Spotfin Croaker	Coastal	37,277.02	10.44	8.33	17,869.77	11.4	6.42
White Croaker	Coastal	82,911.14	58.04	339.81	50,778.46	78.4	338.29
Final APF (acres) as Reported (scaled and represent 95% CI			17.1/15.57	17.23		218.03	101.77

- [1]Raimondi (2011) did not include CIQ goby in the HBGS analysis
  - CIQ goby and Northern Anchovy were excluded from the final CEC APF analysis as estuarine taxa unimpacted by HBGS. See Davis et al. (2006)
  - In all other references to CIQ goby, Raimondi listed them as ”estuarine”
- [2]Table 5 refers to California Coastal Commission Submittal Table 5
- Conclusion: In Raimondi (2011) for Morro Bay and Encina where a mix of estuarine and coastal taxa were included in the APF, all estuarine taxa had a single source water representative of the estuarine habitat not the alongshore displacement

Inconsistency Conclusions

Based on ETM/APF best scientific practices, regulatory precedent and expert opinion, station E has the lowest APF calculation of 17 acres

- 1 Ocean Current Data
  - 2007-08 current meter data
  - Most recent, site-specific scientific data required by CEQA
  - Data more representative because it encompasses the entire water column and not just one depth
  - Better measurement instrument (ADCP vs. Single Point Meter)
  - Complies with OPA requirements
- 2. Taxa Selection
  - Based on site-specific regulatory precedent, CIQ Gobies should <u>not</u> be included in ETM/APF calculations
    - If included, CIQ Goby should be the only estuarine taxon per regulatory precedent / expert opinion from Dr. Raimondi
    - All other taxon (i.e., Blennies and Diamond Turbot) should be characterized as open ocean/soft bottom species per regulatory precedent / expert opinion from Dr. Raimondi

Inconsistency Conclusions

Based on ETM/APF best scientific practices, regulatory precedent and expert opinion, station E has the lowest APF calculation of 17 acres

- 3 Larval Duration - Change
  - OPA compliant - representative of entrained community
  - Incorporates scientific advances since 2005-2006
    - Steinbeck et al. 2007 was published in January 2007 and prepared over the preceding year. All 316(b) analyses from suite of 2006 field surveys were not analyzed until 2007, after Steinbeck et al. was published
- 4 Source Water Habitat and Classification
  - If included, CIQ Goby source water body (TSWB) should be based on NWI per regulatory precedent / expert opinion from Dr. Raimondi