POSEIDON WATER

Huntington Beach Desalination Project

Intake Location Analysis Meeting
August 30, 2018

Meeting's Purpose

- To review the results of analyses of existing data relevant to identifying the best intake location to minimize impacts to all forms of marine life
  - Multiple lines of evidence
  - Quantitative and qualitative lines of evidence

1. BACKGROUND INFORMATION SUMMARY

Habitat Homogeneity

Sediment sampling results offshore HBGS showing the homogeneity of the habitats with grain sizes differing by less than 50 microns and predominantly sand across the area.

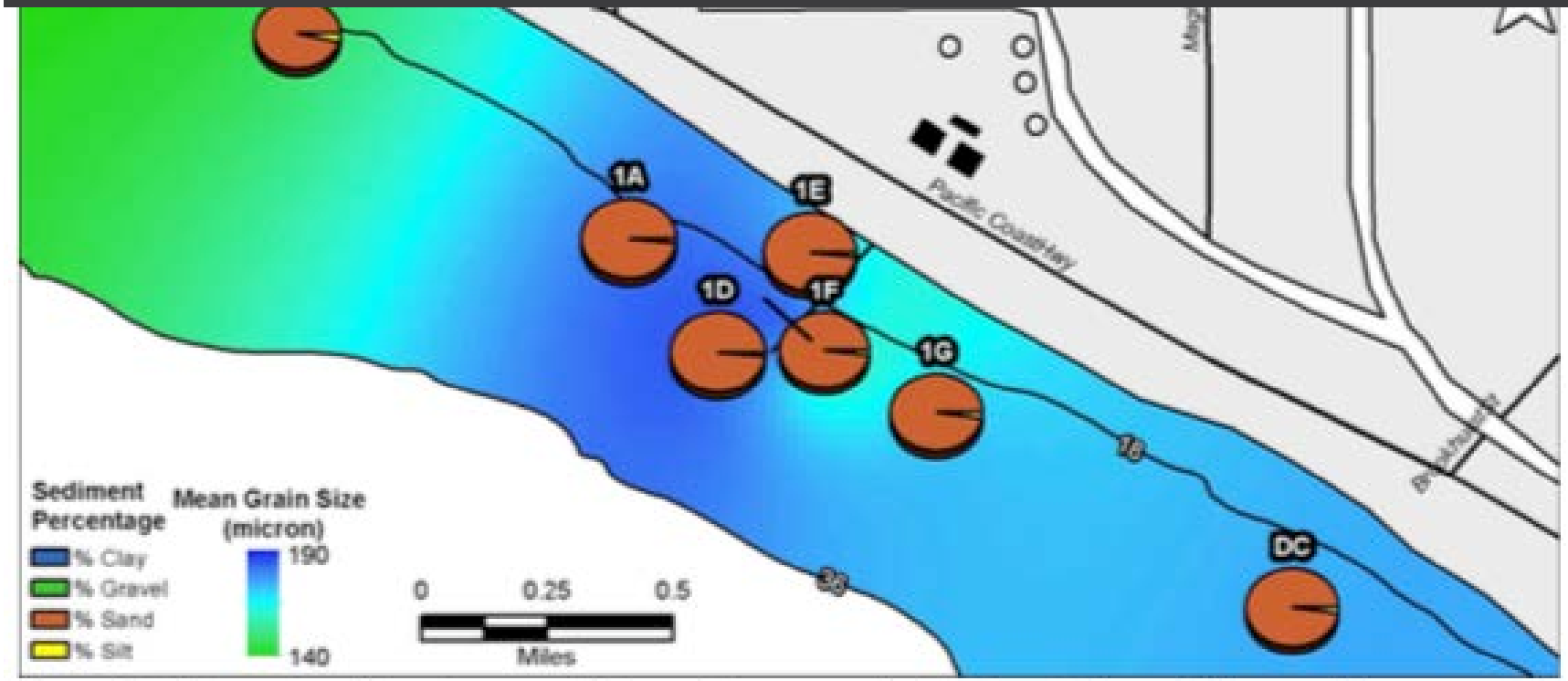


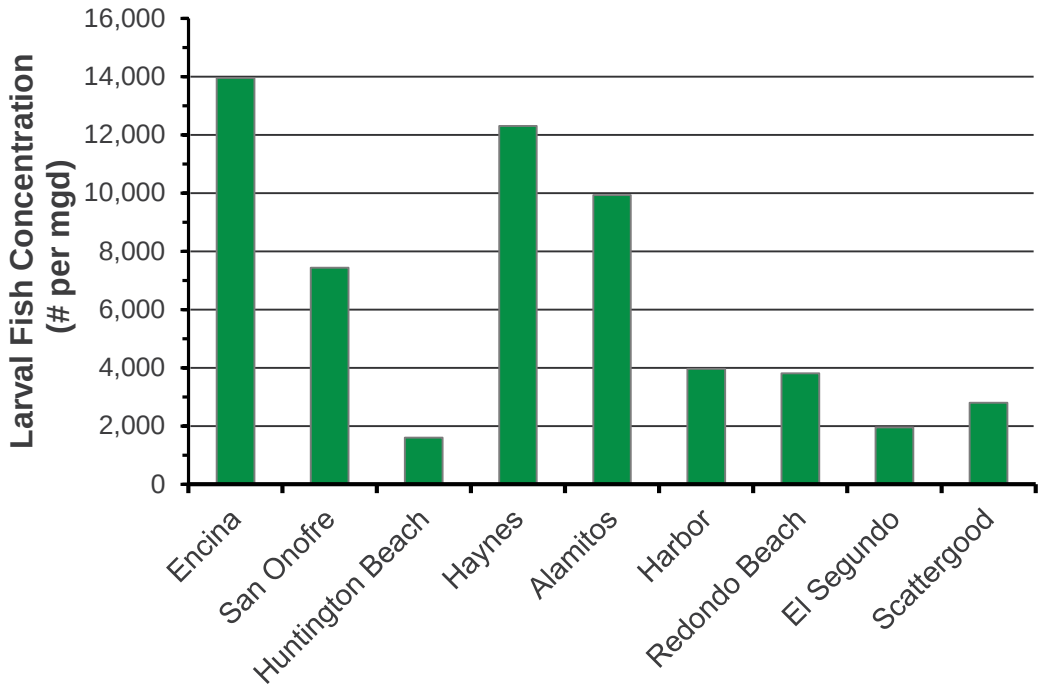
Figure 3-2. Percent sediment composition and mean grain size for stations offshore of the generating station. Huntington Beach Generating Station NPDES, 2010.

Habitat Description

- Coastal, surfzone, subtidal habitat offshore of the proposed HBDP is homogenous
  - Soft-bottom habitat
  - No vertical complexity
  - No biogenic habitat
  - Hard substrate with vertical relief restricted to
    - Huntington Beach Pier
    - Existing armoring rock surrounding the existing HBGS intake

Plankton Data Source

- Plankton sampling completed in 2003-04
- Study designed in accordance with prevailing design criteria that were later summarized in Steinbeck et al. 2007 (Appendix E of the SED)
- Designed to support an Empirical Transport Model analysis
  - Can be used in Area of Production Forgone analysis as a result
- Complies with the literal interpretation of the OPA sampling guidance
  - Identified and counted all fish larvae to the lowest practicable taxonomic level
  - Identified and counted a predetermined subset of invertebrate taxa
    - Cancer crabs (megalops stage only), squid paralarvae, lobster, and *Emerita* (all stages)
  - Measured a subset of fish larvae
    - Predominantly from Station E collections, but included some samples from other stations for up to 4 taxa



Data from Appendix E – Entrainment and Impingement Estimates (Steinbeck, July 2008) in Final Substitute Environmental Document for Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling, May 4 2010.

- Lowest larval fish concentrations of any of the intake locations studied in southern California
- Low abundances at HB are consistent with other locations with offshore intakes in sandy coastal areas such as El Segundo and Scattergood
- Diversity of taxa also lower at HB when compared to El Segundo and Scattergood
- Low impact location due to the absence of a diversity of habitats in vicinity of intake, and low abundances and diversity of larval fishes

Issue at Hand

- What intake location will result in the least loss of all forms of marine life due to the operation of the Huntington Beach Desalination Plant's 1-mm screened surface intake?
- What are the criteria set forth by the OPA Section M.2.b?
  - Site Location Section
  - Construction-related environmental impacts (temporary and permanent) on marine life from moving the intake are not part of this analysis

Criteria in OPA – M.2.b. (Biological Points Only)

- *(3) Analyze the feasibility of placing intake, discharge, and other facility infrastructure in a location that avoid impacts to sensitive habitats* and sensitive species.*
- *(4) Analyze the direct and indirect effects on all forms of marine life* resulting from facility construction and operation, individually and in combination with potential anthropogenic effects on all forms of marine life* resulting from other past, present, and reasonably foreseeable future activities within the area affected by the facility.*
- *(5) Analyze oceanographic geologic, hydrogeologic, and seafloor topographic conditions at the site, so that the siting of a facility, including the intakes and discharges, minimizes the intake and mortality of all forms of marine life.**

2. NEXT STEPS – MULTIPLE LINES OF EVIDENCE

Lines of Evidence Examined

- Lines of evidence currently under review
  - ETM/APF
  - Mean concentration (ind/m^3)
  - Standardized mean concentration (ind/m^3)
- Additional lines of evidence considered
  - Mean concentration of all taxa except Emerita
  - Multivariate analysis
  - Spatial analysis
    - Distance to sensitive habitats
    - Habitat homogeneity

Approved Empirical Transport Model/Area of Production Forgone Revised for Estuarine Taxa

- $$P_M = 1 - f_i\left(1 - \left(\frac{E_i}{(SSWDi\ x\ TSWBV)+(Diest\ x\ TEWBV)}\right)\right)^d$$
- P_M = Proportional Mortality
- f_i = Proportion of the total annual source water population present during the ith survey
- E_i = Estimated number of larvae entrained during the ith survey
- $SSWD_i$ = Estimated mean larval Concentration in the sampled source water during the ith survey
- TSWBV = Total source water body volume derived as the alongshore displacement represented by the larval age (d) x the current speed (km/d) x 4.45km x mean depth of sampled source water body. Or Sampled Source Water Population/[(taxa-specific alongshore distribution (age x current speed)/sampled source water alongshore distance (10.44 for HB)]
- D_{iest} = Estimated larval Concentration in the estuaries during the ith survey
- TEWBV = Total estuarine source water body volume from the estuaries used in the analysis
- d = number of days that the larvae are exposed to entrainment

Multivariate analysis

- Tested to determine if station-specific sampling results indicated separate communities using
  - Hierarchical clustering
  - nMDS
  - ANOSIM
  - SIMPER

Mean and standardized mean concentration analyses

- All identified and enumerated taxa aggregate mean concentration by station
- All identified and enumerated taxa other than *Emerita analoga* aggregate mean concentration by station
  - Sensitivity analysis to numerical impact of *Emerita analoga* on results
    - To clarify if the total concentration is reflective of the community or just *Emerita analoga*
- Standardized mean concentration
  - Standardize all taxa densities (convert to z-scores) prior to averaging
  - Eliminates the impact of numerically dominant taxa and equally weights all taxa in the analysis
- Used effect size to scale the α critical value, aka “floating alpha” (Based on SONGS WNR Mitigation Report) to test for significant differences between station-specific densities

3. ANALYSIS METHODS AND RESULTS

ETM/APF - Methods

- By station
- Using all taxa supported by needed data for Station E (12 taxa, fish and invertebrates) and only those cooccurring at most stations (4 taxa total) per technical working group decision (August 1, 2018 call)
- Station-specific ”d” calculated based on station-specific length measurements
- Use ROMS-derived current vectors provided by Dr. Raimondi by email on August 13, 2018
  - Used 2003 vectors for Sep-Dec and 2004 vectors for Jan-Aug
- Used 1999-2000 current vectors initially used by Tenera (2006) as representative of single point current across all stations
- Used modified ETM – Pe parameter revised (slide 11)

ETM/APF - Methods

- 1st & 99th percentile lengths used
- Standard equation for open coast taxa
- Estuarine equation used for estuarine taxa
  - CIQ Goby, Diamond Turbot
  - Used data from both Agua Hedionda Lagoon and Alamitos Bay in the analysis
  - 3397.78 acres used as the estuarine source water area for all estuarine APFs
- Mean and standard error calculated across all taxa included in the analysis
  - No separation based on habitat scaling classification

ETM/APF - Results

Station	Number of Taxa In Analysis	ROMS				99-00 Current				Grand Mean
		AHL		Alamitos Bay		AHL		Alamitos Bay		
		APF	Std Err	APF	Std Err	APF	Std Err	APF	Std Err	
E	12	130	29.45	130	29.44	99	22.61	97	23.01	114
U4	4	161	45.87	161	45.98	76	16.87	75	17.00	118
D4	4	139	30.82	139	31.17	153	35.82	153	36.12	146
D2	4	148	39.65	147	40.09	145	44.46	145	44.51	146
E	4	213	67.36	213	67.32	126	37.17	126	64.84	170
O4	3	272	78.67	272	78.67	113	32.56	113	32.57	193
U2	4	213	58.21	213	58.22	232	59.83	241	61.37	225
O2	4	286	83.14	286	83.29	288	83.49	288	83.64	287

- Number of taxa included in the APF listed for each station
  - Station E has two rows one with all available taxa and one with only those taxa universal to the Stations
- All APFs are the full, 95th confidence interval estimates
- APF standard error included to highlight the variation at each station
  - High standard error at all stations except Station E (12 taxa) confirms Dr. Raimondi's concerns over use of ETM with limited data
  - Higher standard error leads to less precise and less reliable results
- Grand mean column is the average of all four estimated APFs for each station row to try and summarize the four estimates

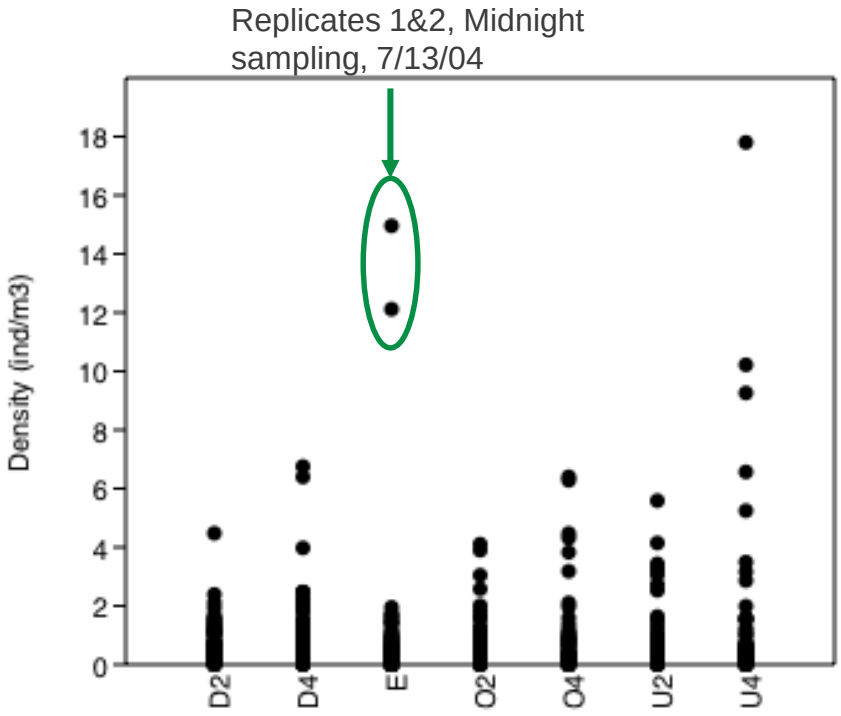
ETM/APF Conclusion

- Station E with 12 taxa included in the analysis had the highest resolution (most taxa and lowest standard error) and the lowest APF
- Variation was higher for each other station's APF where four, or less, taxa could be included in the analysis
- No real difference between APFs derived using Alamitos Bay or Agua Hedionda as the estuarine larvae data source

Mean Concentration – All taxa included

Station	Mean #/m3	Std Err	# of samples >2/m3	Effect Size	p-value	Sig Diff
D2	0.57	0.07	4	0.07	0.30	No
D4	0.82	0.11	11	0.09	0.27	No
E	0.68	0.20	3			
O2	0.45	0.08	5	0.16	0.14	Yes
O4	0.60	0.12	8	0.05	0.38	No
U2	0.54	0.25	9	0.09	0.27	No
U4	0.91	0.10	7	0.10	0.24	No

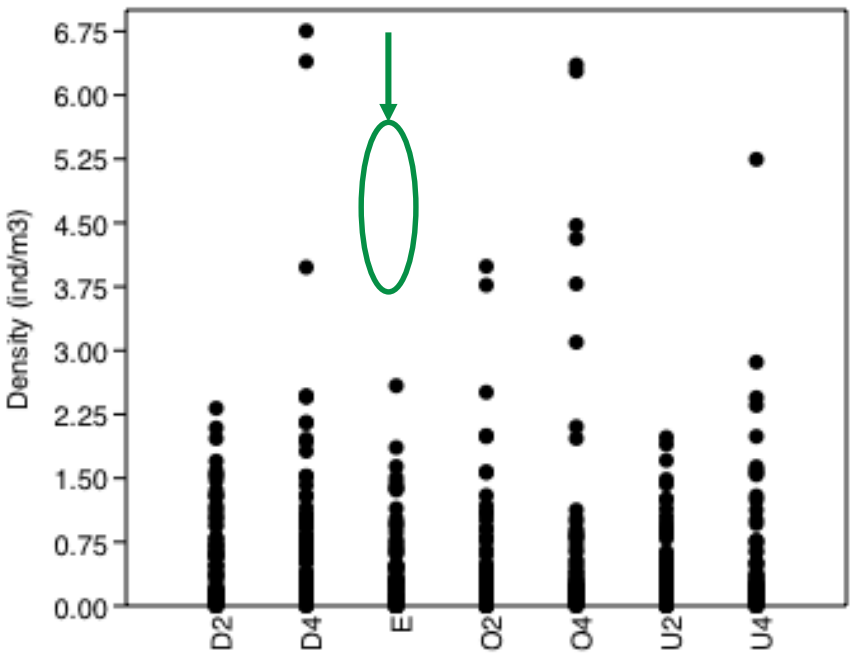
- Effect Size – each station's data compared against E
- P-value – each station's data compared against E



Mean Concentration – Emerita excluded

Station	Mean #/m3	Std Err	# of samples>2/m3	Effect Size	p-value	Sig Diff
D2	0.50	0.06	3	0.23	0.04	Yes
D4	0.75	0.11	10	0.43	0.00	Yes
E	0.38	0.05	1			
O2	0.40	0.07	5	0.04	0.24	No
O4	0.56	0.12	8	0.20	0.04	Yes
U2	0.34	0.04	1	0.08	0.33	No
U4	0.43	0.08	5	0.08	0.17	No

Emerita was the source of the outliers in prior analysis



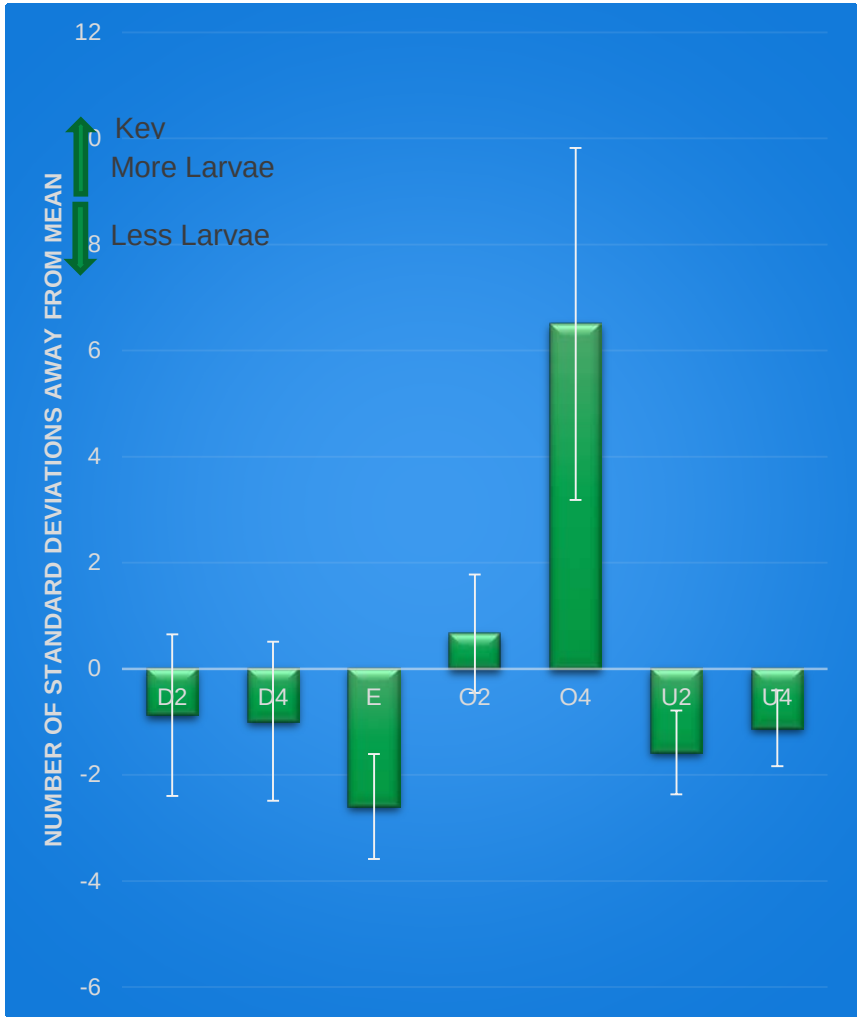
- Effect Size – each station's data compared against E
- P-value – each station's data compared against E

Mean Concentration – Standardized

Standardized Concentration treats all taxa equally and the results better measure impacts to all forms of marine life rather than just the abundant taxa.

Station	Mean #/m3	Std Err	# of samples>2/m3	Effect Size	p-value	Sig Diff
D2	-0.88	1.52	4.35	0.20	0.18	Yes
D4	-0.99	1.50	4.29	0.23	0.19	Yes
E	-2.60	0.99				
O2	0.66	1.12	3.86	0.17	0.02	Yes
O4	6.50	3.32	9.31	0.70	0.01	Yes
U2	-1.58	0.79	3.01	0.52	0.21	Yes
U4	-1.12	0.72	2.96	0.38	0.12	Yes

- Effect Size – each station's data compared against E
- P-value – each station's data compared against E



Mean Concentration - Conclusion

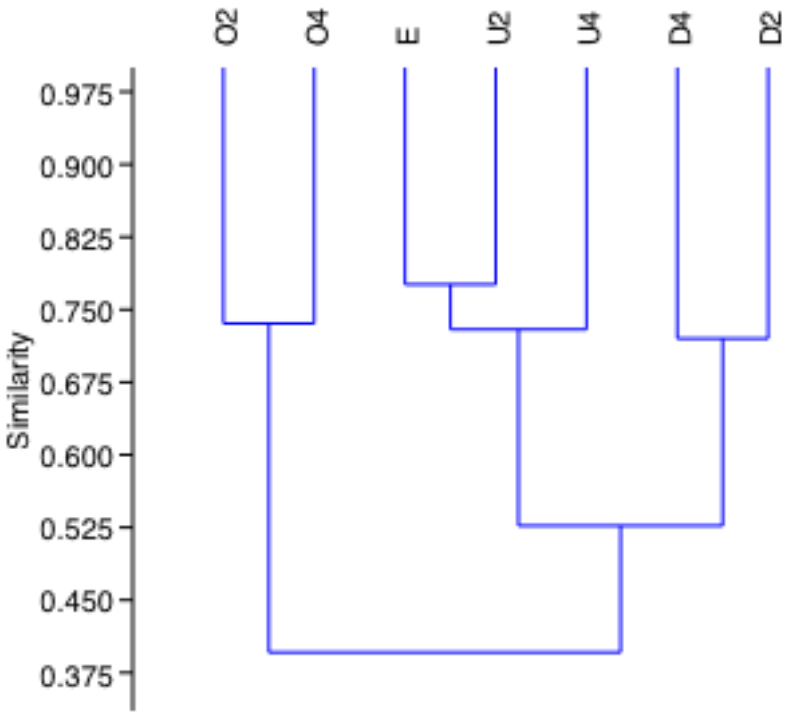
- Emerita dominates the all taxa mean concentration
  - Much of this is predicated on two outliers resulting from the midnight (cycle 3) sampling on July 13, 2018
    - Each dot on the plot represents a single replicate sample
- Excluding Emerita indicates a different pattern in mean concentrations among the stations
  - Densities at 3 stations significantly higher than E
  - Densities at 3 stations not significantly different than E
  - The lowest concentrations were at Stations E and U2, but the difference was not statistically significant between the two
- Standardized concentration
  - Densities at Station E were significantly less than all other stations
  - Standardized concentration weighs each taxon equally so the result provides a more clear insight into potential impacts to all forms of marine life

Multivariate analysis - Methods

- 4th root transformed data
- Bray-Curtis dissimilarity matrix
- Cluster (UPGMA - unweighted pair group method with arithmetic mean)
- nMDS
- SIMPER (if >1 groups identified)
- ANOSIM (if >1 groups identified)

Multivariate analysis – Results & Conclusions

- Communities at each station were statistically indistinguishable
  - The plankton community is homogeneous across the sampling area
- Only one group identified
  - No SIMPER possible
  - No ANOSIM possible
    - Both require at least two distinct communities for analysis

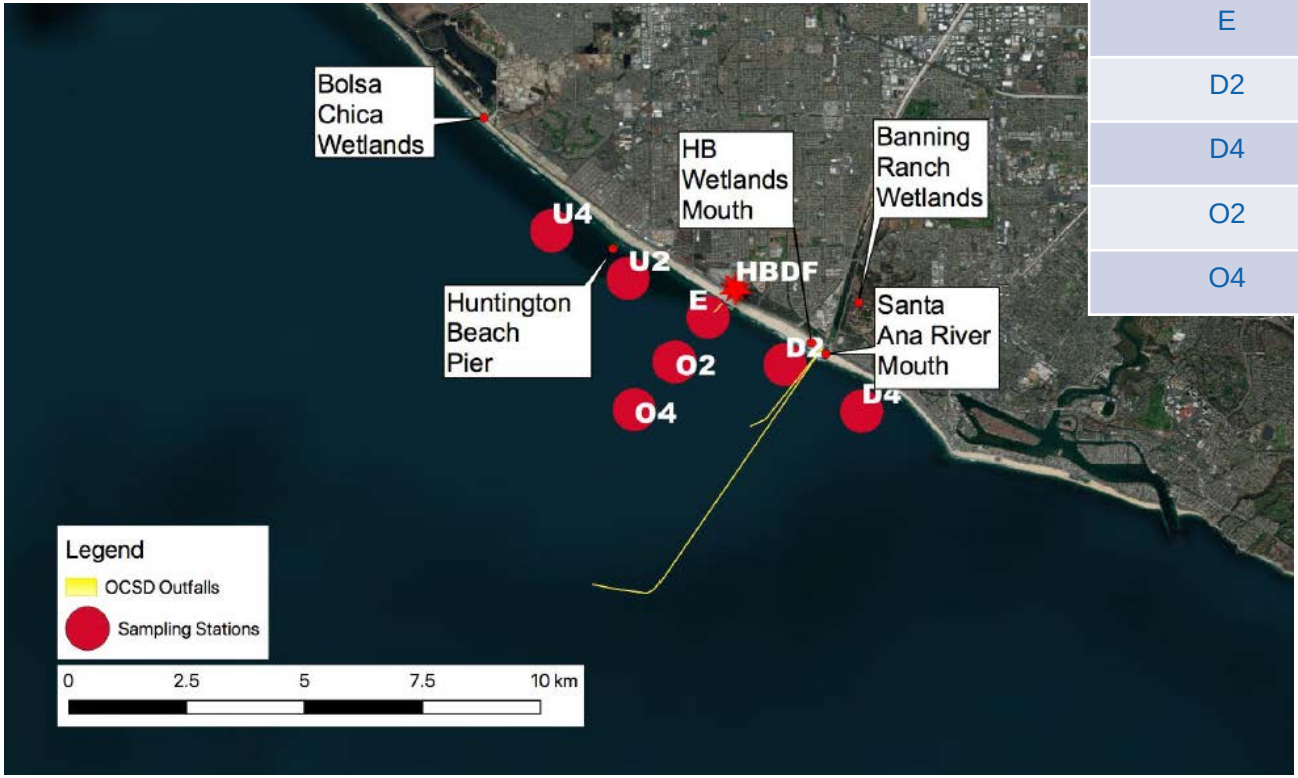


4. SPATIAL ANALYSES

Station E is farthest from MPAs, sensitive areas, and sensitive species

See Appendix AAAAA – Presentation from July 26, 2018 meeting for more details

Station	Distance to BC Wetland (mi)	Distance to HB Wetland (mi)
U4	1.8	4.0
U2	3.1	2.5
E	4.4	1.4
D2	5.5	0.0
D4	6.8	1.2
O2	4.6	1.8
O4	5.0	2.5



Biogeographic Analysis Results

- Moving the intake from Station E upcoast will move it closer to sensitive habitats
  - Bolsa Chica MPAs
- Moving the intake downcoast from Station E will move it closer to sensitive habitats
  - Mouths of multiple wetlands
  - Submarine Canyon
  - Larval sink (see biological analysis)
- Moving offshore will relocate intake closer to Barred Sand Bass spawning grounds
  - Fishery has collapsed (Erisman et al. 2010, Miller and Erisman 2014)
  - Dramatic fishing regulation changes implemented in response by CA Fish and Game Commission in 2013

5. TYING BACK TO OPA GUIDANCE ON SITE SELECTION

Criteria in OPA – M.2.b. (Biological Points Only)

- *(3) Analyze the feasibility of placing intake, discharge, and other facility infrastructure in a location that avoid impacts to sensitive habitats* and sensitive species.*
  - **Moving the intake from Station E to any of the alongshore stations (U4, U2, D2, and D4) move the intake closer to one of the sensitive habitats in the area**
  - **Moving the intake from Station E to an offshore station would move the intake closer to sensitive spawning grounds for a depressed species**
- *(4) Analyze the direct and indirect effects on all forms of marine life* resulting from facility construction and operation, individually and in combination with potential anthropogenic effects on all forms of marine life* resulting from other past, present, and reasonably foreseeable future activities within the area affected by the facility.*
  - **No difference in the seafloor topographic or geologic conditions = no benefit in moving intake**
  - **Construction-related environmental impacts (temporary and permanent) on marine life from moving the intake is still to be analyzed**
- *(5) Analyze oceanographic geologic, hydrogeologic, and seafloor topographic conditions at the site, so that the siting of a facility, including the intakes and discharges, minimizes the intake and mortality of all forms of marine life.**
  - **We will look at each of these in the context of the lines of evidence examined over the following slides**

Lines of Evidence Examined

- ETM/APF
- Mean concentration (ind/m^3)
- Standardized mean concentration (ind/m^3)
- Mean concentration of all taxa except Emerita
- Multivariate analysis
- Spatial analysis
  - Distance to sensitive habitats
  - Habitat homogeneity

OPA – M.2.b.(4) – Ranking the results of the Biological Analyses Using 12 taxa for Station E APF

Ranked the Station's standing in each analysis (lowest impact to highest impact) as a means to try and aggregate all the analyses into one index.

		Rank in Each Analysis				
Station	APF	All Taxa Conc.	No Emerita Conc.	Stand. Conc.	Sum Rank	Site (Best (1) to Worst(7))
D2	4	3	5	5	17	4
D4	3	6	7	4	20	6
E-12 taxa	1	5	2	1	9	1
O2	7	1	3	6	17	4
O4	5	4	6	7	22	7
U2	6	2	1	2	11	2
U4	2	7	4	3	16	3

OPA – M.2.b.(4) – Ranking the results of the Biological Analyses Using 4 taxa for Station E APF

Ranked the Station's standing in each analysis (lowest impact to highest impact) as a means to try and aggregate all the analyses into one index.

		Rank in Each Analysis				
Station	APF	All Taxa Conc.	No Emerita Conc.	Stand. Conc.	Sum Rank	Site (Best (1) to Worst(7))
D2	3	3	5	5	17	4
D4	2	6	7	4	20	6
E-4 taxa	4	5	2	1	13	2
O2	7	1	3	6	17	5
O4	5	4	6	7	22	7
U2	6	2	1	2	11	1
U4	1	7	4	3	16	3

OPA – M.2.b.(4)

- *(4) Analyze the direct and indirect effects on all forms of marine life* resulting from facility construction and operation, individually and in* ***combination with potential anthropogenic effects on all forms of marine life* resulting from other past, present, and reasonably foreseeable future activities within the area affected by the facility****.*
- The boldface text is key
- Many species entrained support fisheries and/or were considered to benefit from the State's MPA network

Taxon	Most Common at Station	MPA	Fishery
Engraulis mordax	U2	NO	YES
Emerita analoga	U4	NO	NO
CIQ	E	NO	NO
Genyonemus lineatus	O2, U4	NO	YES
Seriphus politus	D4	NO	YES
Paralichthys californicus	O4, U2	NO	YES
Hypsoblennius spp.	O4, U4	NO	NO
Paralabrax spp.	O4, U4	YES	YES
Sardinops sagax	O4, U4	NO	YES
Pleuronichthys guttulatus	U2	NO	NO
Atherinopsis californiensis	U2	NO	YES*

- Most common (highest concentration) at station. If offshore station was highest, then the highest alongshore station was added.
- MPA denotes if the MPA-SAT felt that taxon would benefit from MPA protection
- Fishery denotes a commercial or recreational fishery exists for the taxon
- *Atherinopsis californiensis** is included under the Groundfish Fishery Management Plan from NOAA-Fisheries

All Lines of Evidence Conclusion

- The APF based on only four species that were not substantial contributors to total entrainment results in unreliable estimates
  - The only robust ETM/APF analysis (Station E with 12 taxa) resulted in the lowest estimated impact
- The total mean concentration across all identified and enumerated taxa results in *Emerita* overshadowing the impacts to the remaining taxa
- Removing *Emerita* from the concentration analysis (at all stations) indicates the lowest concentrations were at Stations E and U2, but the difference was not statistically significant between the two
- The standardized mean concentration removed the effect of overwhelming abundant taxa
  - Each taxon was weighted equally
- The standardized mean concentration at Station E was significantly less than at each of the remaining stations
- There is no community structure difference between the five alongshore stations

Lines of Evidence Results and Ranking

Line of Evidence	D2	D4	E	O2	O4	U2	U4
APF Common - 99-00	AHL/AB	AHL/AB	AHL/AB	AHL/AB	AHL/AB	AHL/AB	AHL/AB
Value (ac)	145/145	153/153	126/126	288/288	113/113	232/241	76/75
Rank	4	5	3	7	2	6	1
APF All Taxa - 99-00							
Value (ac)	145/145	153/153	99/97	288/288	113/113	232/241	76/75
Rank	4	4	2	7	3	6	1
APF Common - ROMS							
Value (ac)	148/147	139/139	213/213	286/286	272/272	213/213	161/161
Rank	2	1	4	7	6	4	3
APF All Taxa - ROMS							
Value (ac)	148/147	139/139	130/130	286/286	272/272	213/213	161/161
Rank	3	2	1	7	6	5	4
Standardized Concentration							
Value (ind/m3)	-0.88	-0.99	-2.6	0.66	6.5	-1.58	-1.12
Rank	5	4	1	6	7	2	3
Mean All Taxa Concentration							
Value (ind/m3)	0.57	0.82	0.68	0.45	0.6	0.54	0.91
Rank	3	6	5	1	4	2	7
Subtotal Rank Sum	21	22	16	35	28	25	19
Subtotal Rank	3	4	1	7	6	5	2
Mean Concentration - No Emerita							
Value (ind/m3)	0.5	0.75	0.38	0.4	0.56	0.34	0.43
Rank	5	7	2	3	6	1	4

Lines of Evidence Ranking

Line of Evidence	D2	D4	E	O2	O4	U2	U4
Lines of Evidence Currently Under Review Rank Sum	21	22	16	35	28	25	19
Lines of Evidence Currently Under Review Rank	3	4	1	7	6	5	2
Mean Concentration Without Emerita Rank	5	7	2	3	6	1	4
Total MLE Rank Sum	26	29	18	38	34	26	23
Final MLE Rank	4	5	1	7	6	3	2

Final Conclusion

- **Multiple lines of evidence conclude that Station E is best screened-intake location to minimize intake and mortality of all forms of marine life**