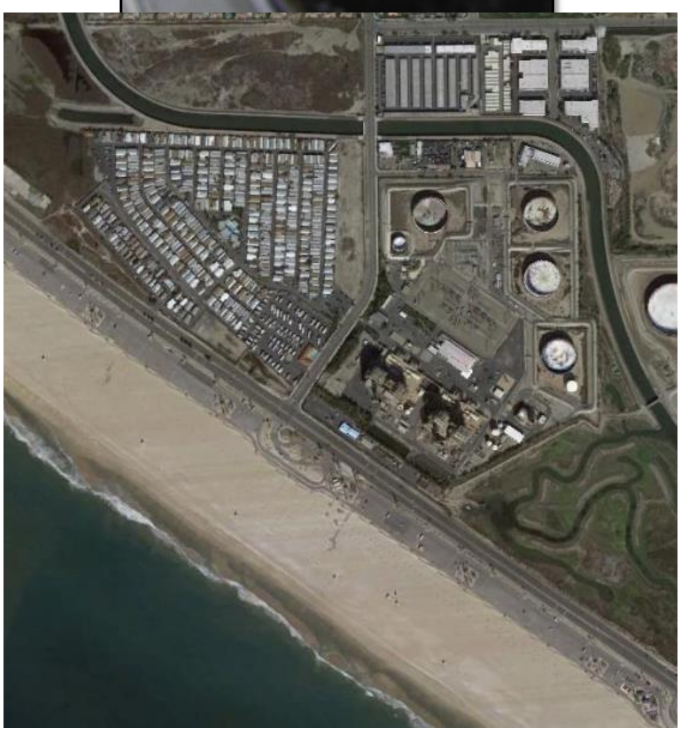

Technical Memorandum

Evaluation of a Long-Distance Offshore Intake for the Huntington Beach Desalination Plant

Poseidon Water

April 29, 2016

April 29, 2016

Scott Maloni
Poseidon Water
17011 Beach Boulevard, Suite 900
Carlsbad, CA 92008

Re: **Technical Memorandum: Evaluation of a Long-Distance Offshore Intake for the Huntington Beach Desalination Plant**

Dear Mr. Maloni,

I am pleased to submit HDR and MBC's draft technical memorandum for the Evaluation of a Long-Distance Offshore Intake for the Huntington Beach Desalination Plant. We look forward to discussing our findings with you at your earliest convenience.

Sincerely,
HDR Engineering, Inc.

Timothy M. Hogan

Tim Hogan
Project Manager

Draft Technical Memo: Evaluation of a Long-Distance Offshore Intake for the Huntington Beach Desalination Plant

Introduction

The Deepwater Desalination Project in Monterey, California proposes to take advantage of the oceanography of the Monterey Submarine Canyon to minimize entrainment of marine life by the project's open water intake. Oceanographic conditions in the Monterey Bay are unique as a result of the proximity to shore of the Monterey Submarine Canyon and the California Current. These same combined conditions are not present in Southern California, especially near the proposed Huntington Beach Desalination Plant (HBDP). The continental shelf offshore of the HBDP is gently sloping and amongst the widest along the California coastline. The Newport Submarine Canyon is similar to the Monterey Submarine Canyon and is approximately four miles southeast of the HBDP. Unlike the Monterey area, the California Current does not flow near the shoreline, but rather retains its near north-south trajectory without tracking the Southern California Bight coastline as it tracks southeast below Point Conception. The California Channel Islands lie between the California Current and coastal California. This separation and the Monterey Submarine Canyon are key differences between the Monterey and Huntington Beach areas.

At the request of the Santa Ana Regional water Quality Control Board ("Regional Board") staff, Poseidon evaluated whether relocating the intake withdrawal point farther offshore would provide a biological benefit similar to that promoted by the developers of the Deepwater Desalination Project in Monterey. The following analyses address the biological and engineering components involved in determining whether moving the HBDP farther offshore is warranted and feasible. The biological analysis investigates the changes in larval fish density with increasing depth (and distance from shore) to determine if there is a biological benefit to moving the HBDP intake withdrawal point farther offshore to deeper waters. The feasibility analysis investigates whether the engineering requirements of moving farther offshore are feasible consistent with the definition of feasibility under the State Water Resource Control Board's Ocean Plan Amendment and the Coastal Act[1].

[1] Feasible is defined as capable of being accomplished in a successful ,manner in a reasonable period of time taking into consideration environmental, technical, social and economic considerations.

Environmental setting

The area in the vicinity of the existing Huntington Beach Generating Station's ("HBGS") seawater intake pipe is generally characterized by a soft, sandy bottom. There are no Marine Life Protected Areas (MPAs) or Areas of Special Biological Significance (ASBS) in the vicinity of the intake pipe. No threatened or endangered species were found in entrainment surveys conducted at the site, and the potential entrainment of commercially or recreationally valuable species will be very uncommon.[2] Entrainment studies demonstrate that the proposed Project site is optimally located to minimize entrainment for the following reasons: (a) it is a low impact location due to the absence of a diversity of habitats in the vicinity of the intake and low abundances and diversity of larval fishes; (b) it has the lowest larval fish concentrations of any of the intake locations studied in Southern California; and (c) the diversity of taxa at the Project site are also lower than other coastal areas such as El Segundo and Scattergood (Figure 1). Tenera Environmental's July 1, 2015 Technical memorandum entitled *"Approach for APF calculations at Huntington Beach"* concludes that the proposed HBDP intake flow of 106 MGD could result in the annual entrainment of up to approximately 73.7 million fish larva, which equals roughly two fish larva for every 1,000 gallons of seawater withdrawn.

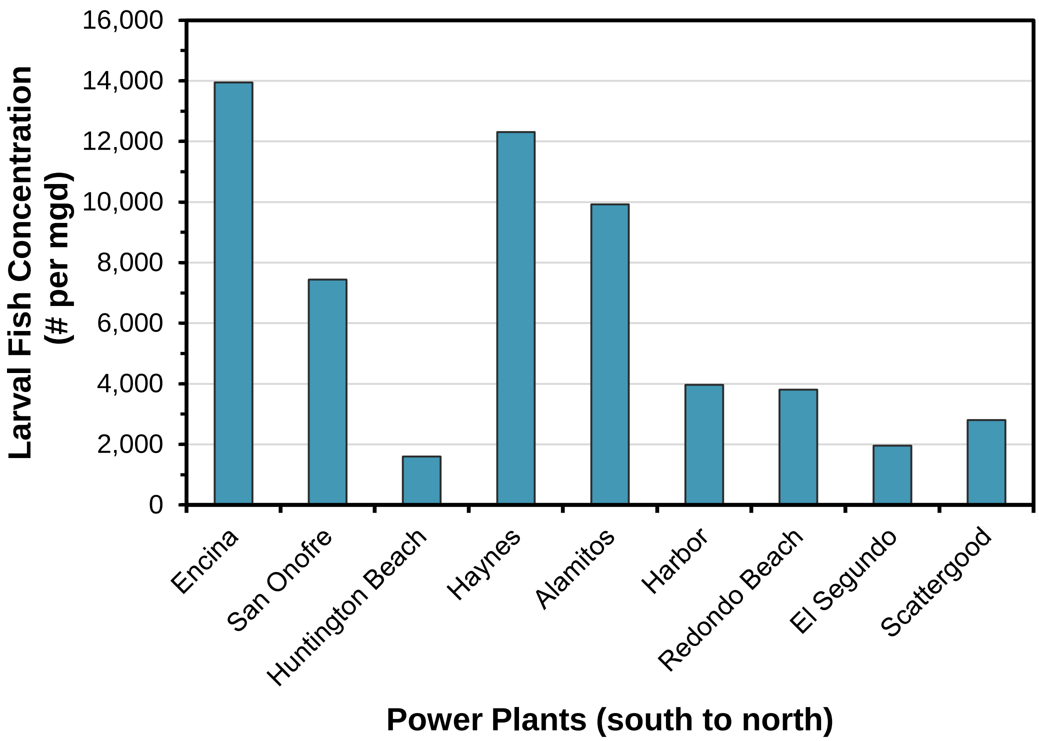

Figure 1. Entrainment Estimates in Final Substitute Environmental Document for Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling, May 4 2010.

[2] "Entrainment and Impingement Effects from Operation of the Huntington Beach Desalination Facility in Stand-alone Mode"; Tenera Environmental, February 2011.

Biological Analysis

Data Sources

The data sources used in this investigation are listed below in Table 1. Maps depicting the sampling stations for the Huntington Beach Generating Station (HBGS) CEC data and for the CalCOFI data are included as Figure 2 and Figure 3, respectively.

Table 1. Data Sources Used in the Biological Analysis.

SOURCE	SAMPLING PERIOD	DEPTH RANGE	SOURCE
HBGS CEC	2003–2004	9.5–21.9 m	MBC and Tenera 2006
CalCOFI	2004–2005	10–80 m	Watson et al. 2005

HBGS CEC = Huntington Beach Generating Station California Energy Commission
CalCOFI = California Cooperative Oceanic Fisheries Investigations

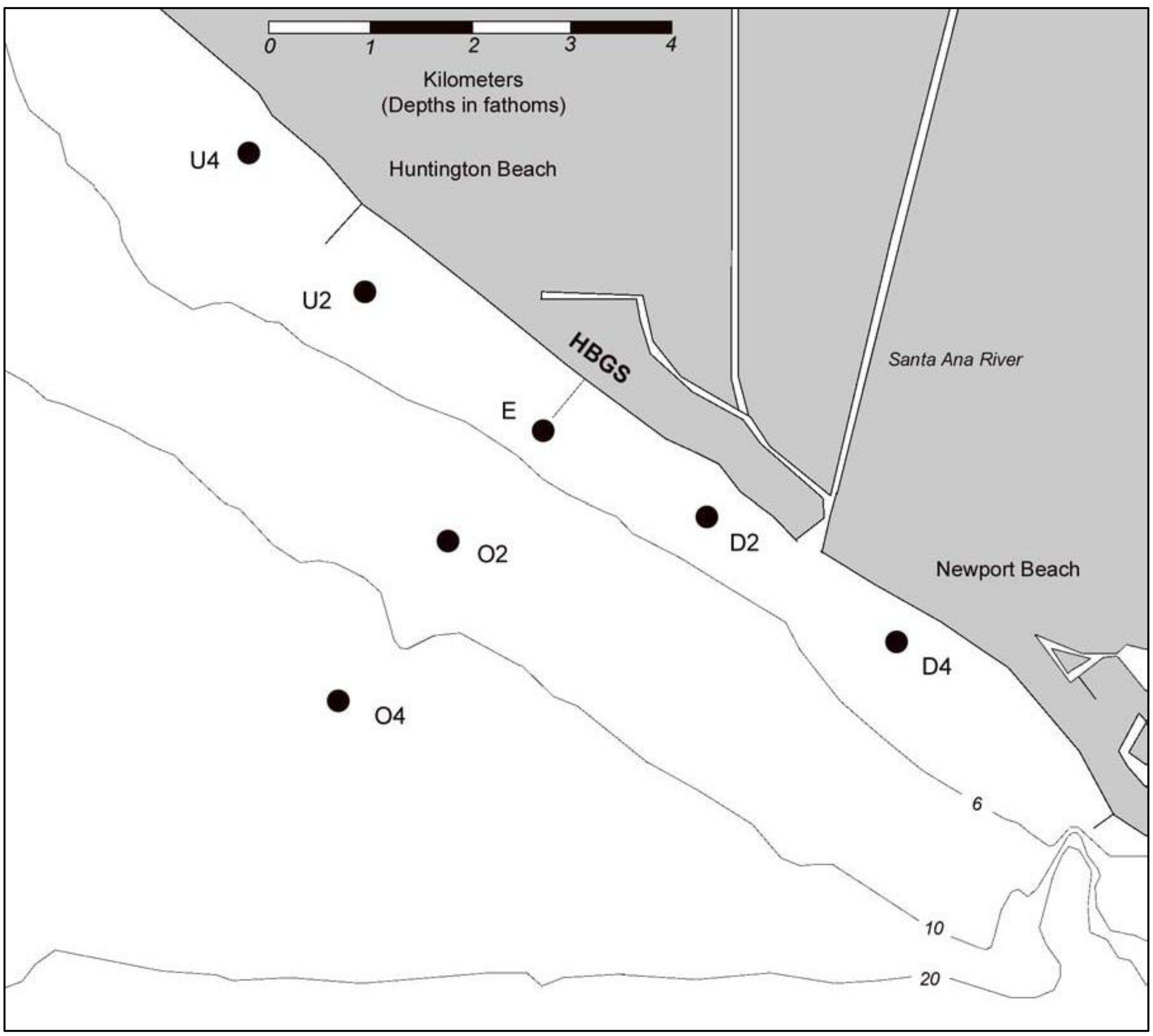

Figure 2. Map of stations occupied during the Huntington Beach Generating Station California Energy Commission entrainment study, 2003–2004. Source: MBC et al. 2005.

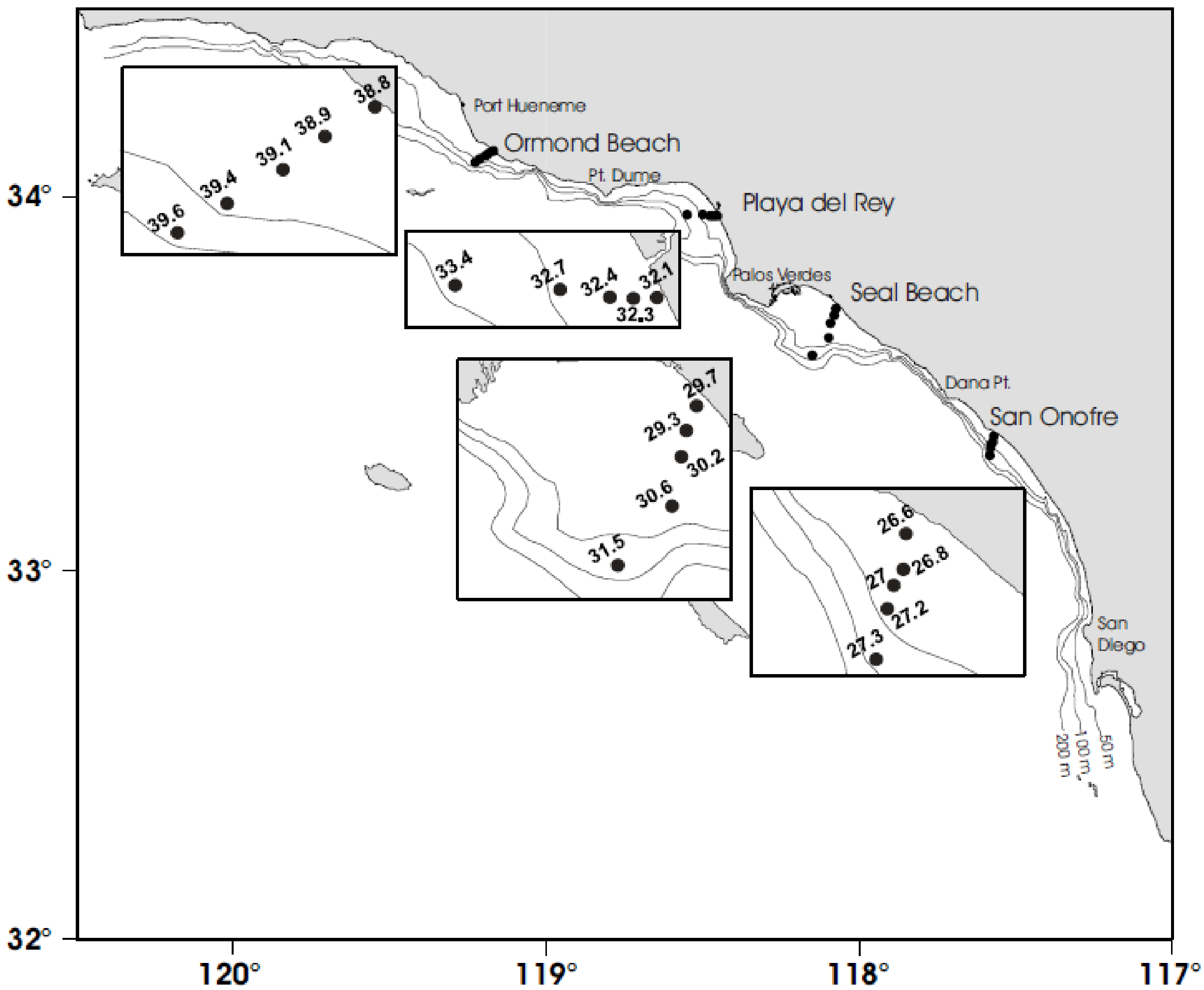

Figure 3. Map of the stations occupied during the California Cooperative Oceanic Fisheries Investigations. Source: Watson et al. 2007.

Analysis

Only fish larvae were included from both data sets. The sum total of all fish larvae collected was used without any species differentiation. All data was standardized to the number per 1000 m^3 of water filtered by the plankton net (density). The two data sets were not merged for this analysis due differences in mesh size. During the HBGS CEC study, a 333-µm net mesh was used. The CalCOFI sampling used a 505-µm net mesh. These different meshes likely lead to differences between the two data sets, but the consistency in sampling within each program maintains the needed sensitivity to depth-related changes in the larval fish communities within each data set. The data were analyzed along the depth gradient from shallow to deep to determine if fish larvae densities increased or decreased with increasing depth on the continental shelf offshore Orange County. The Seal Beach CalCOFI station was used to represent the Huntington Beach area. The depths sampled during each CalCOFI survey were rounded up to the nearest 10-m integer, resulting in five depth classes sampled: 10, 20, 30, 40, and 80 m. All four areas in southern California surveyed by CalCOFI were sampled in the same fashion and were included in the analysis. Descriptive (mean + standard error) and analytical (Kruskal Wallis analysis of variance with a Dunn's multiple comparison test) statistics were used to determine if the depth-specific fish larvae densities were significantly different. All results were presented graphically.

Results

In all cases, average fish larvae density increased with depth, but with very high variability at each depth. During the HBGS CEC study, no significant differences were detected among the three depths sampled (Figure 4; KW, H=0.569, df = 2, p=0.752). The average densities at the 9.5- and 14.9-m deep stations were nearly identical while the average densities at the 21.9-m depth were much higher. Despite these differences in average density, the variability around each average (indicated by the standard error bars) was high and overlapped among the three depths. It was due to the overlapping error around each average density that no statistically significant difference was found between/among the depth-specific densities.

The CalCOFI sampling recorded a similar pattern of generally increasing larval fish densities with increasing depth (Figure 5). Sampling at Seal Beach was the most representative of the Huntington Beach area. Seal Beach lies approximately 10 miles northeast of Huntington Beach, and the CalCOFI stations range from 0.5 to 10 miles offshore. Offshore Seal Beach, the average larval fish densities were similar and comparatively low at the 10- and 20-m deep sampling stations. Average densities peaked at the 40-m station, after which they declined at the 80-m station (to a level similar to that at the 30-m station). The CalCOFI sampling offshore of Seal Beach also did not identify a significant difference with depth (KW, H =3.981, df=4, p=0.409).

In addition to Seal Beach, three other areas were sampled: Ormond Beach in Ventura County, Playa del Rey in the Santa Monica Bay, and San Onofre in northern San Diego County. Similar depths were sampled in all areas, but the distance offshore varied as a function of the slope of the continental shelf. As Figure 3 shows, the continental shelf ranged from relatively wide offshore Seal Beach to narrow offshore San Onofre. Despite spanning >110 miles of the Southern California Bight coastline, the pattern of generally increasing larval fish densities with increasing depth occurred at all CalCOFI sites. The Ormond Beach sampling recorded a pattern similar to that recorded at Seal Beach: highest densities at a mid-depth station rather than at the shallowest or deepest station. Peak densities at Playa del Rey and San Onofre were recorded at the deepest station. In all four areas, the lowest densities were found at the shallowest station. Across all four areas, larval fish density significantly declined with depth (KW, H=14.148, df=4, p=0.007). The densities observed at the 80-m and 40-m stations were significantly higher than the 10-m larval fish densities.

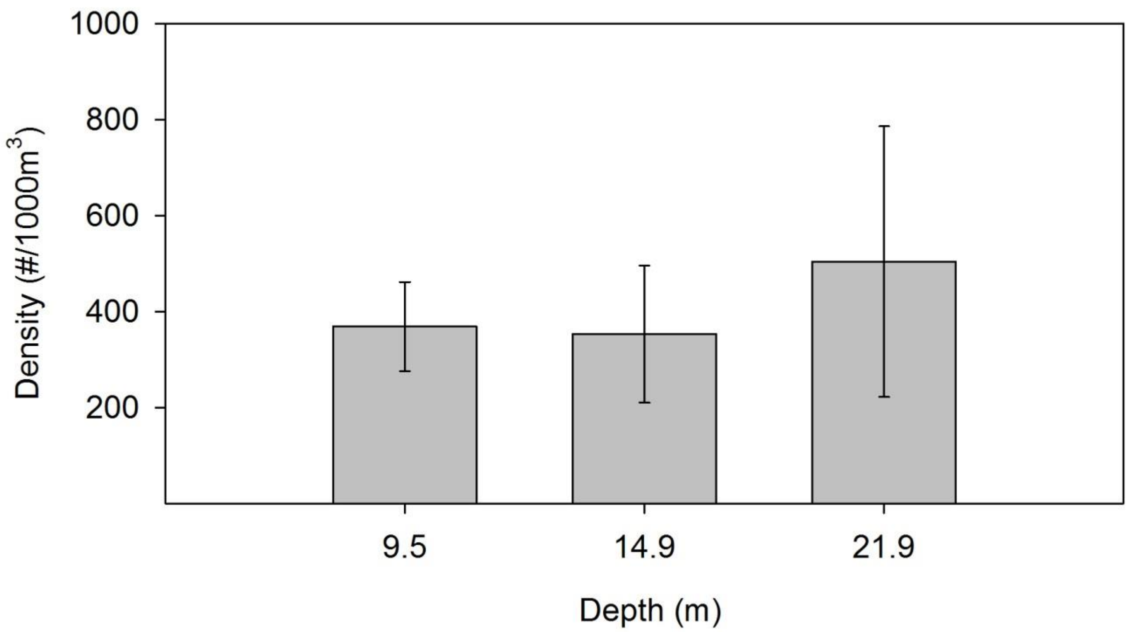

Figure 4. Mean total fish larvae densities (with standard error bars) for sampling at Stations E (9.5 m deep), O2 (14.9 m), and O4 (21.9 m) during the Huntington Beach Generating Station California Energy Commission entrainment study, 2003–2004.

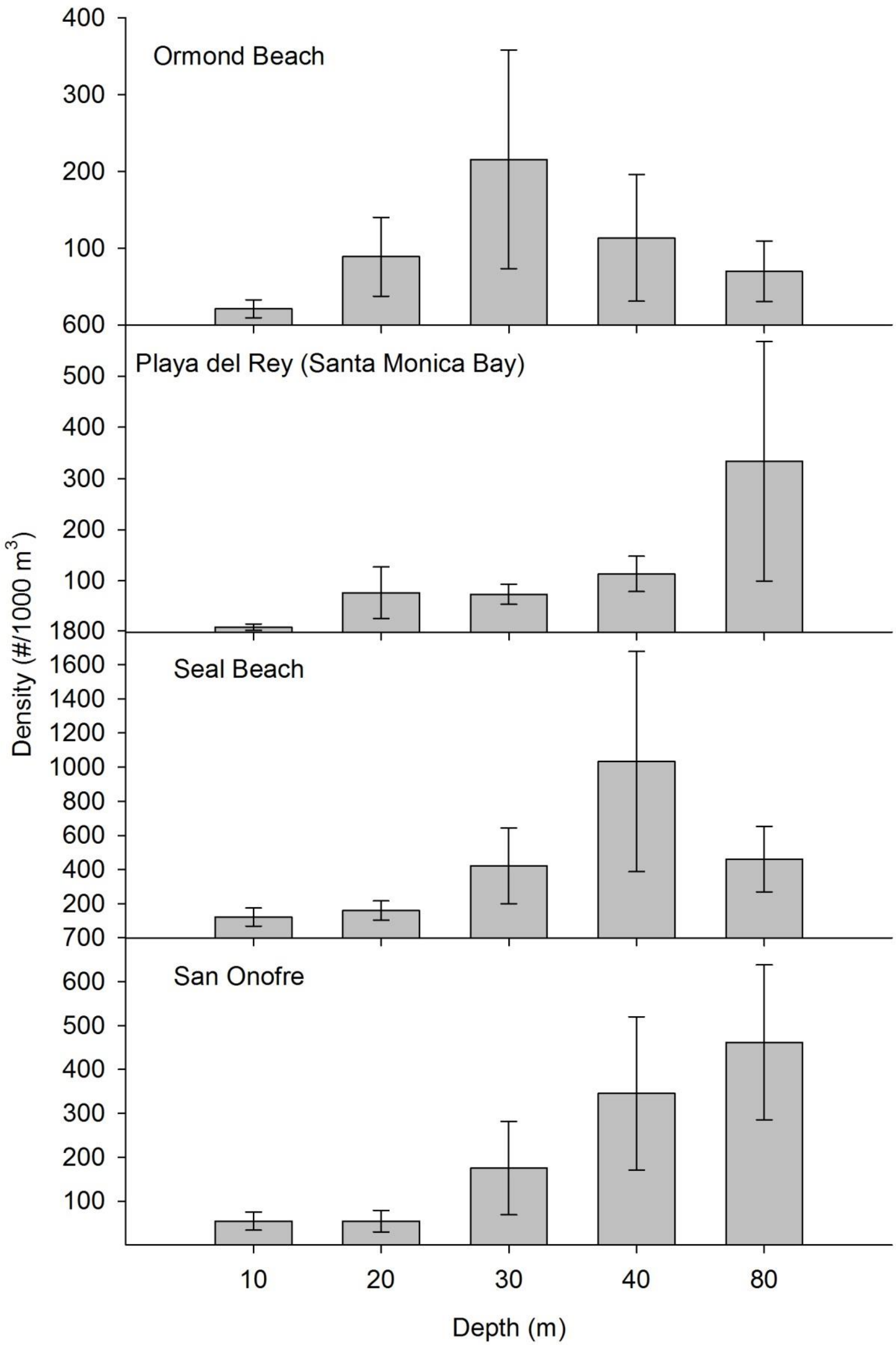

Figure 5. Mean total fish larvae densities (with standard error bars) for sampling at each isobath occupied by the California Cooperative Oceanic Fisheries Investigations offshore of Ormond Beach, Playa del Rey, Seal Beach, and San Onofre.

Feasibility Analysis

Poseidon completed a feasibility analysis to determine the best available site, design, technologies, and mitigation measures feasible to minimize intake and mortality of all forms of marine life for the HBDP. "Feasible" is defined by the Coastal Act and the Desalination Amendment as "*capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors*". The feasibility of extending the HBDP intake farther offshore is evaluated herein using the above definition of "feasible." Therefore this analysis is structured to address each of the aspects of feasibility, namely the environmental, technical, social, economic, and scheduling aspects.

Based on the biological analysis above specific to the HBDP site, the middle sampling station at the depth of 14.9 m (Figure 4) had the lowest mean larval density. This station was approximately 1.2 miles (approximately 6,077) offshore.

For the purposes of this analysis, we assume that extending the existing pipeline farther offshore (from 1,840 ft to 6,000 ft) would be accomplished through the following steps:

1. Sealing the openings on the existing velocity cap
2. Excavating the west side of the buried intake riser
3. Penetrating the existing intake riser or alternatively removing its modular rings
4. Connecting the pipe extension to either the existing intake riser or the remaining intake pipe
5. Installing the length of pipe required to extend to the target offshore distance
6. New extension pipe would be laid using a trench and fill technique

The individual aspects of determining the feasibility of extending the existing intake withdrawal point farther offshore are described in Table 1.

Conclusion

Positioning an open water intake outside the surfzone and at a reasonable depth to prevent negative interactions with beach users and surface vessels is the best possible location to minimize entrainment mortality along the southern California coast. The CalCOFI data supports this conclusion as each of the four areas had lower densities along the 10-m isobath than the deeper isobaths (Figure 5). The Huntington Beach coastline has the least amount of area designated as either an ASBS or an MPA (Figure 6). Data from the Seal Beach CalCOFI sampling is likely representative of the area between Newport and the Port of Long Beach where the continental shelf is wide and gently sloping. Moving the intake south of Newport where the continental shelf narrows bringing deeper waters closer would likely require impacting an MPA. Much of the nearshore subtidal areas between Newport and San Clemente are designated as MPAs.

The extension of the HBDP pipeline from its existing terminus approximately 1,840 ft offshore to the site-specific location with the lowest recorded larval density (approximately 1.2 miles (6,636 ft offshore) would result in substantial construction-related impacts. Some impacts would be temporary while others would be permanent. This preliminary feasibility analysis indicates that due to the construction-related environmental impacts and economic aspects of the pipeline modification, the current intake withdrawal point is best.

Perhaps more importantly, since the sampling location with the lowest larval density does not differ significantly from the existing intake location, the costs of extending the pipeline outweigh the potential benefits and would not justify the extensive construction related impacts to the benthic environment. In order to minimize entrainment in the Orange County area, an open water intake should be positioned at the shallowest depths feasible taking into account other beach uses, such as swimming and surfing.

Figure 6. Map of Orange County coastline showing the location of the Huntington Beach Desalination Facility and the Marine Protected Areas (MPAs) designated along the coastline.

Table 2. Evaluation of Individual Feasibility Components for Extending the HBDP Intake Farther Offshore

FEASIBILITY ASPECT	CONSIDERATIONS
Environmental	• Temporary construction-related impacts include suspension of seafloor sediments near the existing intake riser and along the route of the new pipeline extension, disturbance of sediment from mooring of construction barges, and underwater noise during construction. • More permanent impacts include disturbance of the benthic habitat along the trench and fill pipeline extension route. Though re-establishment of benthic habitat is likely to occur, substantial time will be required for habitat recovery. • Permanent impacts include the loss of benthic habitat at the terminus of the pipeline extension where a new intake riser would be required. • To the extent that cropping of entrained organisms is shown to be a concern, additional pipe length would increase the risk of cropping.
Technical	• Site Constraints: Offshore construction can be difficult to schedule as ocean conditions and weather can delay construction efforts • Equipment: The equipment required for this type of work is commercially available. The best installation approach for a pipeline extension would be either tunneling (not economically feasible) or trench and fill. Additional pipe will create additional headloss in the system that would have to be accounted for based on the final design specifications. The biofouling control approach would have to be expanded to include the additional pipe length.
Social	• Recreational and commercial access to a large offshore area would be restricted during mobilization, installation, and demobilization of construction equipment • During tie-in of the pipeline extension, operation of the HBDP would have to be suspended with an associated temporary loss of product water flow
Economic	• Costs have not been estimated, but extending the pipeline would incur addition costs associated with permitting, design, financing, construction, maintenance, mitigation, project management, and energy consumption over the lifetime of the facility.
Schedule	• Offshore construction can be difficult to schedule as ocean conditions and weather can delay construction efforts. The schedule duration will also rely, in part, on being able to do the work during a time of the year when the swells are small (most likely in spring to early summer). • Permitting for offshore work will require approvals from multiple agencies and will have a strong effect on the overall project schedule

References

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Watson, W., S.M. Manion, and R.L. Charter. 2007. Ichthyoplankton and Station Data for Oblique (Bongo Net) Plankton Tows Taken During a Survey of Shallow Coastal Waters of the Southern California Bight in 2004 and 2005. NOAA-TM-NFMS-SWFSC-410.