**Dear sir,**

**RE: Comments on desalinization impacts on the marine environment**

**The comment below is to be entered as part of the record and responded to as an official comment:**

I happen to live near the Huntington Beach Power Station and the proposed Posidion desalinization unit piqued my interest in the issue of impingement and entrainment (I&E) at this and other sites. As I am considered a real expert in the reproduction, maturation and larval rearing of aquatic animals and have provided world wide consulting services and designs necessary to produce significant numbers of eggs, larva and post larva animals for commercial aquaculture, along with extensive knowledge and experience with aquatic ecologies and associated microbiological ecology dynamics, I am well qualified to speak to the I&E (Impingement and Entrainment) issues relevant to desalinization issues and power plant intake issues.

I actually read the I&E studies at the HB Power Station and the draft report of the "expert review panel" along with other related documents such as associated EIR's. I was shocked to note the almost total use of relatively unavailable and semi-internal reference documents rather than peer reviewed scientific journal references for much of the protocols, biological data, methods of analysis, etc. That makes it virtually impossible to check the details of their estimates of Area of Production Foregone (APF) and other details. In this type of problem, the devil is in the details.

With most of the referencing being internal documents by the same group of "experts" without real outside review, one can get into an internal logical loop in which methods, data and conclusions drift further and further from reality. The thinking of the state "experts" (several agencies) on both one-through cooling and desalinization intakes issues appears to have taken just such a drift from scientific reality and economic perspective. As a member of an editorial board on a scientific journal and a peer reviewer for several journals, I can attest that much of what is in the draft report would be ripped apart as truly sloppy science.

One way to judge the validity of this draft report and how far it has drifted from reality would be to look at the numbers, such as estimating a value of a larval fish at 0.05$/fish (page 12 Appendix 1 of the Draft Report). That boils down to an absurd $50,000/million larva. A typical very small commercial fish hatchery can produce (if you had a market for larval fish) a million/day from a < 100 M2 facility with a staff of 2 to 3 people (I have done it). Larval aquatic animals sell commercially for $100 to $1000/million larva (shrimp/fish species with true pelagic larval stages), an insignificant fraction of the value these authors generated. A million larvae represent the reproductive output of < 10 kg of adult fish/shrimp per year for pelagic spawners, which have eggs in the 1 mm diameter size range. Note: a 50gm shrimp produces about 500,000 larva every 2 weeks and a kg of zebra fish will produce 400,000 every week. A single female California halibut will produce 500,000 every few weeks all spring and summer for many years. Their thinking has drifted about a factor of 10 to 100 or more from any realistic numbers in the direction of claiming that they are working on significant problem.

When they try to estimate the biomass that these larval would become, they seem to ignore the fact that the larval from 10 kg of adult spawners will, on average, only produce another 10 Kg for the next generation, even with many millions of larval. It seems that they are trying to estimate the survival of larval fish in a real world environment using estimates where the basic data comes out of "no-where", such as by assuming that if 10% die (are eaten) at this stage and 20% at another stage, etc. they can estimate how many kg will be produced in a year. The data required to backup such as approach doesn't exist, and the final conclusions are nonsense and don't agree with X kg of adults producing an X kg of next generation adults observation. Their numbers are not even in the right ball park.

The real significance of larval fish numbers on the next generation is further complicated by that fact that the survival of any given larva depends very strongly on food competition/availability. The removal of some larva can increase the survival of other larva and result in no change in post larval recruitment. This is especially true, if the larval fish may be killed by entrainment but the corpse is returned to the environment to be consumed as part of the normal food chain. Most larger larval fish or post larva fish who are eating younger larva don't care if it is dead or alive, other than it is easier to catch when dead. Both power plants and desalinization units rapidly return entrained animals to the ocean (dead or alive).

Their assumed linear relationship between larval numbers and year 1 recruitment is not valid. It is difficult to imagine that these "experts" do not know that it isn't valid. If it were, fisheries scientists could actually predict future harvests with great accuracy, which they can't do. This relationship between larval input and year 1 recruitment with non-selective harvesting of larva may very well be zero over a very wide range of larval inputs into a system. If this is so, all the entrainment issue for desalinization and for cooling water are totally irrelevant to the marine ecology, and any attempts to force "mitigation" is simply a method of obtaining financing for the researchers. Only a tightly closed system, such as a bay or estuary, would require any analysis or thought.

Given the above observation, it appears that the entire exercise demonstrated in this draft report is unrelated to any actual impact on the marine ecology by entrainment of larval organisms in the case of both once-through power plant cooling or desalinization intakes.

Of equal importance is the observation that we are only talking about a few hundred dollars on the annual value of impingement fish. Even assuming their fantastical imaginary values of the larval fish, we are still only adding a few thousand dollars per year at the HB power station. We are talking about a "thousand dollar class problem" which took $3,000,000 dollar to study. We have spent another $10 million on studies and 10 years on permits, hearings, studies, reports and related effort for the proposed desalinization plant. Given this situation, it is no wonder we don't have jobs for people in California, especially for those who don't have the education to cash in on all the "studies" and planning.

The total lack of perspective on the significance of offshore intakes by our government is appalling. Classes of problems with a value of a few thousand dollars are creating huge extra cost for desalinization and huge efficiency decreases for power plants. Power plant efficiency loss results in a 5% or more increase in CO2 emissions from fossil powered power plants located on the coast, where cooling water is available (pure thermodynamics where efficiency = (T1 - T2)/T1 when T2 is the cold side temperature) in the case of flow-through cooling. In an era of resource limitations and global warming, we can't take the economic and environmental hits of deliberately decreasing our thermodynamic efficiency of energy generation (note that a combined cycle replacement of a conventional steam generator is more efficient but a flow-through seawater-

cooled combined cycle is even more efficient than a dry cooled combined cycle -- by a significant amount, since the steam cycle is operating at a fairly low delta T).

Thank You,

Dallas E. Weaver, Ph.D., P.E.

PS: The proposal to use offshore or on shore sand wells as intakes to desalinization plants seems to be an idea generated by bureaucrats with no real world experience. Having consulted on both sand wells and offshore horizontal sand well type intake structure for major shrimp hatcheries (175 million post larval shrimp / mo. facilities), the offshore fields had major maintenance issues and shore sand wells had major water quality issues including high levels of $CaCO_3$ supersaturation, which plugs all the pipes. Ultimately it was cheaper to recycle the hatchery waste water than fix all the issues with the intakes.

My experience with extra salinity has shown aquaculture can produce shrimp at 44 ppt salinity (local seawater at 32 ppt) and fish at up to 45 ppt (tilapia). Much of the data collected on salinity tolerance of animals has stressed the animals in other dimensions that decrease the tolerance for salinity and can't be considered reliable.

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