

**Mendiola, Doris**

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**From:** john stephens <stephens2@earthlink.net>  
**Sent:** Monday, August 24, 2015 6:55 PM  
**To:** Wentzel, Michael  
**Subject:** [External\_Sender] Environmental affects of Diablo Canyo  
**Attachments:** WHY DIABLO Canyon 's ONCE THROUGH COOLING SYSTEM SHOULD BE CONSIDERED.docx

Hello Michael. I'm attaching the statement that I would have liked to present at the August 5th meeting, but ,of coarse, couldn't in 3 minutes. I srudied once through cooling at the power plant in Redondo beach, from 1974 through 1996 and this work has continued to the present5. I know of no better data concerning the affects of once through cooling on a fish assemblage than our 41 year study. See Attachment. John Stephens, Emeritus professor, Occidental college.

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Add= m. Wentzel (m5w2)

## WHY DIABLO CANYON'S ONCE THROUGH COOLING SYSTEM SHOULD BE CONSIDERED "STATE OF THE ART"

I am a marine biologist (an ichthyologist) retired ( 1996) after 38 years of teaching and research. During that time, I spent more than 20 years examining the affects of once through cooling at the Redondo Beach (King Harbor) steam electric generating facility, on the adjacent fish assemblage affected by the intake and hot water discharge. Both temperature change and entrapment/entrainment were examined. In this study, we monitored monthly the volume of plankton and number by species of fish larvae in the adjacent water column. We examined the recruitment of larval fishes to the adjacent rocky reefs and the abundance of juvenile, subadult, and adult fishes by quarterly diver counts on 5-7 transect areas. At the same time we monitored the fish assemblage in a kelp bed site, three miles to the south at Palos Verdes, with transects taken at the same depths as those in King harbor. We considered this site, as a control comparison. Additionally, we followed the fish entrapment for a number of years, including entrapment during heat treatments. We also examined the affects of chlorination on some of these species. This field study is still going on (41<sup>st</sup> year) carried out by my replacement and has produce more than twenty papers. I have listed a number of these papers for your interest at the end of this statement. In general, the fish assemblage surrounding the once through cooling system has remained abundant and diverse, when compared to that of the Palos Verdes kelp bed which is considered an important natural habitat, and the larval entrainment doesn't appear to have an effect on the fishes of the assemblage. This, though the assemblage has changed due to the transition from a cold PDO to a warm one, as well as due to El Nino events, habitat destruction from storms, and breakwater modification, etc.

I have not been a strong supporter on nuclear power plants though I helped develop the fish return system that functioned at SONGS unit 2 before it was shut down. I am a fan of adequate electrical power and not of carbon producing hydrocarbon plants. The U. S. electrical grid is not ready to loose California's last functioning nuclear plant, which produces abundant carbon free energy. Coastal power plants do kill many fish larvae and a limited number of entrapped fishes but we see no evidence of an effect upon the local fish assemblage.

The once through cooling system at Diablo is unique, I believe for California. Both the intake and the discharge are in the intertidal zone, not in the subtidal. A large number of intertidal fishes are small benthic species, rarely swimming in the water column and thus not subject to entrapment. Entrapment of fishes generally occurs at night when a fishes rheotactic sense is marginal and entrapped fish are largely active schooling nocturnal species. (Queenfish, white croakers, anchovies etc). Further, the entrance to the intake was designed for three units and only two were built so that the opening is relatively large and thus produces a slower incurrent. Unfortunately, I know of no data concerning entrapment of fishes at Diablo or any study of entrapment at this site. However, entrapment, even in large subtidal intakes is rarely considered significant as opposed to the affects of recreational and commercial fishing. At King Harbor, thee daily entrapment was much less than the take by any active fishing vessel. Entrainment of plankton and larvae does kill lots of larval fishes and planktonic organisms. I have examined the larval fish data taken by Tenera in over ten years of meter net samples near the intake. Eleven of the top 20 larvae entrained are intertidal species. Of the 9 remaining, anchovies, white croakers and one species group of rockfish rank in the top group, anchovy larvae are abundant in most coastal inshore waters (including my work at Redondo beach), though they are more abundant during cold PDO's. Almost all of the top twenty species show considerable annual fluctuation with no obvious trend. Further, most oceanic or subtidal species of larvae that are taken in the intertidal would be unlikely to survive their settlement into this shallow highly competitive environment. Remember that fishes produce huge numbers of larvae, often greater than 1,000,000eggs/female because >99% will not survive predation, random drift or starvation. (which is the evolutionary pressure for production of so many). The loss to intakes has not been found to be significant. In order to document such an effect, assemblage populations would have to be shown to be declining due to lack of recruitment caused by power plant entrainment. All fish populations have large annual fluctuations and it is highly unlikely that any of these fluctuations could be ascribed to entrainment as fish larvae on the Pacific coast rarely return to their parental population. Suggested, no hard data has shown even a short term affect. A recent report to the California Energy Commission on the King harbor Ichthyoplankton (2008) shows that if the data is plotted from 1974 to 2008, there has

been a "steady" decrease in plankton abundance, yet no correlation between entrainment and this decline was discovered. The major decrease occurred in the late 1970's when the cool PDO ended. If we ignore the cool PDO data, the overall decrease disappears. No increase has been seen since the plant went largely offline in around 2010.

There has never been any long term effect demonstrated for a Pacific coast fish species from open coastal larval entrainment. The geological and oceanographic conditions in the eastern Pacific can not be compared to those of the Western Atlantic where the fish populations are often dependent on large embayments (sunken river mouths) for some stage in the life history and required annual migrations which increase vulnerability to entrapment or entrainment. Even there, marine entrainment has not been shown to be a long term problem.

Hot water discharge is benign for most local mobile fish species which simply move to appropriate thermal conditions.. As a biologist, the thought of a discharge through the intertidal, a wonderfully rich biological habitat, seemed insane. I observed it while lecturing to the plant scientists on fish thermal preference prior to the plants initial operation. Such a flow would certainly drive off motile organisms, including fish, and kill sedentary flora and fauna. Fishes driven from their preferred habitat are certainly more vulnerable to predation. With the initial start up of the plant, this happened. However, only a relatively small area of intertidal is strongly affected and even the worst impinged areas have been recolonized by tolerant species. When the plant is closed, this change should be reversed in several years. Fishes detect water temperature and avoid those that are harmful. The warm water rises quickly to the surface as the water deepens and is rapidly cooled, though the shallow discharge cove has certainly been significantly warmed. Some fishes that normally are known to be common south of Point Conception have taken advantage of this small area and live here happily. Many fish larvae from the warmer southern California environment drift north of the Point Conception faunal barrier, but few are able to survive or reproduce here. The Diablo warmer temperatures may be a harbinger of what will occur as sea water temperatures rise with global warming. What exists here today, due to once through cooling at Diablo is likely to be more prevalent in the future. Again, at King Harbor in Southern California, a number of tropical species have been observed living in the warm discharge water

including broomtail groupers, and the Cortez Chub. This appears to have little effect upon the indigenous species and they usually disappear after an unusually cold winter.

The once through cooling system at Diablo does not show a negative affect on the local fish species and because of its' intertidal intake and discharge is highly unlikely to in the future. Any change due to water warming should rapidly disappear once the plant is taken off line and conditions return to the then current status. Compared to the terrestrial effect of cooling towers, which also would require water for cooling, and could produce local weather changes, the present once through cooling system is the system of preference.

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