The Department of Fish and Game viewed the subject of this portion of the hearing as being the estuarine and marine resources living in the estuary largely downstream of the entrapment zone. The Department believes that such resources should be maintained at their historical level and urges the Board to adopt that as a goal.

The summary we have presented of DFG Exhibits 59 and 60 indicates that at least three groups of fish and invertebrates have life history strategies with important relationships to flow.

The group most obviously affected is the estuarine species. Most of those are more abundant in wet years than in dry years; and three have statistically significant relationships between their abundance and flow. These are longfin smelt, yellowfin goby and Crangon franciscorum. We believe that flows in the late winter and spring control the abundance of all three species, and for all three there is a direct arithmetic relationship between abundance and flow.

In order to provide some perspective on likely impacts of changes in flow, we computed the statistical relationship between the abundance of Crangon franciscorum and March to May Delta outflow, as illustrated in Figure 41 of Exhibit 60, and estimated the abundance of shrimp at mean flows for three conditions. The three conditions are the actual historical flows which existed from 1922 to 1967, 1990 level flows as projected in DWR Exhibit 30-D, and year 2000 level flows as projected in DWR Exhibit 31-D.

The mean flows in 1990 are projected to be about 50% of mean 1922-67 flows. The analysis indicated that the 1990 population for average flows will be about 26% lower than that estimated for historical conditions and that an additional 1.3% decline will occur between 1990 and 2000. We would expect the decreases in wet and dry years to be less and greater respectively, than the change projected for average flows.

Crangon franciscorum is a major component of the food chain for striped bass and other fishes, and also has a direct economic value as bait. The ecological role of the other two species is less clear. Longfin smelt are numerous but occur in the diet of other fish much less frequently than several other species occupying similar habitat. Yellowfin gobies have been introduced relatively recently.

The other two groups of species having apparent relationships to flow are:

1. species such as dungeness crabs and English sole which spawn offshore and use the Bay as a nursery area as a result of their young being carried into the Bay by gravitational circulation, and
2. various marine species which reside in the Bay, with some having either positive or negative relationships to flow, but apparently not generally having a negative relationship as had been hypothesized.

While these last two groups are affected by flow, we have as yet not discovered a quantitative basis for regulating flow to protect them.

What action is warranted by the information on the estuarine species? The evidence indicates that these are a group of species which reside in the area largely downstream of the entrapment zone. They respond positively to flow in the late winter and spring in a manner similar to the response of striped bass in the entrapment zone to spring and early summer flows. The estuarine species are using the relatively large Bay inflows in the late winter and spring beneficially, and the relationships defined in our exhibits suggest that there are no flows surplus to their needs. As the computations for Crangon indicate, these species have presumably declined in abundance as flows have diminished and will decline further if additional water development occurs. Clearly any actions which further diminish flows need to be weighed against this impact. The only way to maintain their abundance evidently is to maintain existing flows.

We will await more precise information on impacts on other species, so we can place the changes in estuarine species in better perspective, before recommending specific measures to protect species in the Bay.