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### **SmeltCam III: Making Science Fiction a Reality with Fish Species Recognition Technology**

**Abstract:** Much is still unknown about actual numbers, trends in abundance, and geographic distribution of rare and patchy pelagic fishes in the San Francisco Estuary and Sacramento-San Joaquin River Delta (Delta). Delta fish species and aquatic organisms are in constant flux and have seen recent declines. To learn more information about these fishes in their natural environment, the Bureau of Reclamation, SureWorks LLC, California Department of Fish and Game, and California Department of Water Resources are developing technology to count and identify pelagic fish species in the Delta using an underwater video imaging system enclosed in a towed submersible. Innovative fish identification methods are necessary to provide more accurate population numbers and locations of occurrence, and more importantly to provide a passive, noninvasive technique that will lessen the impact of current fish monitoring practices. Trawls presently form the foundation of Interagency Ecological Program (IEP) fish monitoring in detecting pelagic organism decline (POD) and population trends for pelagic Bay-Delta fishes. While these long term sampling data have been exceptionally useful in monitoring population trends and abundance, additional sampling is necessary to gain further understanding of the distribution and life histories of rare and patchy species, their ecosystem requirements, and factors that may be correlated with their declines. Pelagic organism declines have led to concern over lethal "take" by traditional trawling methods in a time when more information about sensitive species is needed to advise management decisions and attempt to rescue these organisms in peril. Underwater fish species recognition technology provides a supplemental method to examine pelagic fish distribution and abundance without inadvertently harming or handling threatened and endangered species. The average accuracy of the SmeltCam species classifier was 91% during trawls performed fall 2011. Algorithms in the species recognition model were able to positively identify 88% of delta smelt.

**Statement of Relevance:** Traditional sampling techniques may inadvertently cause harm to ESA listed fish species and further sampling restrictions may result. Implementing alternative methods of collecting population data that won't harm or increase lethal take is necessary to gain information about Delta fishes and sustain vulnerable fish species.