RMP Exposure and Effects Workgroup Meeting

December 4th, 2006
Meeting Minutes

Attendees:

Michael Fry – American Bird Conservancy
Bruce Herbold, EPA
Harry Ohlendorf, CH2MHill
Daniel Schlenk, UC-Riverside
Robert Spies, AMS
Karen Taberski, SFRWQCB
Steve Weisberg, SCCWRP
Don Weston, UC-Berkeley

Jay Davis, SFEI
Ben Greenfield, SFEI
Letitia Grenier, SFEI
Jen Hunt, SFEI
Meg Sedlak, SFEI
Bruce Thompson, SFEI

A. Introductions and Review of Agenda

Meg Sedlak gave an overview of the EEPS and the goals of the study. EEPS is funded through 2008 at $200,000 per year. Ms. Sedlak indicated that the purpose of today's meeting was to determine studies for 2007. Approximately $170,000 is available. Michael Fry offered to give a lunch time presentation on his work on pesticides and birds.

B. Synthesis of Results of Shiner Surfperch Project and Work Proposed for 2007

Bob Spies presented his work on determining an effects indicator in shiner perch. The study looked at growth, fitness, and reproduction with both field- and lab-based experiments. There were two study sites (Oakland and San Francisco) and one reference site for each year of the two-year study (Big River (year 1) and Tomales Bay (year 2)). Twenty samples per site were the targeted number collected in May/June.

Bob Spies reported the results to date. The group has successfully started a lab culture of shiners. No spatial difference in female weight was found at the different sites. Samples collected from San Francisco and Oakland sites had higher female/male ratios. The condition index (CI) of females at Tomales Bay and Oakland were equal; both were greater than at San Francisco, and females at Big River had the lowest CI. The CI of female fish at Oakland, San Francisco, and Tomales Bay were all significantly higher than at Big River. The CI of males at the four sites was, from highest to lowest, Tomales Bay, Oakland, San Francisco, and Big River.

Ethoxyresorufin-*O*-deethylase (EROD) activity was higher in 2006 than 2005. It was unclear why EROD differed between years; it could be an effect of wet weather in 2006. EROD was also high in Big River fish, which may be due to colder water. Histopathology showed some effects in gills from 2005 fish; histopathology was not repeated in 2006 because of the low level of effects seen in 2005. Choriogenin was measured in liver tissue, however due to cross-reactivity it was not possible to determine effects.

An integrated score of all measurements was created for 2006. Using this method, Tomales Bay scored 8, Oakland scored 12, and San Francisco scored 14.

Bob Spies presented the proposed work for 2007. This work includes verifying field work with chemical analysis targeting PCBs and possibly phthalates, conducting gill histopathology, and measuring testosterone and estradiol in plasma. Otoliths would be examined to determine age of fish. Dr. Spies proposed continuing the lab culture work, including the rearing of females in the lab and counting sex and number of fish born. The 2007 proposed work also includes planning future exposure experiments.

C. Update on EDCs in Shiner Surfperch and Pacific Staghorn Sculpin and Work Proposed for 2007

Kevin Kelley gave an update on the endocrine work he had conducted with staghorn sculpin and shiner surfperch. The endocrine system regulates homeostasis, adaptation, and survival. Endocrine hormones regulate physiology and reproduction and are highly responsive to changes in the environment. There are different kinds of endocrine disturbances and particular endocrine disrupting chemicals.

Study objectives were to: 1) determine incidence/magnitude of EDCs in fish and how they affect stress hormones, growth/reproduction, and thyroid function, 2) look at spatial differences in these responses and contaminant levels, and 3) determine liver contaminant concentrations. Two species of fish were examined: staghorn sculpin (bottom-dwelling fish with a primarily invertebrate diet) and shiner surfperch (pelagic). Fish were collected from RMP 2006 sampling sites. Reference site was Bodega Bay.

Cortisol, a hormone that is produced under stress, was measured in fish. Cortisol production increases some catabolic function (glucose levels, lipids) while decreasing anabolic function (growth, reproduction). Suppression of cortisol can be seen in fishes with impaired hypothalmal pituitary interrenal (HPI) axis. One theory is that this suppression could be due to endocrine disrupting chemicals. Endocrine disruption may be used by monitoring programs to assess effects and impact from environmental stressors including contaminants.

The results to date have found suppressed cortisol production at Oakland and San Pablo Bay in caught surfperch and sculpin. Testing of livers for contaminants revealed a variety of PCB congeners, PAHs, and pesticides. Parasitic isopods were commonly found in shiner surfperch and to a lesser degree in sculpin. A UCLA post doc will be identifying isopods.

In a Southern California study, impaired HPI (suppressed cortisol) was linked with increased parasitism near a sewage outfall site and Newport Harbor. Other work has shown mean 17β-

Estradiol concentrations in male flatfish were statistically higher at sites near sewage outfalls than reference sites (English sole and honeyhead turbot). Interestingly, the results to date do not suggest that SF Bay fish have been impacted by estradiol.

Future plans include looking at microassays and biomarkers to find an integrative indicator. Data are promising for stress response. It is believed that PBDEs will be elevated in tissue.

D. Summary of 2006 Benthic Sediment Effects Study and Work Proposed for 2007

Bruce Thompson presented work to date on benthic effects. The purpose of this study is two-fold: to determine concentrations that cause impairment to biota and to validate the Sediment Quality Objectives. The study is looking at which contaminants have highest sediment concentrations and resulting benthic impacts. Historical data were reviewed from five sites: San Leandro Bay, South Bay, San Francisco shoreline, Richmond Harbor, and San Pablo Bay wetlands. In addition to contaminant data, other parameters that can impact benthos have been included (salinity, TOC, % fines). A multivariate analysis was conducted using ERM and ERL for contaminants and benthic matrices (total number of taxa, total abundance, number of molluscan taxa, oligochaete abundance, polychaeate abundance) as response variables.

Preliminary results from San Leandro Bay show that some metals and chlordane may be affecting total taxa and molluscan taxa. Salinity was significantly correlated with total abundance, oligochaete and polychaete abundance. Similar analysis will continue with other sites.

A draft report is due on January 31, 2007. Proposal for 2007 work will be based on the 2006 results and include 1) expanding the 2006 review to additional sites/data, 2) verifying 2006 results with lab mesocosm studies of sediment dose responses, which would required the development of protocols, and 3) piggyback with RMP episodic toxicology TIE study to assess benthic samples from TIE study over a gradient of sites.

E. Avian Exposure and Effects: Egg Monitoring – Cormorants vs. Forster's Terns in RMP Status and Trends Monitoring

Jay Davis presented information on incorporating cormorants vs. Forster's terns into the RMP S&T. There are compelling arguments for including both as they represent different habitats and foraging behavior. In the past, cormorant studies included sampling 3 sites, 2 composites/site (10 eggs/composite). The samples were analyzed for mercury, selenium, organochlorines, emerging contaminants, and dioxins. Cormorants are good indicators of regional contamination since they forage over larger areas than terns. There is clear regional variation for some contaminants.

Terns are a good indicator of shallow water habitats and are more likely to highlight hot spots but show more variation in the data. Terns could provide a stronger link to potential effects and terns are an indicator species for the mercury TMDL.

Jay Davis indicated that there were a couple of potential scenarios for including birds into the main Status and Trends program: 1) add cormorants to S&T as trend indicator, pursue effects in terns through EEPS studies, 2) add terns in S&T as trend indicator, supplemented by effects work through EEPS, 3) add cormorants in S&T, no terns in EEPS and 4) add terns in S&T, no terns in EEPS and 5) add both terns and cormorants into the program.

F. Avian Exposure and Effects: Potential New EEPS Studies

Letitia Grenier presented potential future studies with clapper rails. Mercury levels in clappers are currently above the effects threshold. Hatching success in Bay population is lower than the species average. This is an endangered species which may not be recovering due to mercury levels.

Letitia Grenier outlined an approach for developing a non-invasive method for monitoring mercury in clapper rails. The method would evaluate whether clapper rail mercury concentrations can be predicted from feces or prey items, and whether a bioaccumulation factor can be developed between prey and clapper rails. This information would be used to track changes in space and time and compare to effects thresholds in the literature. Activities that would be undertaken as part of this study include: 1) collaborating with USGS-BRD field study, 2) using stable isotopes to ID prey species, 3) characterizing mercury in rail tissues, prey, and rail feces, and 4) developing predictive models of rail mercury concentrations using prey/fecal mercury values.

Collin Eagles-Smith proposed continuing the existing USFWS/USGS CalFed mercury work with Forester's terns. Forester's have some of the highest blood mercury levels of Bay birds with approximately 58% of samples exceeding the high and extra mercury contaminant categories. This species has high site fidelity and feeds mostly at the Bay margins. The next phases of USFWS study are to 1) determine egg toxicity thresholds for abandonment and hatchability, 2) determine effects threshold of egg-derived mercury on chick mortality, and 3) link mercury concentrations in eggs to those in down feathers.

G. Recommendations of the Advisory Panel Members

The committee recommended increasing the funding for Dr. Kelley to cover additional sites and histopathology work. Dr. Kelley revised his proposal and requested approximately $76,000. The Advisory Panel recommended that the remaining portion of the budget, approximately $94,000, fund the mercury tern work proposed by USFWS. The panel recommended against further benthos pilot study work.