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Exposure and Effects Pilot Study
Science Advisory Panel Meeting
San Francisco Estuary Institute
Meeting Minutes
April 4, 2005

In attendance at the meeting: Terry Adelsbach (FWS), Michael Fry (Stratus Consulting), Harry Ohlendorf (CH2M HILL), Robert Spies (AMS), Karen Taberski (Regional Board), Steve Weisberg (SCCWRP), Don Weston (UCB), Jay Davis (SFEI), Ben Greenfield (SFEI), Letitia Grenier (SFEI), Jennifer Hunt (SFEI), Sarah Lowe (SFEI), Meg Sedlak (SFEI), and Bruce Thompson (SFEI)

1. Introduction – Jay Davis called the meeting to order and introductions were made.
2. Review of last meeting and developments during the past year (Jay Davis)
    a. 2003 RMP Program Review
        i. One of the main recommendations of the 2003 RMP Program Review was to have more emphasis on ecological effects and linking effects to contaminants.
        ii. Review Panel recommended increasing the budget up to $500,000 per year. In response to this recommendation, the TRC has authorized $200,000 per year for EEPS.
        iii. Panel recommended extending the EEPS pilot study for two more years to 2008. This has been approved by the TRC.
    b. Conceptual Framework and Rational for EEPS
        i. As recommended by the Review Panel, a conceptual framework document for EEPS has been prepared. The framework was distributed to the panel last year.
    c. Goals of EEPS
        i. Develop indicators of exposure and effects for potential incorporation into the S&T program. Determination of inclusion into the S&T program will include:
            1. Successful trial in the pilot study.
            2. A clear reference condition (assuming a 'clean' site can be found).
            3. A balanced mix of indicators.
    d. Ranking of studies
        i. At the February 2004, meeting panelists ranked pilot studies. Rankings were 1) cormorants 2) benthos 3) diving ducks 4) fish effects 5) clapper rail 6) seal effects 7) sediment dose response and 8) aquatic toxicity.
        ii. There have been no studies so far on the endangered California clapper rail. This may be an important species to study since it is a

marsh species with a small home range which increases the potential exposure to methyl mercury. There are many salt marsh restoration projects slated for the Bay which could change the rates of mercury methylation.

e. Discussion
    i. Steve Weisberg asked how EEPS fits in with the Indicator work SFEI is involved in.
        1. The indicator work is funded through the SFEP. SFEI receives $30k/year to assist with the development of a broad set of indicators that provide a measure of the overall health of the Bay. SFEI and Andy Gunther of AMS produced a report in 2004. There will be a set of indicators of chemical contamination. The RMP is contributing $15k to the indicator work. There will be linkages between the two efforts.

3. Progress Report: Diving Ducks (Jen Hunt)
    a. Diving ducks are a measure of exposure with a human health component. Se, Hg and organochlorines are measured.
    b. The 2002 Se data was presented in a poster for the State of the Estuary conference. The analysis includes comparison to the Selenium Verification Study (a DFG study) from the 1980s. A manuscript for the 2002 findings is in internal review.
    c. Gut content from surf scoter (2002 results) showed 100% *Potamocorbula* in Suisun Bay, about 70% P*otamocorbula* in San Pablo Bay and no *Potamocorbula* in the South Bay.
    d. The 2004 samples were disposed of due to a freezer malfunction that compromised the samples. No contaminant analysis will be performed on these samples. SFEI will check with Susan Wainwright of USGS to see if they are going to analyze the gut content of the 2004 samples.
    e. Samples were collected again in 2005. 30 surf scoter and 30 greater scaup were collected from three embayments (i.e., Suisun, San Pablo, and South Bay). Susan Wainwright from USGS dissected 29/30 surf scoters and took the GI tract and will do full condition analysis of the scoter. USGS is also tracking scoter from the Bay to their nesting grounds in Canada and Alaska. They will be collecting feathers and analyzing metal levels.
    f. Discussion
        i. DFG collects ducks for free and the 2002 surf scoter gut content work was for free.
        ii. Bob Spies asked if the human health component usurps funding that could be used for ecological effects? Does OEHHA give money for the study? OEHHA provides no funding.
        iii. Don Weston stated that migratory birds are not necessarily good for studying ecological effects.
        iv. Karen Taberski is not sure that these birds are being consumed – Michael Fry said the birds are difficult to de-feather.

v. There is a consumption advisory in place through OEHHA that is based on the Selenium Verification Study from the 1980s.
vi. Chuck Henning found low Se levels in surf scoter liver and eggs from Alaska. Some speculation that scoter may process Se differently than other species.
vii. OEHHA Se screening level is 2 ppm wet weight for breast tissue. Most scoter are above the screening value.
viii. Terry Adelsbach talked about the decline of both lesser and greater scaup in the Bay – scoter populations seem to be stable. Scaup in the North Bay may have greater risk of Se exposure due to diet high in *Potamocorbula*.

4. Progress Report: Tern Studies (Terry Adelsbach)
    a. 2002 & 2003 hatchability study and chemical analysis on Forester and Least terns. Hg analysis funded by EEPS and TEQ analysis funded by USFWS.
    b. For piscivorous birds Hg concentrations were Central Bay<San Pablo Bay<South Bay. Hatchability studies seem to support this since failed eggs were higher in the South Bay. Highest rate of failed eggs were in the Caspians and Foresters.
    c. Very little predation on the tern nesting islands.
    d. Food is not limiting but there is a high rate of mortality for the hatchlings.
    e. Analysis of Hg, Se, PCBs, dioxin, PBDEs – don't have enough money for legacy pesticides. Someone could fund this analysis.
    f. Individuals with neurological problems have been seen in the field, particularly South Bay.
    g. Hatchability is not significant at the population level but there could be effects in chicks.
    h. Forster's show higher variability than the Caspian's in contaminant concentrations.
    i. Point Reyes Bird Observatory show that forester's population may be declining (article published recently in Water Birds).
    j. In the South Bay – contamination is higher in Foresters than Caspians.
    k. The highest published concentration of PBDEs anywhere in the world was found in Forester's terns from the South Bay (USFWS study).
    l. PCB/PBDEs were high in Forster's in the Baumberg area (South Bay).
    m. Artificial incubation of eggs is not being done – this work has been done by Gary Heniz et. al.
    n. Bob Spies recommended putting SPMDs out to collect contaminants and then inject the contents into eggs.
    o. Terry expects to complete the hatchability and chemical concentration report for the EEPS funded portion of the project by Fall 2005.
    p. CalFed Hg proposal
        i. Hg study looking at benthic omnivores (diving ducks), near shore birds (avocets and stilts) and piscivorous birds (terns). Stilts forage in marsh areas and avocets forage in salt ponds. The study may expand to look at other metals such as lead.

ii. This is a large capture effort with radio transmitters placed on some birds and also a bird banding component.
iii. Analysis of Se, PCBs, PBDEs.
iv. Looking at chicks, fledglings; growth curves, Hg deposition and exposure.
v. Feather growth stops and birds are not able to eliminate Hg into the feather – can effect development which is a critical stage for learning.
vi. Bird diet will also be analyzed.
vii. Sex ratio work has not been done but blood and feathers will be collected as part of this work.

q. Fail-to-hatch least tern eggs were analyzed – highest levels of PCBs, TEQs and PBDEs in fail-to-hatch eggs than in other birds. Hg was lower than other tern species. PCBs and TEQs may have impacted fail-to-hatch eggs.
r. Discussion
    i. Steve Weisberg asked how the EEPS work will link back to RMP sediment modeling efforts.
        1. Jay Davis responded that the CEP is has finished a draft model report with terns and sportfish – 1st generation was to model sportfish and 2nd generation was to model wildlife.
        2. Part of the Sediment Quality Objectives work involves modeling sediment to biota transfer of contaminants to fish. The model was validated by looking at PCB data. Frank Gobas and Jon Arnot have completed a report on the PCB food web model. Ben will parameterize this model for pesticides. Could incorporate Terry's work on DDT, Dieldrin and PCBs in bird eggs into this model.
        3. Hg modeling could use bioenergetics model to stimulate Hg update in certain species. The Delta Fish Mercury Project may have more work on Hg modeling.

5. Progress Report: Cormorants (Jay Davis)
    a. Random eggs sampled from three colonies in the South, Central and Suisun Bay in 2002 and 2004. Two composites/area with 10 eggs/composite. Initial data show that cormorants are picking up organics.
    b. In 2002 data there is a strong signal from dieldrin and chlordane.
    c. PBDEs highest at Wheeler Island (Suisun Bay).
    d. Discussion
        i. Can contaminants be tied to effects? There are literature reference conditions on contaminant egg effects.
        ii. Would it be a good trade-off to analyze cormorants every 3-4 years and increase the number of samples per sampling episode to increase power?
        iii. DDT concentrations are very high ~ 4ppm

iv. When was Richmond Harbor dredged? Any linkage to increased DDT seen in 2002?
v. USGS has done work on sediment budget for San Pablo Bay.
vi. High DDT could be due to interannual variation or could be food web related – maybe birds are foraging in Richmond harbor.
vii. Have cormorant prey fish been analyzed? Not yet but this work should be done.

6. Progress Report: Seals (Meg Sedlak)
    a. Moss Landing Marine Lab is collecting seal fur data to analyze Hg in fur. EEPS is funding the Hg analysis. The lab is also collecting blood.
    b. Group NSF proposal is in process.
    c. Discussion
        i. Caltrans is also funding a seal study – partly a telemetry study. CH2MHILL participated in the tagging of seals.
        ii. Bob Spies recommended fatty acid analysis of seal diet to see what they are consuming.
7. Progress Report: Benthos (Bruce Thompson)
    a. Thompson et al. published a paper in Environmental Toxicology & Chemistry (2004) on benthic assessment of impacts. Difficult to differentiate between TOC and contaminant effects. The study was based on mixtures.
    b. There was a report to the State Board on the comparison of the SF Bay and the Southern California benthic assessment methods. Fairly close agreement between the two methods (http://www.sfei.org/cmr/reports/432_bri_sfei.pdf).
    c. Participated in West Coast Estuary Benthic Analysis (EMAP) working with SCCWRP and other west coast agencies on how to set up benthic assessment methods using assemblages (meso or polyhaline).
    d. Participating on Science Team for development of Sediment Quality Objectives (SQO) where benthos is a key element in a weight-of-evidence approach with SCCWRP. Draft report anticipated by the end of summer.
    e. 2005 project goals
        i. Complete West Coast Estuary Benthic assemblage paper – looking at mixtures. Draft anticipated by the end of the year.
        ii. Data analysis of benthic indicators response to sediment chemistry for SQO draft report due by end of year.
        iii. Conduct demonstration assessment of SF Estuary using SQO methods. Sediment triad, fish tissue/sed relationships and human health demonstration by end of the year.
8. Plans for 2005 and Beyond: Fish (Bruce Thompson)
    a. The Science Advisory Panel has recommended that EEPS include a fish effects component. In November 2004, a fish work group was convened with participants from UC Davis and Bodega Marine Labs and a RFP was put out. In 2005, a draft proposal was submitted by Bob Spies and Katy Springman with participation from DFG to look at potential contaminant effects in surf perch.

i. Two-year pilot study at $50k/year. Look at complex contaminant mixtures that will hopefully lead to a population model. This is an exploratory study – more sampling sites would be better but funding is limited.
ii. Surf perch were chosen since this species has high concentrations of organics and there is some evidence of a decline in the population. This species also has high site fidelity.
iii. 1st year is a field study looking at reproductive success and fitness. Collect 40 to 60 fish from contaminated and less contaminated sites.
iv. 2nd year will expose 30 fish to mixtures of contaminants collected from RMP sampling sites through the deployment of Semi Permeable Membranes (SPMs).
v. There is value in developing the partnerships outlined in this proposal.
vi. Proposal anonymously reviewed (3 reviewers) – mostly positive comments.
vii. Discussion
    1. Bob Spies will probably step down from the EEPS Science Advisory Panel if the proposal is funded.
    2. Could postpone the collection of fish until the RMP 2006 status and trends collection.
    3. Could fish be donated from another study i.e. IEP?
    4. Surf perch give birth to live young – there can be spontaneous abortion upon capture. Need to find a window when fish are pregnant but do not abort.
    5. Concern that comparison is only between 1 'clean' and 1 contaminated site. There was a balance struck between number of samples/site and the number of sites.
    6. This pilot study could provide the basis for a CalFed funded study.
    7. Would also like to do bioenergetics/growth models for the project.
    8. Why isn't the proposal dealing with metals? There are high levels of Hg in small fish. Terry Adelsbach may be interested in analyzing samples for metals.
viii. Jay Davis questioned the panel if they wanted to move forward on the proposal? SFEI will give the panel the proposal and peer review comments for them to consider.

9. Plans for 2005 and Beyond: Birds (Letitia Grenier)
    a. Letitia Grenier presented a list of ideas for potential bird studies.
        i. Marsh birds of the Bay have not been analyzed for contaminants – this is a data gap.
        ii. EEPS could do a follow-up egg injection study. Steve Schwarzbach did some egg injection work with rails. The rails were from Georgia and there may have been a pre-existing Hg

burden. Rails were collected downstream from a Hg mine. USFWS is collecting scaup, avocets and stilt eggs for an injection study. EEPS could piggyback on this study.

iii. Intensive Rail population study. What are rails eating? Understand the pathways of contaminants into the food web. Diet of clapper's is not known – could do a stable isotope study.
    1. Very difficult to get permits to study rails. May be able to work with clappers through the Spartina project.
    2. Petaluma Hg project is looking at pathways of Hg contamination in the food web but is using black rails.
    3. Diet seems to vary in marshes maybe along a salinity gradient.
    4. Could also look at prey species for contamination levels. FWS collected clams, polycheates and crabs in 1997-1998 and analyzed for contaminants – could look at this data.
    5. Point Reyes Bird Observancy (PRBO) has funding to do a clapper rail population survey.
    6. Important to determine if clappers are sensitive to contamination – would involve blood and feather samples under a catch and release program.

iv. No information on Hg in salt marsh harvest mouse – mouse trapped for the Montezuma project. Don't know harvest mouse diet.

v. EB Regional Park District collects raccoons – they could be an interesting surrogate for high trophic level. This work has been done in the Everglades. Home range for local raccoon populations is large and they eat a lot of garbage – therefore may not be representative of marsh species at this trophic level.

vi. Analysis of historical specimens for Mercury. Could look at mercury load in historical specimens and how this has changed over time.

vii. Discussion
    1. Tern work seems to be going well – continue to build on that.
    2. Cormorant data needs to have follow-up to determine why levels are so high.
    3. Diving ducks are not resident – difficult to get eggs for possible effects work.
    4. It is important to repeat clapper rail egg injection study – this is a very important end point.
    5. It is easier to integrate the studies of non-endangered species vs. endangered into the RMP. Analysis of clapper rails doesn't seem like a good long-term study.

10. Plans for 2005 and Beyond: Benthos (Bruce Thompson)
    a. Need to identify what is causing the toxicity in the Bay. Can do TIEs. TIEs are not good at measuring toxicity of multiple contaminants – TIEs often fall apart for mixtures.
    b. Need to validate upcoming regulatory guidelines for SQOs.
    c. Need to investigate adding a benthic component back into the RMP Status and Trends – it was in 5 years ago – need to add back in.
    d. There is a lab sediment toxicity study for dose response for 3 pyrethroids using 2 amphipods (*E. estuaries and A. abdita*).
11. Plans for 2005 and Beyond: Toxicity (Sarah Lowe)
    a. Sarah Lowe provided a detailed handout on the status of toxicity studies in RMP and PRISM (included within).
    b. Multiple contaminant approach in toxicity should be considered in the program design.
    c. We know that there are pyrethroids in the sediments since they have a high K_{ow}.
    d. Toxicity and benthos components should work in parallel
12. Panel Feedback and Discussion (Steve Weisberg)
    a. Steve Weisberg spoke for the panel after having a discussion without SFEI staff.
        i. Four questions the panel came up with
            1. Where staff responsive to past recommendations made by the Panel? Staff developed a conceptual model but it was not discussed at this meeting.
            2. Is the fish effects proposal acceptable? Hard to evaluate because the panel was given the proposal the day of the meeting.
            3. How would the panel like to divide up the $200k for 2005? Panel would like more information to make this decision.
            4. When would the benthic component be added to the Status and Trends program of the RMP.
        ii. The panel did not have enough information to make decisions. They requested a 2nd meeting and gave suggestions on what information they would like presented. Each indicator should be presented with the following information:
            1. Discuss the conceptual model and how the indicators fit into the model.
            2. More information on results and how this guides the next step.
            3. How the indicator relates to other studies/partnerships.
            4. Clarify the different funding sources (e.g., RMP S&T vs. EEPS vs. PRISM).
            5. How the indicator work fits into the regulatory context – this should be the big driver for a lot of this work.
            6. How did the indicators get selected and who is doing the work?

7. When are data expected?
8. Develop a 1 to 2 page summary of 2002-2005 data. It is difficult to make recommendations without knowing what we have so far.

iii. The panel also recommended that we look more closely at USFWS study that Terry Adelsbach discussed to see if there are opportunities for collaboration.
iv. The panel will review the fish proposal and comments and communicate this by email.
v. A meeting was set for Monday June 13th and all materials will be sent out 1 week prior to the meeting.