RMP
Technical Review Committee
September 18th, 2012
San Francisco Estuary Institute
Meeting Summary

Attendees
Luisa Valiela, US EPA
Karen Taberski, San Francisco Regional Water Quality Control Board
Bridgette DeShields, Arcadis/WSPA
Eric Dunlavey, City of San Jose
Tom Hall, EOA, Inc. (South Bay Dischargers)
Rod Miller, San Francisco Public Utilities Commission
Ian Wren, San Francisco Baykeeper

Meg Sedlak, SFEI
Jay Davis, SFEI
David Senn, SFEI
Don Yee, SFEI
Ellen Willis-Norton, SFEI
Emily Novick, SFEI
Alicia Gilbreath, SFEI

1. Introduction and Approval of Agenda and Minutes [Meg Sedlak]
Meg Sedlak introduced the newest RMP hire, Ellen Willis-Norton, who recently graduated from Wellesley College with a double degree in Biology and Environmental Studies. Ellen will be an active member of the RMP team. Bridgette DeShields asked for approval of the June 29th TRC meeting minutes. Karen Taberski noted that on page 9 of the June 29th TRC minutes, under the Bioassays discussion that the minutes indicate that the bioassay pilot study will be 10% of the RMP budget, which is not correct. Pending this correction, Karen Taberski motioned to approve, Luisa Valiela seconded the motion, and the minutes were unanimously approved.

2. Information: Steering Committee Minutes [Meg Sedlak]
Meg Sedlak shared updates from August 6th Steering Committee (SC) meeting. The SC approved the special studies that the TRC approved. One exception was the follow up work for the 2013 Moderate Toxicity Workshop that will be held on November 16th, 2012. (There was no proposal for this work; the TRC approved the set aside of funds.) The SC did not approve this set aside for 2013. The SC committee also discussed the 2012 Annual Meeting and plans for integrating the 2013 RMP Annual Meeting with the State of the Estuary Meeting. Eric Dunleavy indicated that the SC meeting minutes from August 6th did not elucidate the Bioassay study discussion and the rationale for proceeding with this study. Meg noted that the TRC and SC both

had concerns with the research aspect of the study as well as how long it might take to develop a tool that could be used in the RMP. Although it might take a while, the SC was supportive of developing new tools to measure contaminant effects on biota. In addition, the SC acknowledged that the State Panel report recommended developing bioanalytical tools. Jay Davis mentioned that the SC chair Tom Mumley endorsed this study and that was a factor in the approval of the proposal.

3. Update: RMP Annual Meeting 2012 [Jay Davis]

The 2012 RMP Annual Meeting will focus on the workgroups starting with efforts to model the Bay (Nutrients and Contaminant Fate). Work on watershed modeling (Sources Pathways and Loading) will follow this discussion and then on to two talks on effects of contaminants on fish (Exposure and Effects). The meeting will end with two talks on Emerging Contaminants. After each block of presentations, there will be a facilitated discussion led by the moderator of the session. The interactive lunch activity needs to be decided.

Discussion

Karen Taberski noted that Bruce Herbold's presentation did not seem to fit into the Exposure & Effects Workgroup presentation block based on the title "Fish Habitats in Suisun Bay and What Degrades it." Jay Davis agreed and said that he needs to talk to Bruce about how he should talk about the effect of ammonia and other pollutants in fish populations as a fish biologist.

Action Items

1. Jay Davis will talk to Bruce Herbold about his annual meeting presentation to ensure it focuses on the effect of ammonia and other pollutants in fish populations.

4. Preview: Annual Meeting Presentations

"The Regional Watershed Spreadsheet Model: A Tool for Estimating Regional Loads" [Alicia Gilbreath]

Alicia's talk will follow several other talks on modeling work within the Bay, which will provide an introduction for the Regional Watershed Spreadsheet Model (RWSM). The RWSM is a team effort with oversight from the Small Tributaries Loading Strategy (STLS). Michelle Lent developed the hydrology work for the model and now the STLS group is applying her work to the whole RWSM. Alicia's presentation was organized by listing the top 10 reasons to be excited about the RWSM.

Summary of Alicia's Presentation:

- #10: The RWSM is a tool for estimating loads from small tributaries in urban areas. The model improves prior load estimates. TMDL studies have estimated some Hg and PCB concentrations based on small watersheds. The RWSM is advantageous because it provides load estimates on the regional scale.
- #9: The RWSM model is simple to understand. The inputs include watersheds, soil type, and land-use. For each of the parameters, a digital elevation model was used to obtain an average slope. A runoff coefficient is produced based on the soil type, land-use, and slope. The model then adds a precipitation layer; the area of each unit is determined and

then the units are multiplied together to obtain the total runoff volume. To determine contaminant load for the various land uses (e.g. industrial, open space, etc.), the mean concentration of the contaminant is plugged into the model which then calculates contaminant load. The model is complex because the runoff volume and consequently the contaminant load is calculated for a 9,000 km^2 area; the model is preforming computations on millions of intersected units.

- #8: A large amount of data has already been developed outside of SFEI: The PRISM dataset is available for precipitation values, the ABAG dataset is used for land-use, and the National Land Cover Dataset (NLCD) records imperviousness.
- #7: RWSM allows the creation of spatial data source layers that are correlated with particular contaminants (e.g. electrical transformers, military areas, drum recycling, cement production, crematoria, oil refineries/petrochemicals, metals manufacture, rail transport, shipping transport, metals recycling, auto recycling, old industrial areas, and power plants). For each new spatial data source, the project team wants to apply a specific concentration lookup table; therefore, input concentrations are needed.
- #6: SFEI and others have developed a solid base of stormwater concentration data, which allows concentration inputs for calibrating the model. The RMP has funded three multi-year intensive loading studies in the Sacramento-San Joaquin Rivers, the Guadalupe River, and the Zone 4 watershed. Additionally, several samples were collected at Coyote Creek and a reconnaissance study was completed in 17 watersheds. Finally, samples collected during the 2012-2013 pollutants of concern (POC) and low impact development (LID) work will be available for use in the model.
- #5: The model is a cost-effective approach for determining contaminant loads; monitoring cannot happen in every watershed. Although similar, more sophisticated models exist, we cannot apply those models at the scale the STLS team is interested in. Michelle Lent is working on creating a back calculation that inputs bottom-of-the-watershed concentration values and will output land-use-specific runoff concentrations.
- #4: The RWSM model will have a simple user interface. Jamie Kass (SFEI GIS specialist) is using Python to develop the user interface. The user interface is flexible, for example the lookup tables can change; anyone who considers themselves slightly above beginner level in GIS will be able to use the model.
- #3: "The RWSM has a plan." The model will be packaged and a user manual will be created for outside use.
- #2: The RWSM's plan is already being carried out; a module for hydrology, sediment, copper, mercury, etc. has been developed.
- #1: The RWSM complies with several Municipal Regional Permit (MRP) provisions which makes for happy BASMAA Representatives and Water Board Regulators.

Discussion

Karen Taberski thought the explanation of the model was very clear, but wondered if the RWSM was going to include SWAMP's concentration data. Karen thinks using SWAMP's data may be useful for validating concentrations. Alicia Gilbreath responded that she will look into using the SWAMP data. Bridgette DeShields wondered if land use or percent imperviousness was used in the model because both we're mentioned in the presentation. Alicia agreed that mentioning both

was confusing and that she will take out percent imperviousness from the presentation. Michelle Lent determined that land use performed better than the impervious surface approach in model calibration; however, percent imperviousness may be used for a sub-model architecture (it may be an important explanatory variable for a specific contaminant). Bridgette mentioned sensitivity analyses and Alicia made clear that sensitivity analyses will be run to determine which variable is having the largest influence on the total runoff volume and contaminant load. Ian Wren wondered how the mean concentration values were obtained (e.g., literature values or empirically derived). Alicia responded that the RWSM is mainly using local data to define input concentrations and to calibrate the model, but some data is being pulled from the literature to constrain the concentration bounds and to fill in data gaps. Rod Miller suggested that one of the contaminant models (e.g., PCBs) should be used as an example and expanded to show the real data, data source, etc. Tom Hall thought that the last slide about MRP compliance should be moved earlier in the presentation as well. The connection to the MRP will make clear the target audience/user before the model's details are described. Ian asked how the model would be packaged, he wondered if the model would be an ESRI add-on. Alicia was not sure how the model will be packaged, but is hopeful that it will be separate of ESRI. However, the model will need ArcGIS to run.

Eric Dunlavey and Luisa Valiela then suggested ways to reduce the presentation's length. Eric warned that there might be some questions on how Alicia narrowed down 150 land uses to seven land uses during the discussion period. Luisa added that the audience would most likely question why the model doesn't include San Francisco and Coastal Marin; Alicia may want to explain the absences during the presentation. Luisa suggested explaining the data sources for the lookup table and explaining how many contaminants will have a unique lookup table.

Contaminants of Emerging Concern: Synthesis and Strategy" [Meg Sedlak]

The main goal of Meg Sedlak's presentation is to show the contaminants the ECWG has detected in the Bay and the process by which contaminants are prioritized.

Summary of Meg's Presentation

There are 100,000 chemicals in use today; the Clean Water Act requires 126 of those to be monitored, and the RMP is currently evaluates 107. The RMP has developed a risk-based approach to prioritizing Chemicals of Emerging Concern (CECs). The approach includes: occurrence, usage/volume; toxicity; and determining the chemical's fate (bioavailability and persistence); and obtaining RMP workgroups, TRC, and SC advice and opinions. This work is somewhat challenged by lack of information (e.g., chronic toxicity data for organisms of interest, fate of a chemical in the environment) and lack of methods to analyze compounds. Howard and Muir (2009) used a similar risk-based approach to prioritize emerging contaminates. They evaluated 22,000 high production chemicals to determine which chemicals were likely to be persistent in the environment. Based on this assessment, they developed a priority monitoring list of 610 chemicals. The RMP has monitored pharmaceuticals and personal care products, alkylphenols, flame retardants, perfluorinated chemicals, current use pesticides, and chlorinated paraffins. The State Board put together a national panel of scientists to make recommendations for monitoring CECs. The RMP is monitoring most of the CECs listed. The RMP recently put

together a synthesis document that prioritizes CEC's on a tiered system based on their level of concern. Currently there are no chemicals that are Tier IV, chemicals of high concern.

Meg selected chemicals from each Tier I, II, and III to explain in more detail to illustrate how chemicals are classified in the tiered system. The chemicals she described in the presentation include:

- PFOS (Tier III)
- PBDEs (Tier III)
- Fipronil (Tier II)
- Pyrethroids (Tier I for the Bay)

Tier III (Moderate Concern)
PFOS are used commercially and residentially as a stain repellent, pesticide, and for metal finishing. They are carcinogenic, developmentally toxic, immunotoxic, and are an endocrine disruptor. PFOS were phased out in 2002 when they were detected in the American blood supply, but the prior high production resulted in a large environmental reservoir. Additionally, there are a number of precursors still used that can degrade to the perfluorinated compounds. In South Bay, high concentrations of PFOS were found in seals and cormorant eggs, above the predicted no effects concentration. PFOS at the Richmond Bridge sample site were not as high, but were considerably higher than in Tomales Bay, the reference site. PFOS remain a contaminant of moderate concern (Tier III) because they were detected in apex predators, at concentrations above a threshold value at one location; there is no sign of declining concentrations in bird eggs; precursors continued to be use; and there is potentially a large environmental reservoir. To continue PFOS monitoring in the Bay, the RMP is sampling seals in South Bay and correlating concentrations with small fish (that seals eat), sediment, and water samples.

PBDEs are slowly being phased out with penta and octa phased out in 2006 and a voluntary phase-out of all PBDEs in December 2013. PBDEs are endocrine disruptors that impair the nervous system and the RMP has been monitoring PBDEs since 2002. Since monitoring began, the RMP has seen a dramatic decline in PBDE concentrations in cormorant eggs, bivalves, and sportfish. The advisory concentration level for sportfish consumption is 100 ppb, and concentrations in sportfish are currently around 15 ppb. Some of the highest detected concentrations of PBDE in tern eggs were detected in Bay terns; however, in 2009, samples were well below the 63 ppm that was previously detected and substantially below 20,000 ng/g effects threshold.

Tier II (Unknown Concern)
Fipronil is an urban pest control and is used in consumer products such as Frontline. The RMP monitored fipronil levels in sediment in 2010 and 2011 and found that concentrations were not far below the LC-50 (150 ng/g org C). Fipronil concentrations in water were not analyzed; therefore, back calculations were performed to estimate pore water concentrations. Fipronil is listed as Tier II because the sediment concentrations are close to the LC-50 threshold and the concentration in water is unknown. Additionally, Gan et al. 2012 found evidence of fipronil toxicity in runoff from urban areas in Sacramento and Orange County.

Tier I (Minimal Concern for the Bay)
Pyrethroid usage has surged with the phase out of the organophosphate pesticides in the mid-1990s however, there have only been sporadic detections of one pyrethroid, the least toxic pyrethroid, permethrin. In stormwater, 14 pyrethroids have been detected and monitoring in six bay area sites will continue in 2012-2013. Pyrethroids continue to be of concern in Bay tributaries.

New techniques for identifying CECs are being developed. NIST is using gas chromatography and mass spectrometry to identify chemicals. NIST has incorporated the 610 chemicals identified by Howard and Muir into the library of chemicals used to identify CECs. Using this technique, approximately 35 new chemicals have been identified in Bay biota. Bioanalytical tools are also being used to detect CECs, which integrates the EEWG and ECWG workgroups. Bioassays link cellular effects to organism effects. Bioassays may allow the RMP to analyze estrogenic compounds and PPCP chemicals that the state panel recommended. Next steps for evaluating CECs would be to evaluate the CECs that are in the higher tiers, review the state's CEC advisory panel recommendations, and identify new CECs with the techniques described in the presentation.

Discussion:
Karen Taberski was surprised by the placement of pyrethroids, she thought they would have a higher ranking. She wonders how much feedback SFEI has received regarding their tiered CEC classification system. Meg Sedlak has received feedback from the ECWG and SC regarding the tiered approach. Additionally, a synthesis document explaining tiers is currently out for the workgroup's review. According to Tom Mumley, pyrethroids are not a concern for the Bay, although they may be a concern for the watersheds. Meg will clarify in her presentation that she is only referencing pyrethroid concentrations in the Bay. Luisa Valiela noted that on the risk chart, there are no CECs that are of "High Concern." She wonders what it takes to be Tier IV if there are no CECs that are currently reaching this ranking. Meg responded that concentration risk and management priorities are driving the tier levels. Jay Davis argues that the lack of Tier IV CEC's is a success story. Eric Dunlavey wanted a longer explanation about the tier system; Karen suggested presenting four or five criteria that would place a CEC in each tier. Tom Hall wanted Meg to explain how a chemical could move up or down on the ranking system, maybe by showing a CEC's historical concentrations and comparing it to current concentrations, which reduced its tier level. Meg liked Tom's suggestion and during the presentation she will explain rankings are subject to change as new information is acquired, using PBDEs as an example. However, Jay Davis noted that PBDEs would have been in Tier II, not Tier IV, because thresholds were not available. The success story would be that thresholds were acquired and PBDEs moved from unknown concern to moderate concern. Karen Taberski stated that discussing a switch from Tier II into another tier highlights the need for developing thresholds. Meg agreed and noted that one of the challenges is the lack of toxicity data. Luisa wondered why there were generally higher concentrations of PFOS in South Bay. Meg responded that she does not know the reason, but theorizes it could be less dilution in South Bay (most RMP contaminants are higher in the South Bay) or a particular source in the South Bay. Ian Wren was confused about why CECs of unknown concern were above CECs of minimal concern. The figure makes it seem as though Tier II CECs would be downgraded to Tier I, which not always

true. Ian suggested removing "unknown concern" from the hierarchical chart and placing it off to the side.

Action Items

1. Meg Sedlak and Alicia Gilbreath will revise their presentations and send the new version to Chris Sommers by September 24th.

5. Update: Pulse 2012 and 2013 [Jay Davis]

The Pulse Lite is going to the printer tomorrow. Comments and edits were received from both SC and TRC members. Jay Davis enjoyed having a shorter Pulse this year, he now feels refreshed and ready to start on the next Pulse of the Estuary. This coming year the RMP Annual Meeting will be integrated with the State of the Estuary Meeting so the Pulse has to be out on time. Therefore, Jay wants to start writing articles a quarter earlier than normal. Jay passed out a preliminary Pulse outline for 2013. The focus of the 2013 Pulse will be Contaminants of Emerging Concern. Below is a description of the articles that Jay is planning on featuring in the 2013 Pulse.

The articles will be divided into a management and a science section. In the management section Jay would like to have an article on the Water Board's management of CECs since Tom Mumley has mentioned that the Board is developing a policy statement on CECs. The second article will feature Green Chemistry because it can be linked with managing water quality in the Bay. SFEI is in the process of developing a green chemistry strategic plan, and it is one of the institute's top priorities. Chris Werme can serve as an author on these articles, as well as Debbie Raphael and Meg Sedlak.

The tiered framework for identifying CECs of concern will serve as the science section's theme/unifying principle. The first article will feature highlights from the RMP CEC synthesis with a sidebar on the strategy for ranking CECs (the synthesis figure illustrating the tiered structure). Other sidebars for the article will focus on specific pollutants that fit within the tiered framework (nonylphenol, PBDEs, and brominated dioxins). The second article will be a review of the National Mussel Watch CEC Study, which Keith Maruya will present at the annual meeting. Jay predicts that SCCWRP will be able to take a lead role in writing this article. The sidebars will include: 1) an explanation of the pro bono AXYS Bivalve Study 2) a statewide north to south comparison 3) and an examination of PAHs in NOAA mussels after the oil spill. The final two articles in the science section will be on PFOS in San Francisco Bay written by Meg Sedlak and an article on Broadscan Screening for CECs.

The "Latest Monitoring Results" section will include mercury and nutrient data. Although nutrients are not a CEC, they will be featured in many reports and publications as the RMP moves forward. Therefore, nutrients will be included in the 2013 Pulse.

Discussion

Bridgette DeShields suggested including a fipronil sidebar and Rod Miller thought pharmaceuticals should also be a sidebar. Jay agreed with both ideas, especially pharmaceuticals because they generate public interest even if they are not of high concern. Similarly, Luisa Valiela wondered if pyrethroids were not included because they are a watershed rather than a

Bay issue. Jay confirmed that they were not included for that reason, but that they could still be featured in a small sidebar. Luisa also mentioned that Chris Werme is writing a lot of articles and wondered if Susan Klosterhaus could help write some articles even though she has left SFEI. Luisa reasoned that Susan may be interested because she can provide an NGO's perspective to the Pulse.

Action Items

1. Jay Davis will run the idea of an article about Water Board management of CECs past Tom Mumley and Naomi Feger.

6. Information: Annual Meeting 2013 [Meg Sedlak]

In 2013, the RMP Annual Meeting will be integrated with the SFEP's State of the Estuary meeting. The date for the meeting is not set yet, but it will most likely occur in late October. Meg Sedlak is working with the SFEP to make sure the dates will work for the RMP. Meg noted that combining the meetings will result in attendees not having to travel twice to the region for conferences that are within three weeks of each other. The RMP will be one of three concurrent sessions at the State of the Estuary meeting, which will increase the RMP's exposure. The meeting's advisory committee is stellar. Financially, hosting the meeting in conjunction with State of the Estuary is almost equivalent to hosting the RMP Annual Meeting. The meeting will be hosted at the Oakland Marriott, which is more expensive than the David Brower Center.

Jay Davis mentioned that he is in the process of preparing an insert for the State of the Estuary report. The insert is on flame retardants and was written by Chris Werme. Jay is planning on internally reviewing the article this week and then sending the article to TRC members to edit and review by next week.

7. Modeling Strategy Update [Don Yee, Jay Davis, and Dave Senn]

Don Yee, Jay Davis, and Dave Senn presented an update on the "Conceptual Model of Contaminant Fate on the Margins of San Francisco Bay" and the "Conceptual Foundations for Modeling Bioaccumulation in San Francisco Bay" reports. During the presentation, Don provided an explanation for the rationale for creating the contaminant fate on the margins model; Jay described how a model can link contamination sources to bioaccumulation in species of interest; and Dave described the plan and timeline for developing a flexible contaminant and nutrients model.

Conceptual Model of Contaminant Fate on the Margins of San Francisco Bay [Don Yee]

After work on a numerical modeling of the Bay began, the CFWG decided that the needs and output of the model has not been sufficiently addressed. Work on the initial numerical model was suspended while the workgroup began refocusing on what the model needed to accomplish. The margins conceptual model originated from the workgroup discussions. Don began by providing a summary of conceptual models' needs. He began by stating that all models have shared elements: hydrodynamics, sediment load and transport, contaminant loads and ambient process, and bio-uptake. The timescale focus can vary between models; persistent organic pollutants have a decadal focus, biotransformed pollutants can have a decadal and seasonal focus, and shorter lived pollutants (nutrients) typically have a seasonal or even shorter focus. Spatially, models can be built to focus on the whole Bay, to concentrate on one segment of the Bay, or they can be

built on a site specific scale. System elements that should be built into a model include: hydrodynamics, sediment transport, chemical fate (incorporating loads, partitioning and transport, and degradation/transformation), and bioaccumulation. In the San Francisco Bay, the system characteristics that the model needs to capture are: 1) hydrodynamics including north versus south flows and differences between the wet and dry season; 2) sediment characteristics, such as loads history, predicted changes in sediment budget, spatial differences in sediment quality, and residence time; 3) chemical fate, which includes historic responses to treatment and bans, patchiness and persistence of contamination despite management bans, and knowledge of a uniform dispersion in the deeper Bay; and 4) bioaccumulation including the lack of a trend in POP concentrations for regionally mobile species and the awareness that there are patchy, high concentrations in margin species.

Before work on the margins conceptual model can begin, RMP staff need to understand managers' priorities in order to focus the model. Once the priorities are known, certain characteristics would be modeled in more detail. Don made clear that they will not produce one model, but will use one platform with different implementations. The model will need to be flexible so various contaminants can be examined on different scales. Previously, SUNTANS was used to build the model, but it is not a widely-used open source model. The authors are considering using EFDC or Delft3D (used by USGS for sediment fate) because they are both open source and widely-used. Finally, Don noted that upkeep on the model takes as much time as writing the code.

Conceptual Foundations for Modeling Bioaccumulation in San Francisco Bay [Jay Davis]
Jay Davis then focused on modeling bioaccumulation in San Francisco Bay. He described the contents of the August 2012 technical report "Conceptual Foundations for Modeling Bioaccumulation in San Francisco Bay" to the committee. Currently there is a mechanistic model for PCBs and OC pesticides at the Bay scale, but the margins need to be modeled on a finer scale. The contaminant sources need to be linked to accumulation in the food web, which can be done if the Bay's margins are modeled at a fine scale. Additionally, other pollutants besides PCBs and OC pesticides need to be modeled. The model should be able to forecast conditions under different management scenarios, allowing for adaptive management.

Jay then summarized the contents of the technical report. The first section highlights the objectives of the report, which are to summarize current data and knowledge, identify future monitoring and modeling priorities, and most importantly supporting the development of bioaccumulation models. The second section identifies pollutants of greatest concern and describes how they enter and move through the food web. The third section designates key indicator species to characterize categories of species and habitat types.. For example, a striped bass is a predator that is regionally mobile. Therefore, the fish is integrating the entire system and is representing conditions in the entire Bay. On the other hand, shiner surfperch are not high on the food web (they mainly eat invertebrates), and tend to have high site fidelity. Therefore the shiner surfperch are good indicators of site -specific contamination. Similarly, Forster's Terns forage in salt ponds, so they indicate contamination in the salt ponds. The site-specific biological indicators are where management action is most likely to occur. Section four reviews key concepts that affect bioaccumulation including: spatial distribution of contaminates, management action, seasonal variation, long-term trends, habitat types, and spatial scale and movement.

Methods of contaminants uptake and elimination, primarily dietary uptake, are also described in the report.

Jay then provided examples of how each indicator species can verify contaminant hotspots. The shiner surfperch reflect contamination occurring at the margins of the Bay. For shiner surfperch, there are two places on the California coast where PCB levels in the fish were above the no consumption limit: San Francisco Bay and San Diego Bay. Shiner surfperch in San Pablo Bay have low concentrations compared to the rest of the Bay, but in comparison to all of California, PCB levels are relatively high. In general, PCBs in small fish are reaching concentrations that are comparable to concentrations found in sport fish. Jay noted that this atypical relationship is because the small fish are in the contaminated margins; sediment contamination is also higher in the margin areas. High PCB concentrations in the margins are causing persistence in the rest of the Bay. There is a strong correlation between PCB sediment concentrations and concentrations in Topsmelt and Mississippi Silverside; indicating that once a source for sediment contamination is discovered, modeling can be used to determine how contaminants are entering the food web. Unlike PCBs, methylmercury in small fish varies at a local and regional scale and contamination is not clearly associated with sediment, making MeHg modeling difficult. But, there is isotopic evidence that MeHg contamination is coming from the sediment.

Section five of the report is a summary of the data and recommendations for moving forward. Jay suggests that the first step is developing a comprehensive plan for linking bioaccumulation in species of interest with abiotic modeling (water and sediment). While developing the plan it is important to consider the management decisions that could be made based on model outcomes. Jay noted that existing models for PCBs and pesticides could be adapted to incorporate bioaccumulation. However, more empirical work needs to be conducted before modeling begins, it is important to know about the area that will be part of the model. Additionally, empirical correlations can help determine what to model. The relationship between PCBs in sediment and small fish made clear that modeling PCB bioaccumulation would most likely be more successful than modeling MeHg.

Modeling Plan [Dave Senn]

Dave Senn gave a detailed schedule for creating a conceptual model of contaminant fate on the margins. In June/August, the RMP agreed to move forward on a modeling approach that will be used for multiple issues: 1) contaminants; 2) nutrients, phytoplankton, and biogeochemistry; 3) sediments; and 4) possible sea-level rise. The CFWG modeling team wants to move forward on using Delft 3D. The schedule is to develop a detailed modeling plan in 2012 after identifying key management questions. Then, in 2013-2014 develop or adopt a robust, 3D hydrodynamic model. A simple nutrient/phytoplankton model can be built on the 3D hydrodynamic model using grid aggregation (reducing spatial and temporal complexity). A simple contaminant model can also be added on to the 3D hydrodynamic model. The simple model will make the model feasible to run. Once the team is able to focus in on data and variables that are needed, a more complex model can be created for nutrients and contaminants. It is important to note that the simple nutrient model may only include Suisun and South Bay at first.

The schedule for 2012 includes assembling a modeling plan technical team in September. Jim Fitzpatrick is willing to serve as a team member and Dave has also extended invitations to Frank

Gobas, Dave Schoellhamer, Ed Gross, and Mark Stacey. In October, a draft outline for the report will be written for the technical team and managers to provide input. Finally, the CFWG and NWG will come together to produce a final report in November.

The management questions that will drive the creation of the nutrient and contaminant model are below:

Nutrients

1. Which nutrient sources, pathways, and transformation processes contribute most to concern?
2. What nutrient loads can the Bay assimilate (without impairment of beneficial uses)?
3. What future impairment is predicted for nutrients in the Bay?

Contaminants

1. What patterns of biota exposure to contaminants of concern are forecast for major segments of the Bay under various management scenarios?
2. What is the contribution of contaminated Bay margins to Bay impairment?
3. What are the projected impacts of Bay margin management actions to Bay recovery?

Discussion

Luisa Valiela wonders if the model is able to isolate sections of the Bay since we already know areas of the Bay where nutrients are a concern. Dave responded that the model would be able to segment the Bay during the grid aggregation step. He noted that Suisun and South Bay cannot be modeled as one well-mixed cell; the average depth is different from the photic depth. The depths will need to be modeled separately, a shallow box and a deeper box (accounting for light limitation). The modeling team will need to know how transport occurs between the two boxes. Tom Hall added that Jim Cloern from USGS is developing a two box model for South Bay. Dave said that the modeling team applied for BACWA funding to create the two box model; BACWA earmarked the funding until a clear road map for modeling nutrients was developed. Once the BACWA funding is made available, it will be merged with the RMP funding to develop the underlying 3D hydrodynamic model and biogeochemistry model. Around $100,000 is currently allocated for completing the models. Tom wondered if modeling nutrients for both Suisun and South Bay should occur at the same time. Dave thought that the team should focus on one of the two Bays initially, Suisun preferably, even though the model architecture should be the same for the two models. Eric Dunlavey asked if the modeling will be completed in-house or if it would be contracted out. Dave plans on hiring a hydrodynamic and water quality consultant to build the model and then the technical team will run simulations. However, Dave noted that there is interest in building the Regional Water Board or SFEI's capacity for building models in-house. Eric questioned whether the model would be flexible enough to include nutrients and contaminants. He was skeptical if the model could run for both because nutrients are unique (e.g. light attenuation is specific to nutrients). Don noted that the model can be tweaked to look at long term sediment accumulation or suspended sediment concentration (SSC); nutrients will be "tweaked" to look at SSC (i.e. light attenuation). Don also wondered if the model needed a vertical dimension for nutrients, then when the model is used for contaminant loads the depth can be averaged. Jay added that all management questions will be put on the table and a model will be built that addresses as many questions as possible.

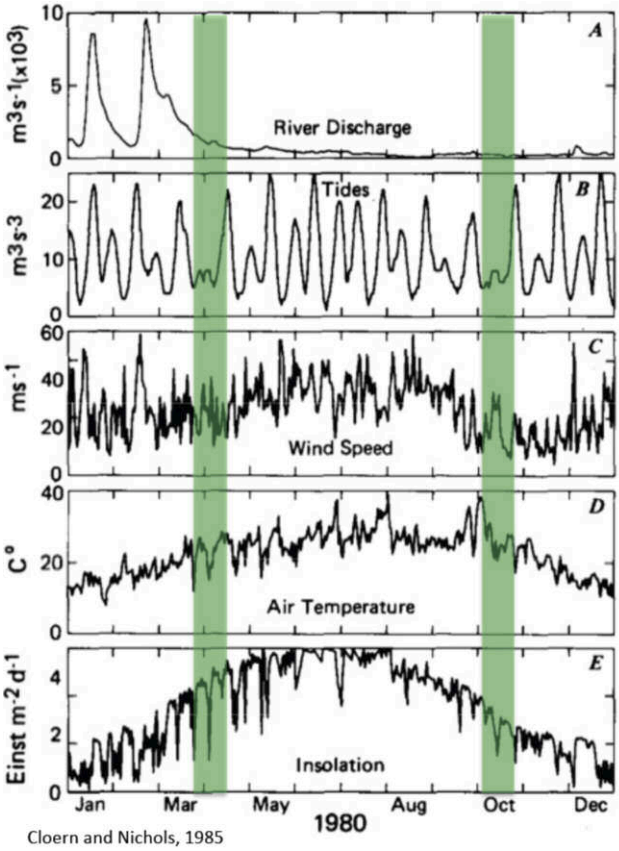
8. Nutrient Strategy Update [Dave Senn]
Dave presented an update on the two RMP funded nutrients projects: 1) the nutrients conceptual model and 2) the nutrient loading study.

Nutrient Conceptual Model Update
The conceptual model helps determine what a nutrient problem would look like in the Bay based on environmental and/or management changes. The process of developing the conceptual model is 1) defining the problem statement and 2) identifying what changes would bring about the problem. The conceptual model will inform regulatory decisions and lead to management actions.

In May, the main modules of the conceptual model were agreed upon, sketches of a conceptual model for some of the modules were completed, themes for the problem statement and future scenarios were discussed, and data gaps and priorities were identified. The main modules for the conceptual model are as follows: 1) phytoplankton biomass 2) phytoplankton community composition (including HABs and algal toxins included) 3) dissolved oxygen 4) nitrogen, phosphorous, and silica and 5) physics. On September 14th, the team discussed what product would be most informative to managers and stakeholders and subsequently began refining the conceptual model. It is envisioned that the report will be a 15-20 page summary document with detailed appendices.

Dave then described what drives phytoplankton blooms in the Bay system. The main drivers include calm winds, high temperatures, maximum light attenuation, stratification (river discharge), the biannual low point in tidal energy mixing, and low clam abundance. Additionally,

if ammonium levels drop below a certain level a phytoplankton bloom is likely to occur.



Green lines indicate optimal conditions for a phytoplankton bloom.

It is key that we understand how the above drivers will change in the future. For example, the 2004 red tide bloom was because of high temperatures, the bloom followed the three warmest days on record that occurred during a weak tidal mixing cycle. Dave suggested that there could be multiple phytoplankton community compositions in different areas of the Bays that overlap with each other. The width of each community would vary as a function of different drivers (e.g. flow rate from the delta). Natural and anthropogenic factors could impact community composition (e.g. after a *Corbula* invasion total biomass was lower and the smaller phytoplankton became dominant).

The conceptual model draft was supposed to be completed by September, but an internal draft will most likely be ready in October. The final document will be ready by December and external review will occur in 2013.

Discussion

The TRC agreed that the report should be short, that is 30 pages (the committee agreed the report could be 15 pages longer than Dave proposed) rather than long, 150 pages. Tom Hall noted that there will be different drivers for different portions of the Bay. Dave agreed and said that an overarching conceptual model will be produced with the various drivers differing spatially. The report will most likely include different diagrams for each portion of the Bay to show how the main drivers vary. Luisa Valiela stated that the manager's will want to know how each region

specifically will be impacted; therefore it will be important to include how the drivers change in different sections of the Bay. Tom wondered if there will be interim projects or will the next document be the overall draft report. Dave responded that the next deliverable was the overall draft, but that there will be discussions and updates before the draft is released.

Nutrient Loading Study Update
The goal of the nutrient loading study is to quantify nutrient loads to the Bay, to determine how the loads vary spatially and seasonally, and to identify sources and major data gaps. A draft report for the study will be available in 2013. Sources include stormwater runoff, POTWs, GG, and internal loads. Emily Novick has been working on the nutrient loading study in Suisun Bay and the study will eventually focus on other locations in the Bay. Emily and Dave have looked at ammonium and nitrate loads from POTWs in Susiun Bay. Central Conta Costa Sanitary District collects ammonium data daily and Delta Diablo Sanitation District collects data on a monthly basis. Fairfield Suisun has collected nitrate data since 2003. The sanitation districts' data show that from 1990-2010 there has been a 25 percent increase in loads. During certain months there has been a 2-fold increase in ammonium concentrations.

Stormwater ammonium and nitrate loads were determined by examining land-use in Suisun Bay and then calculating weight average runoff coefficient based on rainfall patterns. During high flows, the ammonium load is about 400 kg/d and the nitrate load is about 1,500 kg/d. It is important to note that uncertainty estimates have not been performed as of yet. The study also began quantifying loads arriving at the Delta by combining IEP station data with daily flow estimates from 1975 through the present. They found that the Delta removes approximately 60 percent of ammonium loads prior to efflux to Suisun Bay; the delta ecosystem is assimilating N and converting it. There is a clear seasonality for N loads in Suisun Bay; ammonium loads in Suisun Bay varied by a factor of five. Due to the seasonality of Delta N loads, POTWs contribute a significant amount of ammonium and nitrate loads during fall, when Delta loads are low. Overall, stormwater loads are not an important N source to detail, but sediment loads appear to be higher than stormwater loads and may be an important source to study further. When creating management priorities for nutrients, it is important to realize that ammonium regulation is different than Dissolved Inorganic Nitrogen (DIN) regulation; DIN needs to be considered if regulation on ammonium moves forward. Next steps for the study include refining load estimate for Suisun and applying the same quantitation approach for other subembayments. The draft should be prepared by February 2013.

9. Mussel CEC Pilot Study [Jay Davis]
Jay Davis gave an update on NOAA on how the National Mussel Watch special study on CECs. In 2010, all of the funding for the National Mussel Watch study was directed to a special study of CECs in mussel in the State of California. The National Mussel Watch program has historic data from 1986 and they have been monitoring 71 sites along the coast.

Jay Davis presented some of the Mussel Watch's historic data, including DDT, PCB, and PAH concentrations. DDT samples from 2007-2009 revealed that the Emeryville had one of the highest DDT concentrations in the state. In general, the Bay has experienced declining DDT concentrations; but, concentrations in Emeryville have remained consistent since 1985. Similarly, Emeryville has relatively high PCB concentrations. PCBs had either declined or no

trend had been observed at most stations; significant decreases in PCBs were observed at San Mateo Bridge and at Palos Verdes Royal Palms State Park. Jay pointed out that PAH concentrations were interesting because of the 2008 Costco Buson oil spill. There was a large spike in PAH concentrations at the Yerba Buena sampling site after the oil spill. The Emeryville site also high PAH concentrations. Unlike DDT and PCBs, there were more sites with increases in PAH concentrations than decreases, 21 out of 35 sites showed upward trends (even though only five sites were statistically significant).

The Mussel Watch Pilot Study is designed to inform future monitoring efforts on what CECs should be targeted. All of NOAAs analytical resources were designated toward the Mussel Watch study, with a focus on CECs to make the National Mussel Watch more relevant. The Mussel Watch Pilot Study's collaborators include NOAA, SCCWRP, SWRCB, SFEI, and USGS. Candidate contaminant classes include: pharmaceuticals and personal care products (PPCPs), industrial and commercial CECs, current use pesticides, legacy organohalogens and butyltins, and PAHs. Additionally, a variety of land uses and sources were included in the study. When comparing both CECs and legacy pollutants, PAHs had the highest concentration, followed by OC pesticides; some PPCPs also had relatively high concentrations. However, concentrations are not particularly informative because of the pollutants differing toxicity. Most pollutants were associated with urban land use (e.g. alkylphenols), except for pesticides which were associated with agricultural areas. PPCPs concentrations are uniform across land use categories because they are also used in farm animals. When examining CECs by discharge category, alkylphenols and PBDEs are associated with stormwater discharge. Similar to land use, PPCP concentrations are uniform across discharge categories.

Jay then examined data from a pollutant of interest within each contaminant class. He noted that nonylphenols (4-nonylphenol was analyzed) are not especially high in the Bay area. BDE-47 (within the PBDE class) concentrations in the Bay were highest at Emeryville, followed by Yerba Buena, San Mateo, and Dumbarton bridge. San Francisco had the highest concentration of Sertaline (a PPCP commonly known as Zoloft) in the state, although concentrations were still near detection limits. Emeryville had the highest Diphenhydramine (another PPCP) concentrations in the state; San Mateo and Dumbarton Bridge also possessed some of the highest concentrations in the state. 4'4-DDE, an OC pesticide, had high concentrations in 1998, but concentrations are lower today. Only the Monterey Bay Salinas River 4'4-DDE concentrations remain elevated, most likely because of legacy organic pesticide pollution. The PAH Fluoranthene had exceedingly high concentrations at the Yerba Buena site compared to the rest of the state because of the 2008 oil spill. Finally, for PCB-153/152 a disconnect was observed between bivalves and sportfish/smallfish. Unlike concentrations seen in Bay fish, bivalves do not show high PCB concentrations.

Jay concluded by noting that PBDEs, alkylphenols (APs) and PPCPs were the most frequently detected CECs. Additionally, urban land use stations generally had higher concentrations for many CECs, except for current use pesticides. CECs had the highest concentrations at stations influenced by storm water discharges, which reinforces the need to monitor selected CECs (especially in heavily urbanized regions). The results of the mussel watch study is being published in the Marine Pollution Bulletin. The results will also be featured during a SETAC session.

Discussion
Luisa Valiela wanted to know why the Mussel Watch Study might not have funding in the future. Jay Davis responded that monitoring legacy pollutants now has a very low return, in regards to management decisions; however, Jay thinks that monitoring CECs through the Mussel Watch program is still interesting. Luisa also wanted to know how the data is informing management decisions (i.e. why is there no management action in Emeryville). Jay responded that the project leaders may not be connecting with managers effectively.

Action Items
1. Jay Davis will give the TRC a copy of the marine pollution bulletin that features the Mussel Watch CEC Pilot Study.
2. Meg Sedlak will send out information on the CEC session at SETAC.

10. Information: Delta RMP [Thomas Jabusch]
Thomas Jabusch was not at the TRC meeting. Meg Sedlak said that a steering committee for the Delta RMP is being assembled and includes POTW, stormwater, agricultural water quality, and state and federal agency representatives.

11. Information/Discussion: Workgroup Deliverables and Workgroup Updates [Meg Sedlak]

Workgroup Updates
The SPLWG is in the process of getting ready for the 2012-2013 wet weather season. The SPLWG is sampling at six sites, the RMP is in charge of two of those sites (Sunnyvale and North Richmond). Under the workgroups activities document, Meg Sedlak incorporated an "Items of Interest" section that compiles things that are related to the Bay, but are not directly RMP related. If TRC members want to add anything to the section let Meg know. Meg presented the Organization and Structure of the RMP at the California monitoring council meeting in August. She said it was gratifying that many people said the RMP serves as an example for how monitoring programs can be effectively run. Attendees were especially enthusiastic about the RMP's data visualization techniques. Robin Grossinger is working with the Oakland Museum to develop a Bay Exhibit that is timed with the opening of the Bay Bridge. Meg Sedlak and Jay Davis are providing technical content. Thomas Jabusch is currently on the agenda for the December meeting to keep the TRC updated with the Delta RMP project.

Discussion
Karen Taberski attended a State Board Bay Delta meeting that discussed how to coordinate monitoring programs in the Bay (e.g. increased coordination between the IEP and RMP). Meg Sedlak and Jay Davis said they were willing to be involved with increasing cooperation and thought Thomas Jabusch would be great liaison.

After discussing the PCB conceptual model, Rod Miller noted that the RMP data has blank contamination that should be resolved.

Action Items

1. Meg Sedlak will send the TRC the 2012 Estuary Insert for Review.

12. Action: Set Agenda and Date for Next Meeting, Plus/Delta [Meg Sedlak]
The next meeting will be on December 4th. Bridgette DeShields liked being able to preview the annual meeting presentations during this meeting and Eric Dunlavey enjoyed having the agenda package posted online.