RMP Microplastics Workgroup Conference Call
March 7, 2017
San Francisco Estuary Institute

Final Meeting Summary

Attendees

There were approximately 45 people on conference call including the following:

Name	Affiliation/Roles
Chelsea Rochman	University of Toronto
Sam Mason	SUNY- Fredonia
Anna-Marie Cook	USEPA
Harry Allen	USEPA
Nirmela Arsem	EBMUD
Carolynn Box	5 Gyres
Mike Connor	EBDA
Marcus Ericsen	5 Gyres
Mary Lou Esparza	Central Contra Costa Sanitary District
Manon Fisher	SFPUC
Lorien Fono	BACWA
Reinhard Hohlwein	CalRecycle
Betty Kwan	Bay Planning Coalition
Sherry Lippiatt	NOAA Marine Debris Program
Rachel Merzel	University of Michigan
Karin North	City of Palo Alto
Bill Robertson	USEPA
Chris Sommers	BASMAA
Mark B.	State Water Board
Luisa Valiela	USEPA Region 9

Julie Weiss	City of Palo Alto
Jim Wong	CCSD
Jay Davis	SFEI
Rusty Holleman	SFEI
Diana Lin	SFEI
Meg Sedlak	SFEI
Rebecca Sutton	SFEI

1. Introductions and Meeting Goals

Meg Sedlak outlined the goals of today's meeting were to get feedback on the Microplastic Sampling and Analysis Plan (SAP) and a decision on whether to recommend the microplastic bivalves monitoring proposal to the RMP Technical Review Committee. Meg Sedlak said even though the Moore Microplastic project seems like a large grant (e.g., close to $1 million), the scope of the project is quite large and as such it will require the team to be strategic about the study design. She made the analogy to having a quiver with a limited number of arrows (e.g., project elements), and we need to make sure we use each arrow carefully to hit the bullseye (e.g., building knowledge to help answer the high priority management questions).

Comments on the SAP are needed from the Workgroup by 3/15, and the revised Microplastic SAP will be submitted to the Moore Foundation on 3/31/2017.

While the framework of the SAP has been established with the Moore Foundation to sample microplastics in sediment, water, and fish, there is room to make adjustments to the plan. Meg pointed out that the SAP elements (e.g., sediment, water, fish, etc.) come directly from the RMP Microplastic Strategy Document that was developed in consultation with the RMP stakeholders and external experts.

Table 2.1 in the SAP is the Microplastic Strategy Document Multi-Year Plan to study microplastics. Many of the elements presented in the Plan for 2017 and 2018 are funded by the Moore Foundation, greatly expanding the RMP's ability to further this work.

Meg introduced the microplastic topic experts:
1. Dr. Chelsea Rochman from the University of Toronto
2. Anna-Marie Cook from USEPA Region 9
3. Dr. Sherri "Sam" Mason from SUNY Fredonia

2. **Discussion: Draft Microplastic Sampling and Analysis**
    a. **SAP Presentation**

Meg Sedlak described the Microplastic SAP as a team effort, including researchers at Moss Landing, University of Toronto and University of Michigan, 5 Gyres, and a team at SFEI.

The genesis of the project came from a small 2015 study led by Rebecca Sutton that looked at microplastics in the Bay water and wastewater effluent. Key findings from the study were that the microplastic concentrations in the Bay appeared to be higher than measured concentrations in other urban areas such as the Great Lakes using comparable methods. This led the RMP to convene a Microplastic Workgroup meeting on June 29, 2016 to discuss and determine the key questions and study elements. Building off the guidance from the workgroup meeting, Rebecca Sutton and Meg Sedlak developed the Microplastic Strategy Document, which was released on February 2017 after incorporating stakeholder comments.

The SAP is a 2-year field sampling and analysis plan to monitor microplastics in the Bay and surrounding National Marine Sanctuaries. During year 1, surface water and sediment will be sampled for microplastics (MP). Prey fish samples will be collected to investigate uptake of MP into the food web. The RMP stakeholders identified surface sediment as a high priority for sampling because there is no MP sediment data for the Bay. Monitoring of Sanctuaries was identified as a high priority area by Moore Foundation to evaluate the flux of MP between the Bay and surrounding sanctuaries. Wastewater effluent and stormwater discharge samples will be collected in year 2. That said, SFEI has already started collecting the stormwater samples this year to take advantage of the large rainfall events we have been having recently.

Surface water samples will be collected in the Bay and Sanctuaries. Part of the project will be to develop better collection and analysis methods. For example, the team will develop new collection methods for the 5 mm to 20 micron range using a pump. Manta trawls will be used for surface water samples. The analysis of microplastics will be done using Raman spectroscopy by the Rochman lab at the University of Toronto. Nanoplastics analysis, which is a small portion of the project and overall budget, is very much in the scientific exploratory phase. The nanoplastic work will be done at University of Michigan by Rachel Merzel in the Banaszak Holl lab using an AFM-IR technique.

The sampling sites were chosen to measure ambient water conditions in the Bay (sites along main stem of the Bay) and the influence of pathways (e.g. stormwater and wastewater effluent). There are 16 sites in the Bay, and 12 sites in the marine sanctuaries. Several samples will be collected outside the Golden Gate to understand the flux of MP between the Bay and sanctuaries.

Sampling will also be conducted in the wet and dry season to look at seasonal influence. Surface water samples will be collected using 3 methods: manta trawl (particle size fraction >355 um), pump system (size fraction 20 um - 5 mm), and grab samples (<1 um, nanoplastic analysis). The results will help to develop models to understand the transport of MP.

The project will also evaluate microplastic in sediment and fish. The sediment sites will leverage the RMP margin sampling that is being undertaken in the South Bay this summer as well as prior sediment cruises in the ambient Bay and the margins sediment sampling in Central Bay. A subset of sediment sites from South Bay and Lower South Bay will be collected for microplastic analyses (16 sites). In addition, sediment will be collected at 8 sites in the North Bay and 3 sites in a reference location (Tomales Bay). At eight sediment sites, 20 prey fish will be collected, consisting of two different species representing different habitats: anchovy and Mississippi silverside or topsmelt. Fish sites were selected based on consultations with Moss Landing Marine Labs to assure a high probability that fish are present.

Previous sampling visually identified fibers in Bay Area wastewater effluent. Because they were visually identified, it could not be confirmed that the fibers were plastic. Nirmela Arsem led a Bay Area Clean Water Agencies (BACWA) study that found not all microparticles in wastewater effluent are plastic. Another finding was that 24-hr composite samples could be collected; the previous study collected 2-hour (peak flow) composites only. The SAP has incorporated several of these findings and as a result, spectroscopy will be used to chemically identify microplastics, 24-hour composite sampling will be undertaken and documentation of methods will be conducted. Eight wastewater facilities will be evaluated to assess different treatment methods (secondary and tertiary treatment). The SAP focuses on plants that have greater than 10 MGD. Currently, there are already 7 plants that have agreed to participate (EBMUD, SJSC, SFPUC, EBDA, Palo Alto, CCSD, City of Sunnyvale, and the study is looking for an additional 1 plant).

Stormwater samples will be collected at 7-15 sites, and site selection will leverage RMP STLS sites. STLS sites were selected to fit other criteria (potential presence of PCBs), but many of the sites have properties that make them useful for MP analysis. Several samples were already collected this year given the deluge of rain that has occurred. If next year is a dry year, it may be more difficult to complete the study design. Sites will include locations where trash is already an area of concern, such as Colma Creek, Coyote Creek, and San Mateo Creek. In addition, large watersheds are also targeted. Lastly, it was desirable to select watersheds that reflected different uses (e.g., urban vs rural, etc.).

The Rochman lab will use Raman spectroscopy to identify microparticles. The morphology, size, and chemical composition will be analyzed and reported. This analysis will be conducted on ambient Bay surface water, effluent water, stormwater, sediment, and fish samples. A new instrument is being built, and the methodology will be developed carefully to ensure consistency.

The nanoplastic analysis will be conducted at the Duhaim and Banaszak Holl labs at the University of Michigan, and will develop methods towards quantification of nanoparticles. It was emphasized that this portion of the project is exploratory.

Field and Lab QA/QC procedures will be implemented, including the use of field and lab blanks, field and lab duplicates, and spiked matrix samples. Data will be reported using EDD template, undergo QA review, and be uploaded to CEDEN and CD3.

Year 1 and Year 2 reports will be completed in May 2018 and December 2018, respectively.

High-level comments are requested from this meeting, and more detailed comments are requested to be submitted by email.

b. SAP Discussion

Mary Lou Esparza asked what percent match in the sample spectroscopy to the library is needed to confirm the chemical composition of the particle. **Chelsea Rochman responded that she would think about this more and add the methodology used to confirm identification to the SAP.** Dr. Rochman stated that ideally they would look for at least an 80% match, and ideally 90%, and that previous experience would also be used to confirm a match. She indicated that particles can have a biofilm which may make the identification harder.

Mary Lou also asked for whether a second detection method would be used to analyze samples to ensure identification is robust to make management decisions. For example, whether some samples sent for Raman spectroscopy analysis could also be analyzed using FTIR. Dr. Rochman said that they do not have an FTIR instrument, and that an analytical partner would be needed for secondary analysis. Dr. Rochman said she would look at some review papers that compared labs that did both Raman and FTIR analysis; according to her review, FTIR does not work as well for smaller particles. Rachel Merzel, who will be doing the nanoplastic analysis, said that they used thermal absorbance technology to analyze samples, and that they may be able to do limited set of confirmation analysis of particles up to 7 um in size; however, this size fraction is too small to compare to results from Dr. Rochman's lab, which can analyze as low as 20 microns. Dr. Rochman indicated that secondary confirmation is not usually conducted. Meg indicated that the budget did not include secondary analyses. **Meg said she would follow-up with Chelsea on the review articles that looked at both methods of analysis.**

Mike Connor commented that one of the key goals of the project is to categorize "stuff" that was in the water, and that it was important to relate the different types of particles to their different effects. Becky said that the analysis will include the polymer type, morphology, size, and shape of identified particles, and she would work with Amy to ensure category bins for particles would

be properly uploaded to the database. Becky stated that identification of the particles was important to infer the sources and pathways of the particles. Mike suggested the category bins should be included more explicitly.

Nirmela emphasized the importance of good lab practice, and for the lab to demonstrate its analytical capabilities. Meg and Chelsea agreed that the lab could participate in a demonstration study after the new instrument is built. Chelsea has historical samples that the lab can use to conduct method development and assess precision. The instrument is being built by Horiba Scientific. As part of the contract, Horiba has a dedicated analytical chemist who will work with U of T on method development. Chelsea said they were looking at published extraction methods, and would work towards developing better and standardized method. Chelsea said she would share methods as they are developed.

Chris Sommers said that more information on the modeling techniques could be included in the SAP to explain how stormwater loads will be calculated. Becky said the SAP was limited to monitoring and sampling for microplastics, and that she did not plan to include more details about the contaminant transport model. Rusty said the MP transport modeling would leverage ongoing monitoring data and models. Chris emphasized that clarification is needed to understand how sampling data will be extrapolated to get different types of loads, such as annual and storm event loads. **Phil summarized the discussion by paraphrasing the question to: how will we convert stormwater and effluent data to a load?** The team agreed to clarify this in the SAP.

Mary Lou asked where are the large particles coming from and what are sources of plastics. Carolynn Box replied that this project will not be evaluating trash loads from urban creeks as BASMAA and 5 Gyres have just completed a Tracking California Trash project in the Bay Area, which developed methods to track particles > 5 mm.

Nirmela Arsem commented that it was important to define microplastics and to be clear on the method of analyses. That is for the pathways such as stormwater and wastewater, the sieves screens will only capture microplastics down to 125 microns; however, for Bay and sanctuary samples, the project will be able to analyze down to 20 microns. Therefore, it is important to be clear when comparisons are made that these differences are highlighted. Meg indicated that all samples are being analyzed using the same methodology (Raman spectroscopy) by the same laboratory so this will alleviate a source of uncertainty. Becky emphasized that the use of bins for different sized particles will allow appropriate comparisons.

Chris again emphasized the need to be clear on how data will be presented particularly in regards to concentrations and loads from POTWs (publicly owned treatment works), tributaries, and other pathways. There are many larger plastic materials that can degrade into MP, and it's

important that the data does not become a source discussion. He was concerned that the data can paint the wrong picture of sources of MP. He emphasized the data are meant to inform management decisions. Phil clarified that we can be make that sure we are making apples to apples comparison when comparing data, and be clear on what is and is not represented in the data. He also said one challenge is studying trash and larger particles.

Becky asked if the group had any comments on the site selection or site locations. Phil said they would have preferred to sample more sites, and agonized over limited number of sites available based on the existing budget. Mary-Lou asked if sites coincided with historical RMP sites, and Meg responded that they are not the historical sites, except of a few sediment sites. However, for the margin sediment sites, chemistry that has been conducted at that a particular site will be publicly available through the RMP web portal.

Mike said that he was not clear on how data from sites will answer questions about the Bay and how the sample results will be used to answer the management questions. Meg said that it is a challenge to meet all the data needs for this project, because MP is a very different analyte than other chemical compounds traditionally studied by the RMP. She said we will have to see what the data looks like, to see what answers can be teased out, and what statistical analysis can be done. For example, the previous study found that wastewater effluent contained mostly fibers. It is possible that some pathways may have a specific size distribution or type of MP which will facilitate comparisons. At minimum, the Bay and Sanctuary waters will be compared as well the differences in season. Rusty said sites were chosen to have some sites in places where the Bay is well mixed, sites to represent potential sources, and that they tried to get one arrow in each bullseye, but there were not enough sites to double up on sites. Mike mentioned the need to think about potential removal processes, such as settling, filtration, and that chlorophyll could be a potential surrogate. He asked whether the data would give meaningful data that the models can use. Rusty responded that modeling the transport of MP is still an open topic, and that at a recent conference, the research presentations were mostly on sampling and composition, and not yet on transport processes. He said the best thing is to distribute the sampling sites to show different conditions, such as areas with and without settling. Mike mentioned this could overlap with work from Dave Schoelhammer. **Phil summarized that there is the question about settling velocity for different particle sizes, and that he would meet and discuss this with Dave.**

Nirmela requested a definition of MP and nanoparticles, and that this be consistent through the document. Meg said she would expand on the definitions, and make sure comparisons are making apples to apples, such as particle sizes, and be very clear on what we are talking about.

Mary Lou asked how will data from this project be integrated with previously data? Becky answered that this data would be stand alone, because the methods would be different (i.e.

extraction method and plastic identification), and it would be hard to make a comparison. Phil said this was a safe approach, and that the previous data set is small in comparison.

Comments should be sent ASAP to meg@sfei.org, and deadline is 3/15.

3. **Recommendation for Special Study: Microplastic in Bivalves**
   a. **Special Study Presentation**

Phil said that the RMP has provided some matching funds to the Moore study. In addition, the RMP has set up a microplastic workgroup that will propose special studies to be funded by the RMP. The MP Bivalve special study is not funded by Moore; this Workgroup will decide whether to recommend the special study for RMP funding to the TRC. The discussion had mentioned that filtration could be a possible removal process, and we know that bivalves are an important removal mechanism for other contaminants.

Meg reminded everyone that part of the MP Strategy Document outlines looking at filter feeders. Bivalves are a key element of the food web, and can help answer management questions, such as do we see uptake of MP in bivalves, and what are potential risks to higher organisms like apex predators. Bivalves are good trend indicators, and if MP turns out to be a large issue, they could be a key trend indicator, and inform management actions.

The study design will leverage 2018 RMP work. At 7 Bay sites, transplants of *Mytilus edulis* will be placed for 90 days, and at 3 margin sediment sites, resident samples will be collected. At each site, 3 composite samples will be collected. Composites will be analyzed by the Rochman lab using Raman spectroscopy. The RMP work will also analyze samples for other pollutants (e.g. PAHs, possibly PBDEs), and the study will try to determine correlations with MP data.

Field work will be conducted in the summer of 2018, analysis in the fall of 2018, with reporting in winter of 2018. Results will be included in Moore microplastic report.

b. **Special Study Discussion**

Phil asked will data be going into CEDEN. Meg said yes, data will be incorporated into CEDEN and CEDEN has count and categories as of a month ago. She is working with CEDEN and the data management team to potentially supplement data with photos, and they are helping CEDEN develop methodology for including MP data. She will follow-up on this. **Chris pointed out that the category and data types are important, and that we should hold back on data until this is well defined, and only have to upload data into CEDEN once.** Meg agreed, and that it would be inefficient to have to revisit data and re-upload.

There was a question concerning digestion method. Chelsea said there are various chemicals that have been used for digestion, and that the KOH method has performed the best. Therefore, this is the method that they will be using, but **she will also test the method to see if there is an impact on the analysis of very small particles.**

Mary-Lou asked whether concentrations measured in bivalves will be translated to organisms or human exposure. Phil answered that the transplants will be measured for biological exposure to the bivalves, and not used for fish advisories, which is more appropriate with measurements from sport fish. Becky said they will be looking at differences between transplants and resident bivalves.

Phil stated that there are 6 other workgroups that are developing proposals for 2018, and each group will put forward project ideas to the RMP Technical Review Committee (TRC) in June. The TRC combines the recommendations into 1 set of proposed studies for the RMP Steering Committee (SC) to approve.

Jay mentioned that the current plan is to not do PCB analysis on the bivalves in 2018, because the PCB cycle is every 8 years. PCB analysis is not planned till 2022, so a question for the Workgroup is whether to do PCB analysis to compare to the MP data. PBDE and PAH data will likely be collected. There was a discussion on how PCB data can be useful to correlate with MP data. However, the data may not be conclusive or show causation. Meg asked the technical experts for their input. Becky pointed out that the primary purpose of the study is to look at MP, and that other chemical analyses should be considered add-ons. The Workgroup discussed whether the study design could include other chemical tracers of plastics like alkylphenols and PBDEs. Phil summarized that adding on additional analysis would be a significant increase to the scope of the project, and we would have to consider whether there are options for that, and that they may need to be a follow-on project.

4. Decision: Recommendations for 2018 Special Studies Funding
A decision was made and confirmed to recommend the study to the TRC.

5. Identification of Action Items, Next Steps
- Follow-up with Chelsea and Mary Lou about papers comparing spectroscopy confirmation of plastics.
- Explain in the SAP how the stormwater and wastewater data will be analyzed to calculate loads. Discuss this with stormwater team. We will also want to consider making climate adjustments, such as this year versus a normal year.
- Ask Chelsea Rochman to share with the workgroup some of the demonstration data as the instrument is brought on line to assure that the data is robust.
- Define MP size fractions in the SAP.

About the RMP

RMP ORIGIN AND PURPOSE

In 1992 the San Francisco Bay Regional Water Board passed Resolution No. 92-043 directing the Executive Officer to send a letter to regulated dischargers requiring them to implement a regional multi-media pollutant monitoring program for water quality (RMP) in San Francisco Bay. The Water Board's regulatory authority to require such a program comes from California Water Code Sections 13267, 13383, 13268 and 13385. The Water Board offered to suspend some effluent and local receiving water monitoring requirements for individual discharges to provide cost savings to implement baseline portions of the RMP, although they recognized that additional resources would be necessary. The Resolution also included a provision that the requirement for a RMP be included in discharger permits. The RMP began in 1993, and over ensuing years has been a successful and effective partnership of regulatory agencies and the regulated community.

The goal of the RMP is to collect data and communicate information about water quality in San Francisco Bay in support of management decisions.

This goal is achieved through a cooperative effort of a wide range of regulators, dischargers, scientists, and environmental advocates. This collaboration has fostered the development of a multifaceted, sophisticated, and efficient program that has demonstrated the capacity for considerable adaptation in response to changing management priorities and advances in scientific understanding.

RMP PLANNING

This collaboration and adaptation is achieved through the participation of stakeholders and scientists in frequent committee and workgroup meetings.

The annual planning cycle begins with a workshop in October in which the Steering Committee articulates general priorities among the information needs on water quality topics of concern. In the second quarter of the following year the workgroups and strategy teams forward recommendations for study plans to the Technical Review Committee (TRC). At their June meeting, the TRC combines all of this input into a study plan for the following year that is submitted to the Steering Committee. The Steering Committee then considers this recommendation and makes the final decision on the annual workplan.

In order to fulfill the overarching goal of the RMP, the Program has to be forward-thinking and anticipate what decisions are on the horizon, so that when their time comes, the scientific knowledge needed to inform the decisions is at hand. Consequently, each of the workgroups and teams develops five-year plans for studies to address the highest priority management questions for their subject area. Collectively, the efforts of all these groups represent a substantial body of deliberation and planning.

PURPOSE OF THIS DOCUMENT

The purpose of this document is to summarize the key discussion points and outcomes of a workgroup meeting.