BACKGROUND

- **California has legislative mandates for microplastics management**
  - SB 1422 requires implementation of routine drinking water microplastics monitoring
  - SB 1263 requires creation of a Microplastics Management Strategy for the California ocean
- **The State has been active in addressing those mandates**
  - State Water Board held a workshop on November 17 to introduce their draft monitoring plan
  - Ocean Protection Council adopted their strategy document last week
- **The SCCWRP Commission asked for a briefing on these two initiatives**
  - Actions the State is taking on these issues
  - How did SCCWRP science contribute to the plans?
  - What future research does SCCWRP staff envision conducting in response to those plans?

SENATE BILL 1263 (PORTANTINO 2018)

- **Requires OPC to adopt a Statewide Microplastics Strategy by December 2021**
  - Also requires a report to the Legislature with findings and additional policy recommendations by December 2025

- **Ocean Protection Council issued a draft plan for public comment in December**
  - Adopted the plan at their meeting last Wednesday
  - This is the first plan of its type in the world and is gaining international recognition

TWO-PRONGED APPROACH

Solutions

Multi-benefit solutions the state can act upon now while the scientific knowledge of microplastics further develops.

- **Pollution Prevention**
  Eliminate plastic waste at the source (products or materials from which microplastics originate)
- **Pathway Interventions**
  Intervene within specific pathways that mobilize microplastics from a specific source into California waters
- **Education**
  Inform the public and industries of microplastics sources, impacts, and solutions

Science to Inform Future Action

Research priorities to advance scientific knowledge of microplastics to develop and refine future solutions.

- **Monitoring**
  Understand and identify trends of microplastic pollution statewide
- **Risk**
  Improve understanding of critical thresholds at which aquatic life and humans are adversely impacted by microplastic exposure
- **Sources & Pathways Prioritization**
  Identify and prioritize future management solutions based on predominant ways microplastics enter California waters
- **Evaluating New Solutions**
  Develop and implement potential future solutions

POLLUTION PREVENTION

- **Core of the plan is reduction in use of plastics**
  - Easier to keep plastics out of the system than to retrieve them once released
- **Emphasis on working with industry to identify alternative products**
  - Five industries specifically highlighted: Tires, foodware, agriculture, textiles, and fisheries
- **Plan also calls out product and material regulation**
  - Eliminate sale & use of expanded polystyrene
  - Reduce use of single-use foodware
  - Eliminate single-use tobacco products that demonstrably contribute to plastic pollution
  - Eliminate intentionally added microplastics for specific consumer products
  - Comprehensive statewide plastic source reduction, reuse, & refill goals

PATHWAY INTERVENTION

- **Incorporation of microfiber filters in washing machines and dryers**
  - Precedent for this in other countries
- **Extended producer responsibility to help finance waste infrastructure**
- **Emphasis on stormwater management**
  - SFEI study illustrated stormwater runoff as the primary input to San Francisco Bay
  - Plan supports multi-benefits of low impact development (LID)
- **Wastewater treatment is noted in the plan, mostly calling out co-benefits resulting from reuse strategies**
  - POTWs should note concerns raised about biosolids disposal

EDUCATION

- **Education is something everyone agrees they can get started on now**
  - Public awareness campaign to facilitate behavior
  - Informal & formal educational programs on microplastic sources, impacts, and solutions
  - Industry engagement to advance sector-specific pollution prevention strategies

SCIENCE TO INFORM FUTURE ACTION

- **Develop monitoring programs**
  - Understand and identify trends of microplastic pollution statewide
- **Conduct risk assessments**
  - Improve understanding of critical thresholds at which aquatic life and humans are adversely impacted by microplastic exposure
- **Determine sources and pathways**
  - Identify and prioritize future management solutions based on predominant ways microplastics enter California waters
- **Evaluate new solutions**
  - Develop and test potential future solutions

SCCWRP'S CONTRIBUTIONS - MONITORING

- **Work conducted to date**
  - Our method evaluation study was basis for State Water Board adopting a standard method
  - Presently working with ELAP to develop an accreditation process for that method
  - We conducted training on that method for about 20 labs in the State
  - Presently developing a comparable SOP for sediment and tissue matrices

- **Future work we have planned**
  - We have plans to conduct method evaluations for an array of new methods
  - Hope to make the Bight Program a foundational part of the OPC's monitoring plans

SCCWRP'S CONTRIBUTIONS – RISK ASSESSMENT

- **Work conducted to date**
  - Risk assessment is central to the OPC strategy
  - SCCWRP's expert workshop was the first to produce a management framework and identify critical thresholds at which biological effects manifest
  - Have a special issue of a scientific journal dedicated to this topic coming out later this month

- **Work that we have planned**
  - We are conducting lab experiments that will improve the threshold values
  - Presently preparing a manuscript that applies thresholds to calculate biological risk in SF Bay

SCCWRP'S CONTRIBUTIONS - SOURCES

- **Work conducted to date**
  - Presently working on emissions estimates for POTWs statewide
  - Also working on emission estimates for two local river systems

- **Work that we have planned**
  - Hope to add more river systems to that portfolio
  - Need to quantify atmospheric deposition
  - Exploring means for fingerprinting microplastics to identify upstream sources

SCCWRP'S CONTRIBUTIONS – TECHNOLOGY EVALUATION

- **Work conducted to date**
  - None yet

- **Work that we have planned**
  - We will add a microplastics evaluation component to our BMP program
  - Hoping to establish a program for evaluating alternative products

DRINKING WATER MONITORING PROGRESS

- State Board adopted a definition of microplastics in June 2021
- They have determined the sample processing method they will require
- Developed a monitoring program design
- Implementation of that design will begin this summer

MONITORING PROGRAM DESIGN

- **Identified two classes of questions to be answered**
- **The first is to characterize the nature of the issue**
  - What kinds of plastics (size, shape, polymer type) are present in both source and finished waters
- **The second is a compliance question about whether finished water exceeds a threshold for public warning (or worse)**
- **Early years will focus on the first question, as we don’t have reliable thresholds yet**
  - First year will be limited to about half a dozen large water utilities
  - Sampling will include source water, intake water, finished water and tap water

HOW DID SCCWRP'S WORK CONTRIBUTE?

- **Method selection**
  - Our study was the basis for method selection and standardization
  - We are helping develop the accreditation procedures and training the ELAP staff
- **Monitoring program design**
  - Our method evaluation study precision estimates and the thresholds developed in the workshop helped define the volume of water that needs to be sampled
- **Interpretational framework**
  - Workshop also defined most important science needs to develop confidence in the thresholds

ANTICIPATED FUTURE SCCWRP CONTRIBUTIONS

- **SCCWRP has been asked to implement the first year of monitoring**
  - The utilities need more time to learn the lab method
  - We will also work with them to perfect a collection method
- **Will be evaluating alternative cheaper methods during implementation**
  - Presently recruiting method developers as partners in that project
- **Hope to inform reuse decisions by integrating our wastewater and drinking water sampling**

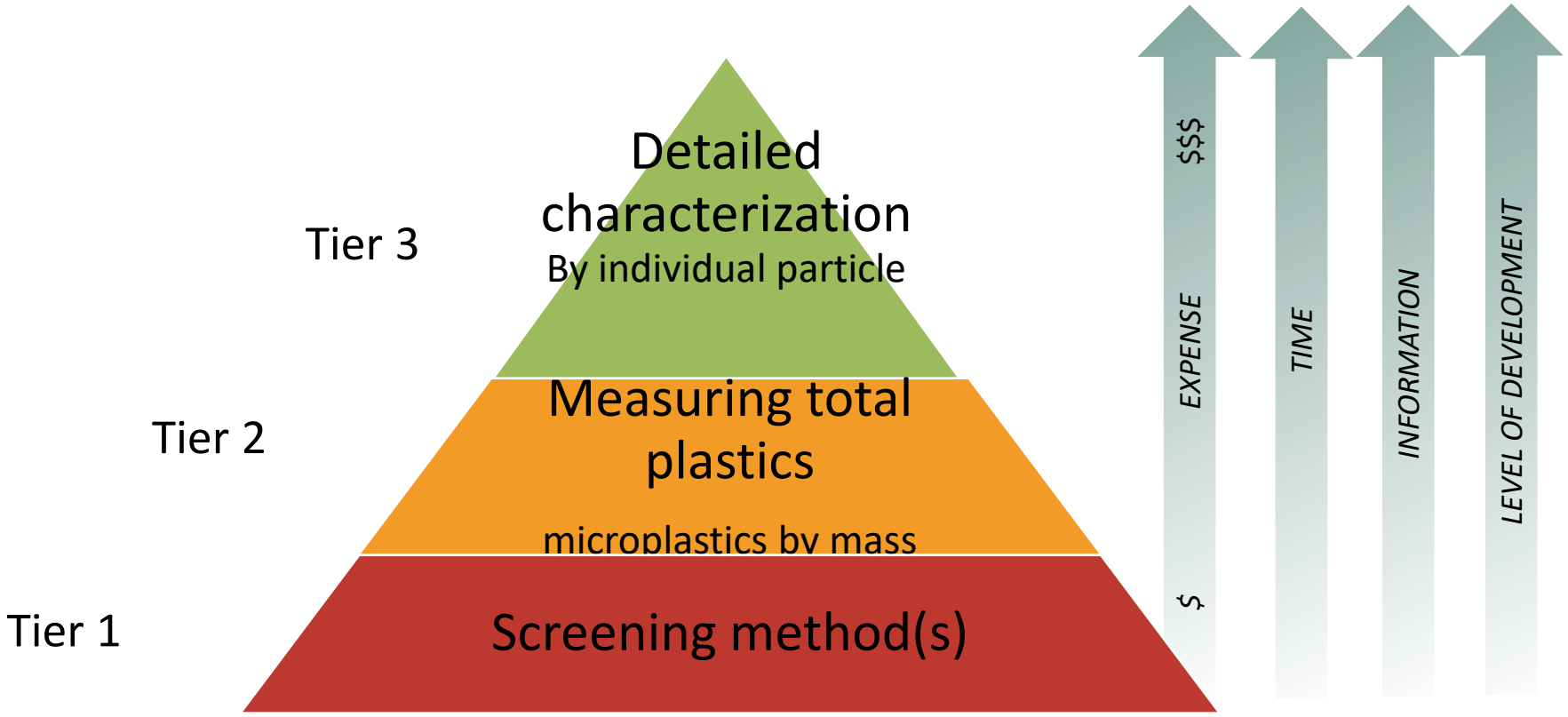
COMMISSION FEEDBACK

- Are we planning to work on the right things?
- Anything else you would like to see us focus on?

SAMPLE PROCESSING METHOD FOR MONITORING

- **The State Board has selected Raman spectroscopy and Fourier Transformed Infrared (FTIR) as two acceptable methods**
- **Issued standard operating procedures for each of those methods**
  - Have identified performance characteristics of those methods
- **Presently working with ELAP to develop an accreditation program for these methods**
- **They have also identified a plan for incorporating additional methods in future monitoring**

Tiered Monitoring Framework

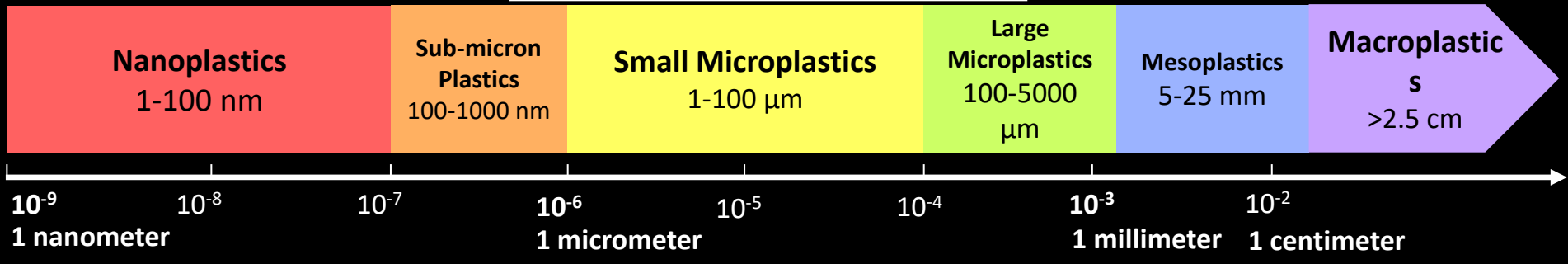


Official Definition: ‘Microplastics in Drinking Water’

‘solid polymeric materials to which chemical additives or other substances may have been added, which are particles which have at least three dimensions that are greater than 1 nanometer and less than 5,000 micrometers.

Polymers that are derived in nature that have not been chemically modified (other than by hydrolysis) are excluded.’

Size-Based Classification



FURTHER DEFINITION OF MICROPLASTICS

- Solid means a substance or mixture which does not meet the definitions of liquid or gas. ‘Liquid’ means a substance or mixture which (i) at 50 degrees Celsius (℃) has a vapor pressure less than or equal to 300 kPa; (ii) is not completely gaseous at 20 ℃ and at a standard pressure of 101.3 kPa; and (iii) which has a melting point or initial melting point of 20 ℃ or less at a standard pressure of 101.3 kPa. ‘Gas’ means a substance which (i) at 50 ℃ has a vapor pressure greater than 300 kPa (absolute); or (ii) is completely gaseous at 20 ℃ at a standard pressure of 101.3 kPa.

- Polymeric material means either (i) a particle of any composition with a continuous polymer surface coating of any thickness, or (ii) a particle of any composition with a polymer content of greater than or equal to 1% by mass.

- Particle means a minute piece of matter with defined physical boundaries; a defined physical boundary is an interface. ‘Polymer’ means a substance consisting of molecules characterized by the sequence of one or more types of monomer units. Such molecules must be distributed over a range of molecular weights wherein differences in the molecular weight are primarily attributable to differences in the number of monomer units. A polymer comprises the following: (a) a simple weight majority of molecules containing at least three monomer units which are covalently bound to at least one other monomer unit or other reactant; (b) less than a simple weight majority of molecules of the same molecular weight. ‘Monomer unit’ means the reacted form of a monomer substance in a polymer. ‘Monomer’ means a substance which is capable of forming covalent bonds with a sequence of additional like or unlike molecules under the conditions of the relevant polymer-forming reaction used for the particular process.

Microplastics Drinking Water Workgroup

Scott Coffin – State Water Resources Control Board
Elaine Khan – Office of Environmental Health and Hazard Assessment
Christine Lemieux – Health Canada
Steve Weisberg – Southern California Coastal Water Research Project Authority
Todd Gouin – TG Environmental
Hans Bouwmeester – Wageningen University
Susanne Brander – Oregon State University
Ludovic Hermabessiere – University of Toronto
Bart Koelmans – Wageningen University
Stephanie Wright – Imperial College London
Martin Wagner – Norwegian University of Science & Technology

Sector
Government/JPA
Academia
Consulting

Interpretational framework

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

Highest Concern
Water advisory notice
(e.g. public notice for limited use)

Advisory Level
Site/situation specific

Elevated Concern
Mitigation strategies recommended

Response Level
≥1x10^{-4} Cancer Risk
≥10x Notification Level

Moderate Concern
Monitoring of potential sources, public notification may be issued

Notification Level
≥1x10^{-6} Cancer Risk
≥Health-Protective Concentration

Low Concern
Monitoring to assess aqueous levels and sources of contamination

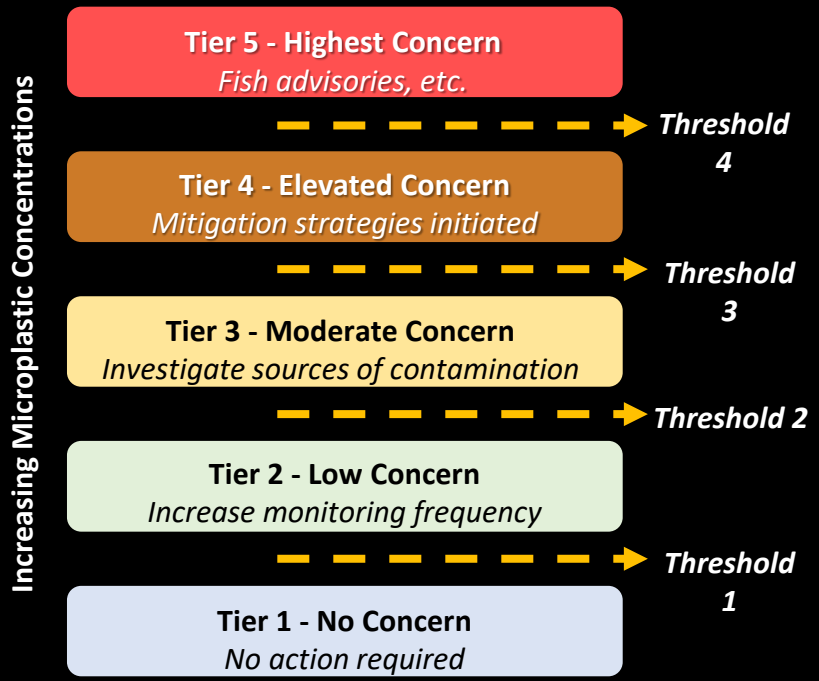
Investigatory Level

No Concern
No action required

Possible Concern
Targeted, investigatory monitoring
No responses required

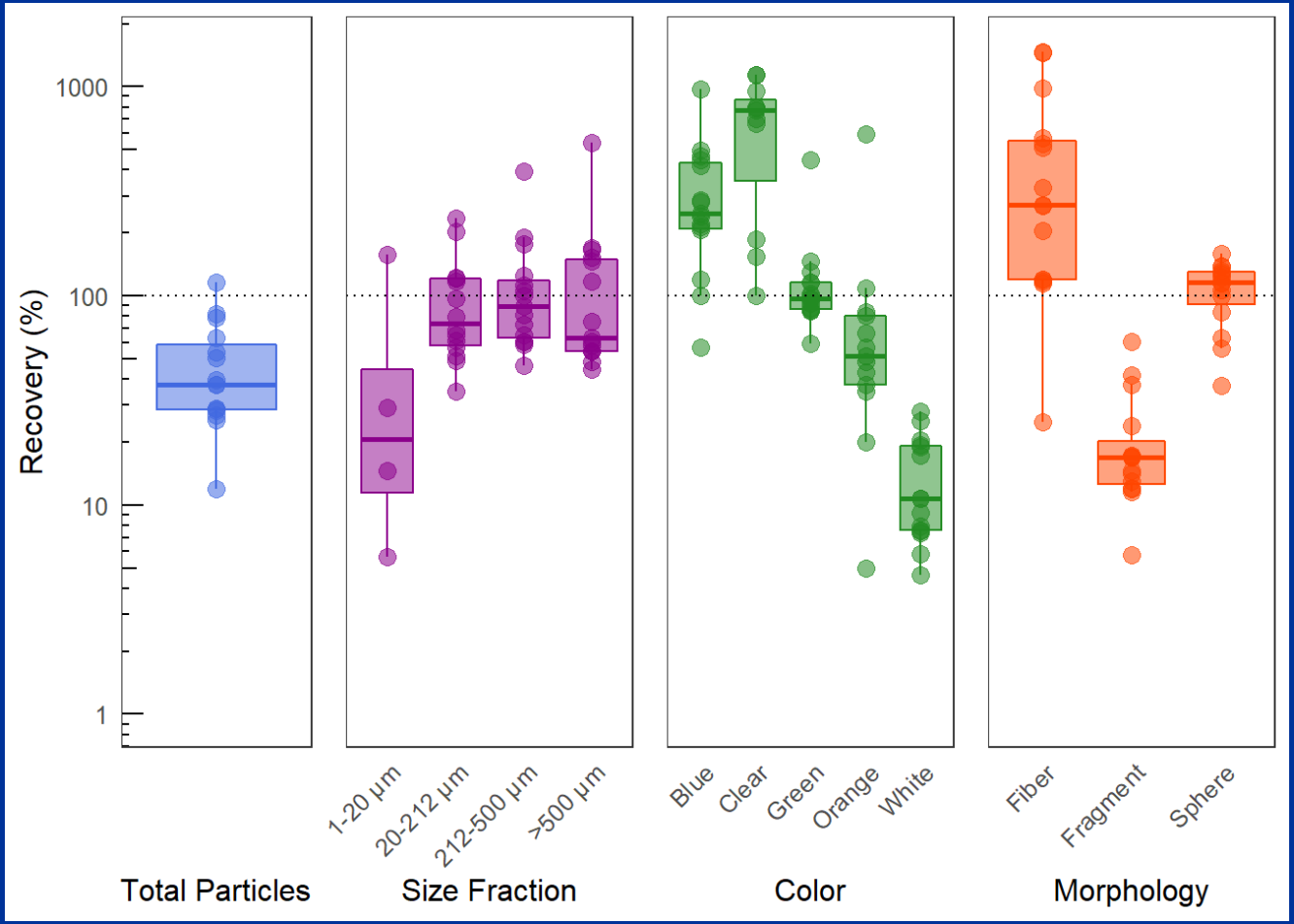
Identify necessary toxicity studies → Re-evaluate thresholds

Proposed management framework



Threshold	Volume (µm³/L)	Count (particle/L)
1- Investigative monitoring	38	0.5
2- Discharge monitoring	630	8
3- Management planning	1093	14
4- Source control measures	7294	94

Performance at a glance



Proposed thresholds- tissue translocation

Threshold	Surface area (µm²/L)	Count (particle/L)
1- Investigative monitoring	16 712	236
2- Discharge monitoring	92 803	1 312
3- Management planning	218 962	3 097
4- Source control measures	1 018 046	14 397