



Science, consensus, and
monitoring strategies:
the art of revising a long-term
benthic monitoring program

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Getting to yes is easy when:

monitoring program redesign
is guided by
well defined program goals and a
solid scientific basis

Monitoring program redesign is guided best by well defined program goals and a solid scientific basis

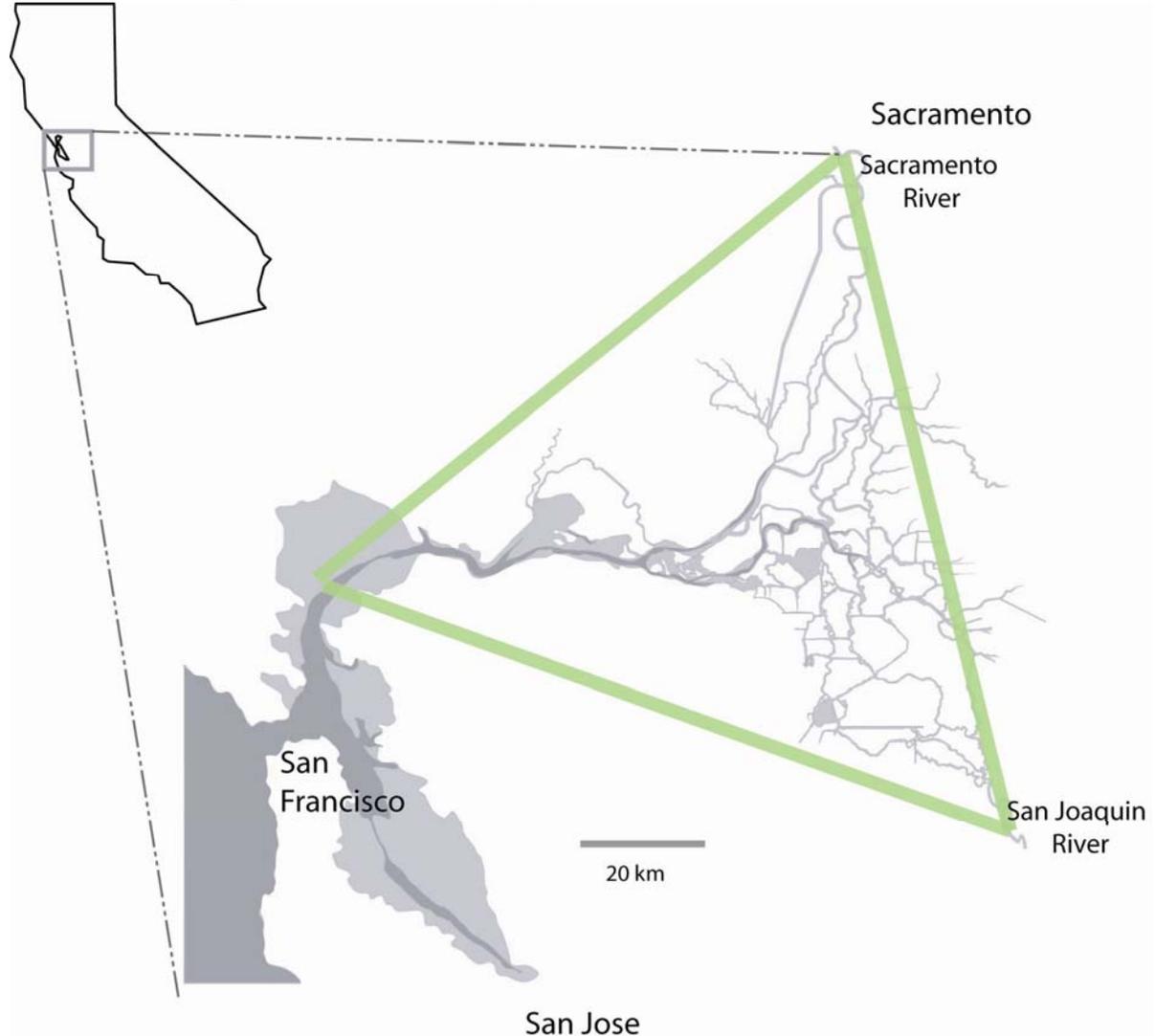
- 1) Overview of the benthic monitoring program
- 2) How monitoring goals have shaped the program over the past 30 years
- 3) The current monitoring paradigm and goals
- 4) The current proposed monitoring plan and how we expect it to meet our goals
- 5) Concluding remarks.



IEP Environmental Monitoring Program conducts water quality, physical, and biological monitoring in the upper San Francisco Estuary

Interagency Ecological Program

COOPERATIVE ECOLOGICAL
INVESTIGATIONS SINCE 1970

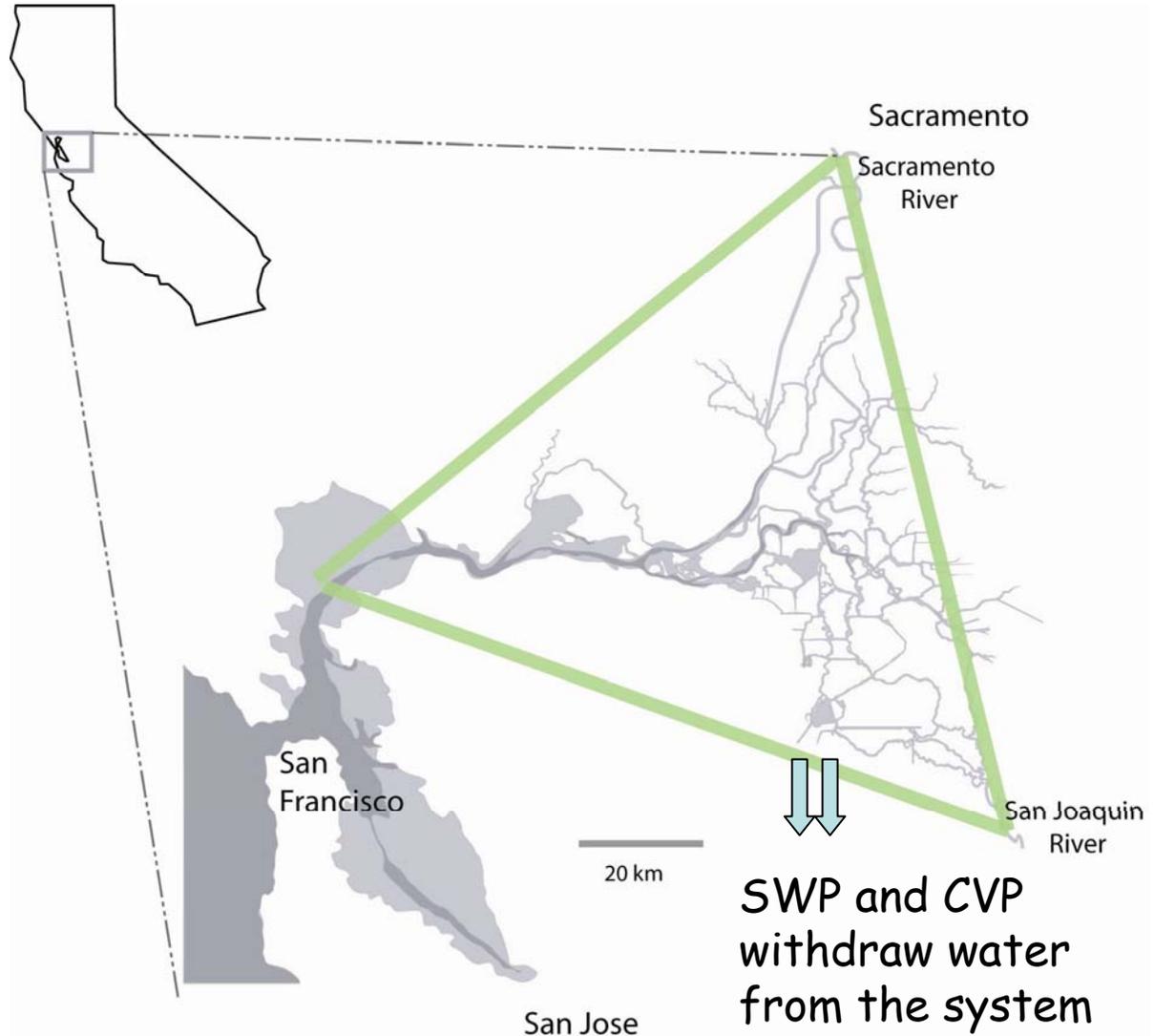




Monitoring is funded by the State and Federal government to track changes in water transport, hydrology, chemistry, and biology that might affect the San Francisco Estuary's ecosystem.

Interagency Ecological Program

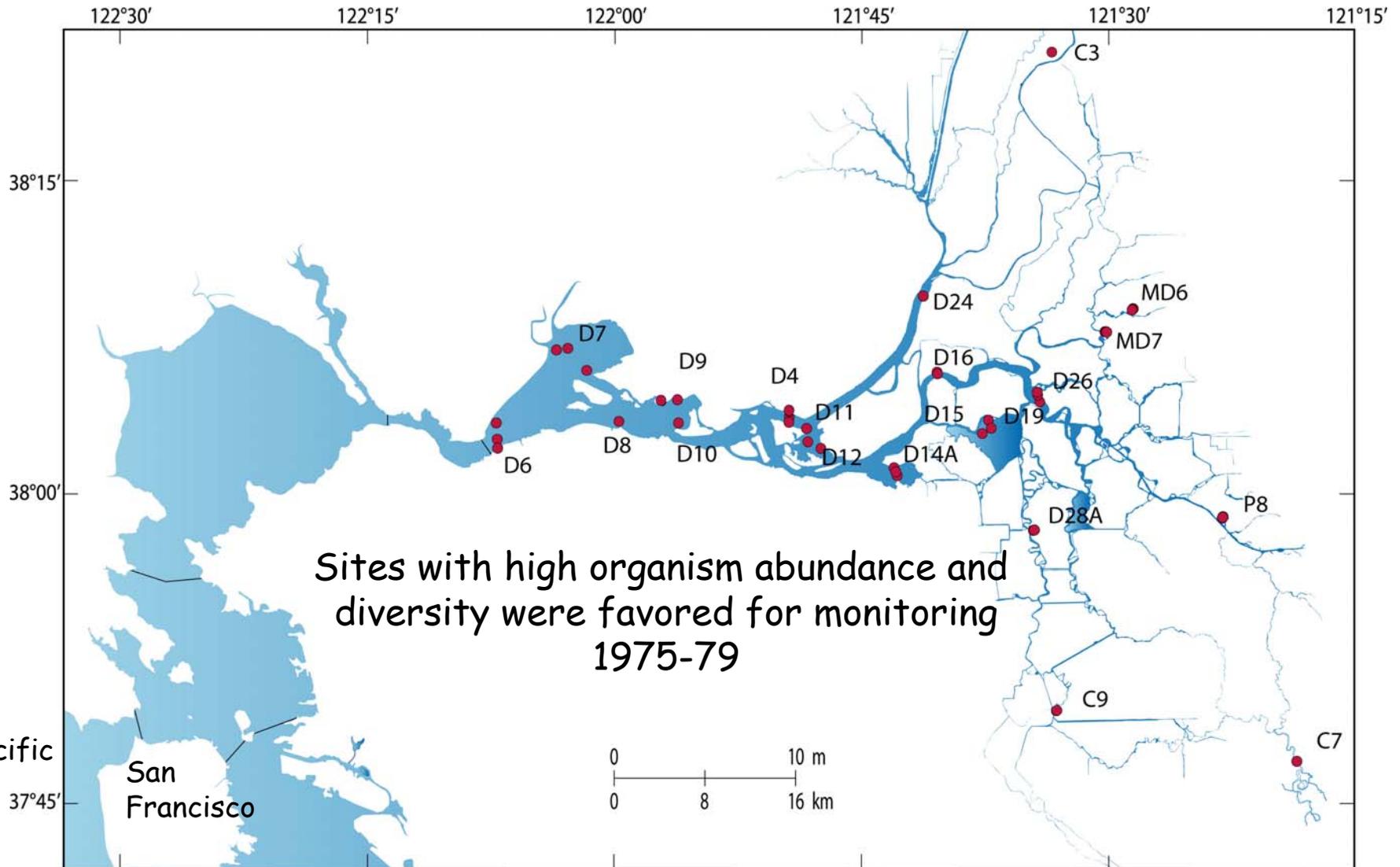
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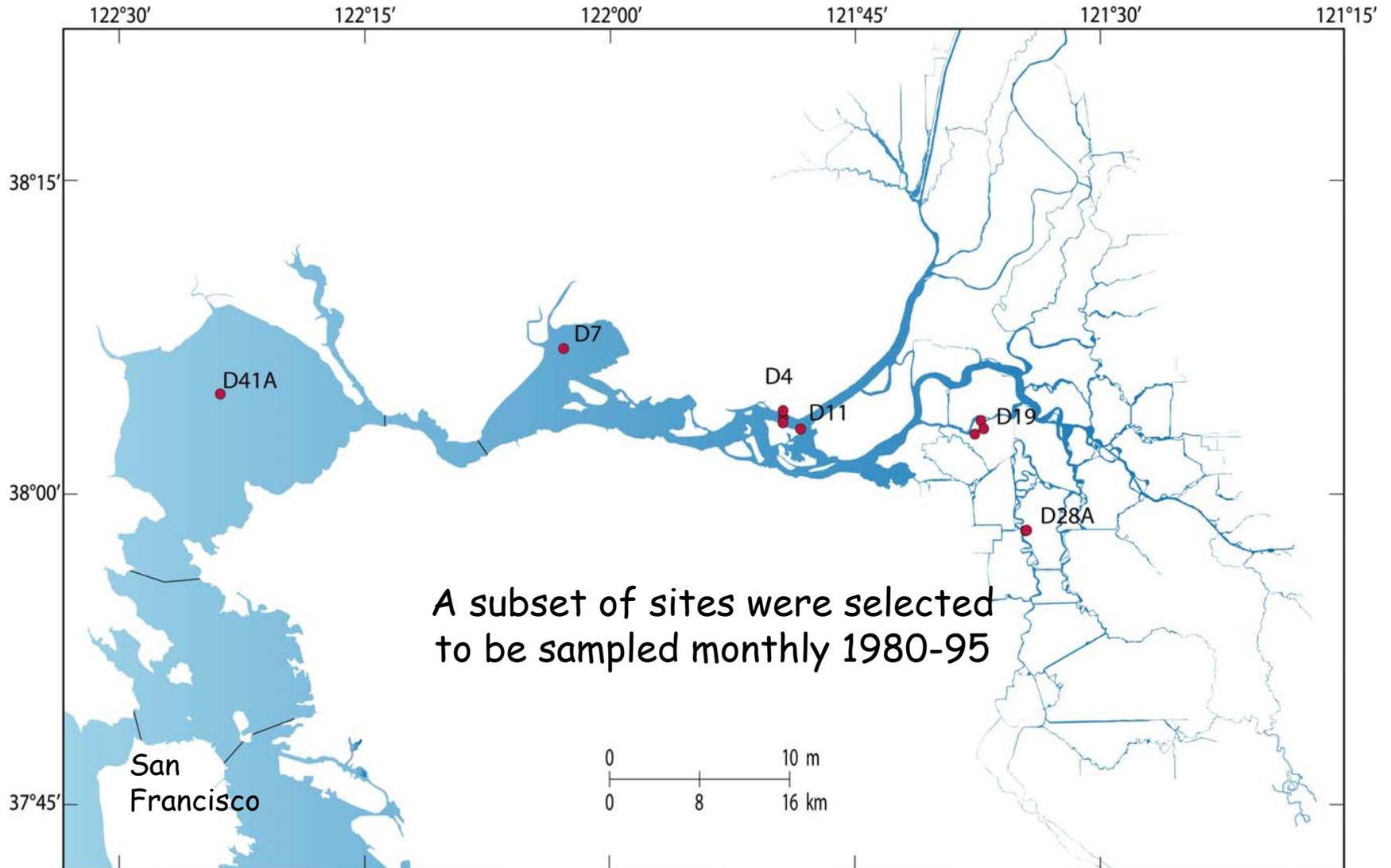
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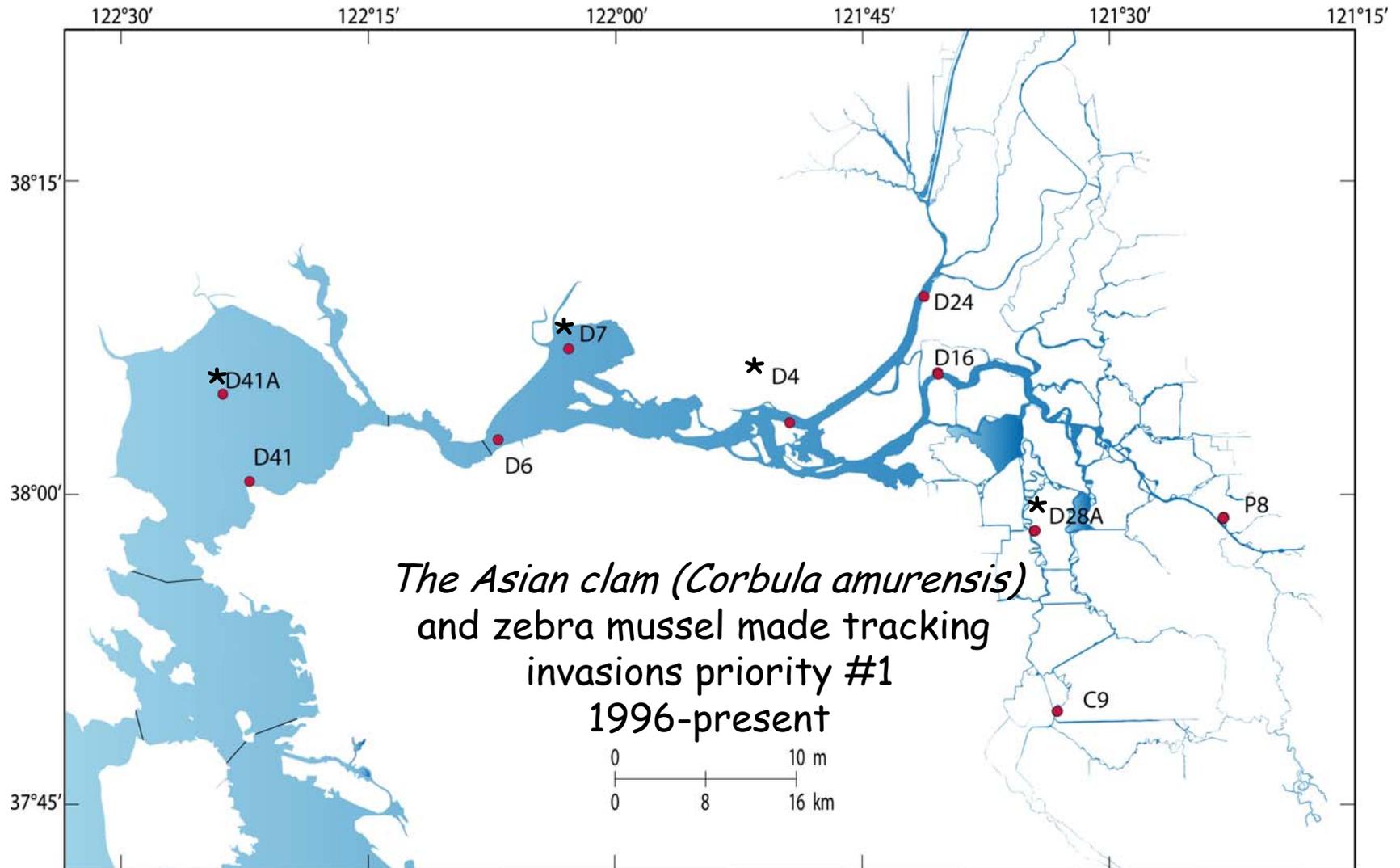
Benthos were initially expected to be indicators of salinity changes in the estuary



Improving temporal resolution required reducing the number of sites sampled



Electronics could monitor salinity, but invasions showed how important benthos are



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The current paradigm is shaped by scientific review

- IEP Science Advisory Team
- EMP Subject Area Teams
- The 2003 program review
- Benthic Estuarine Ecology Team

Define monitoring program goals and objectives

Preserve continuity of long-term monitoring stations

Improve spatial resolution of sampling locations

Provide data that will allow for calculation of mass balances and integration of physical and chemical processes

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Define monitoring program goals and objectives

Preserve continuity of long-term monitoring stations

Conduct a thorough analysis of the historic benthic data

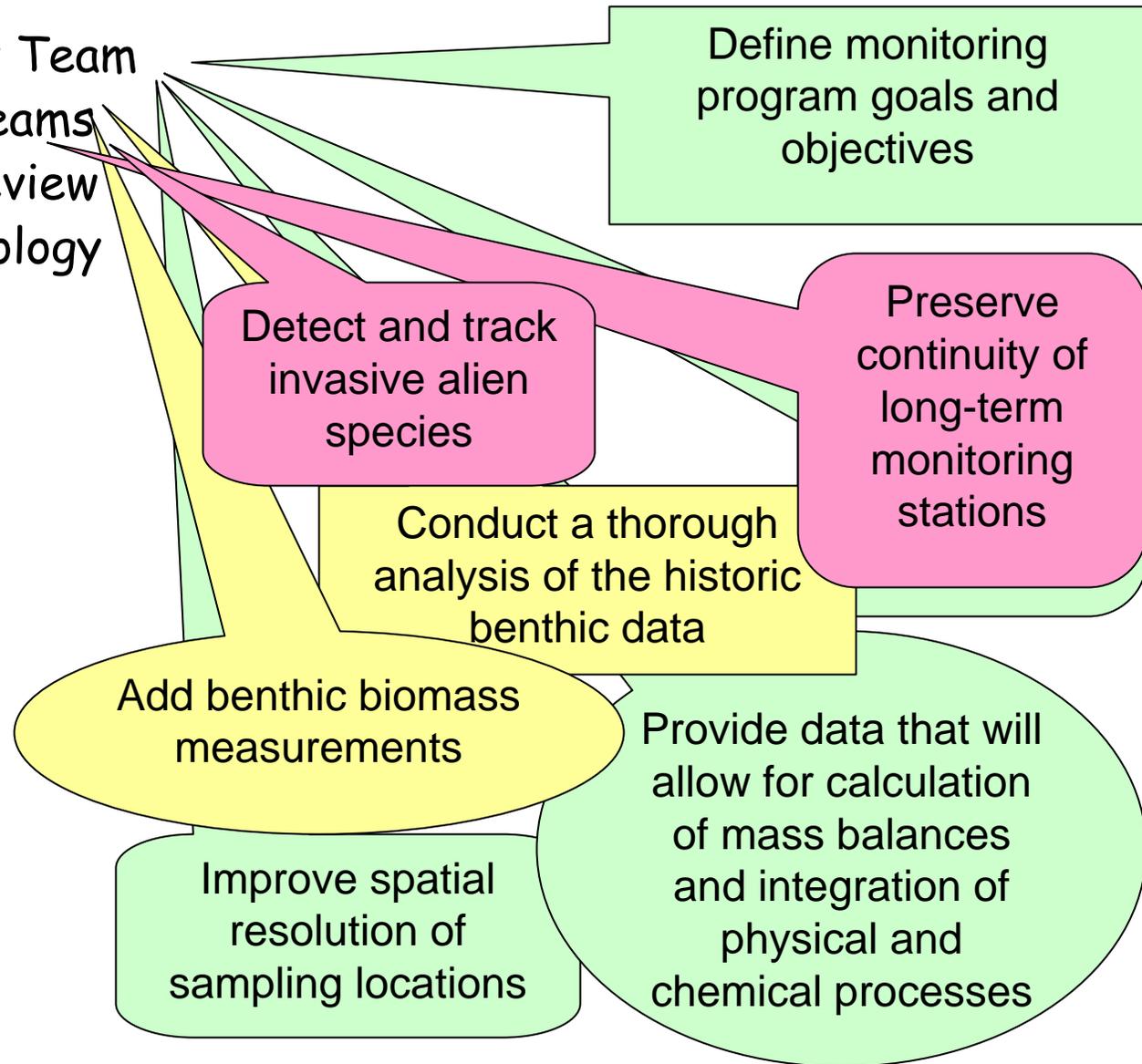
Add benthic biomass measurements

Improve spatial resolution of sampling locations

Provide data that will allow for calculation of mass balances and integration of physical and chemical processes

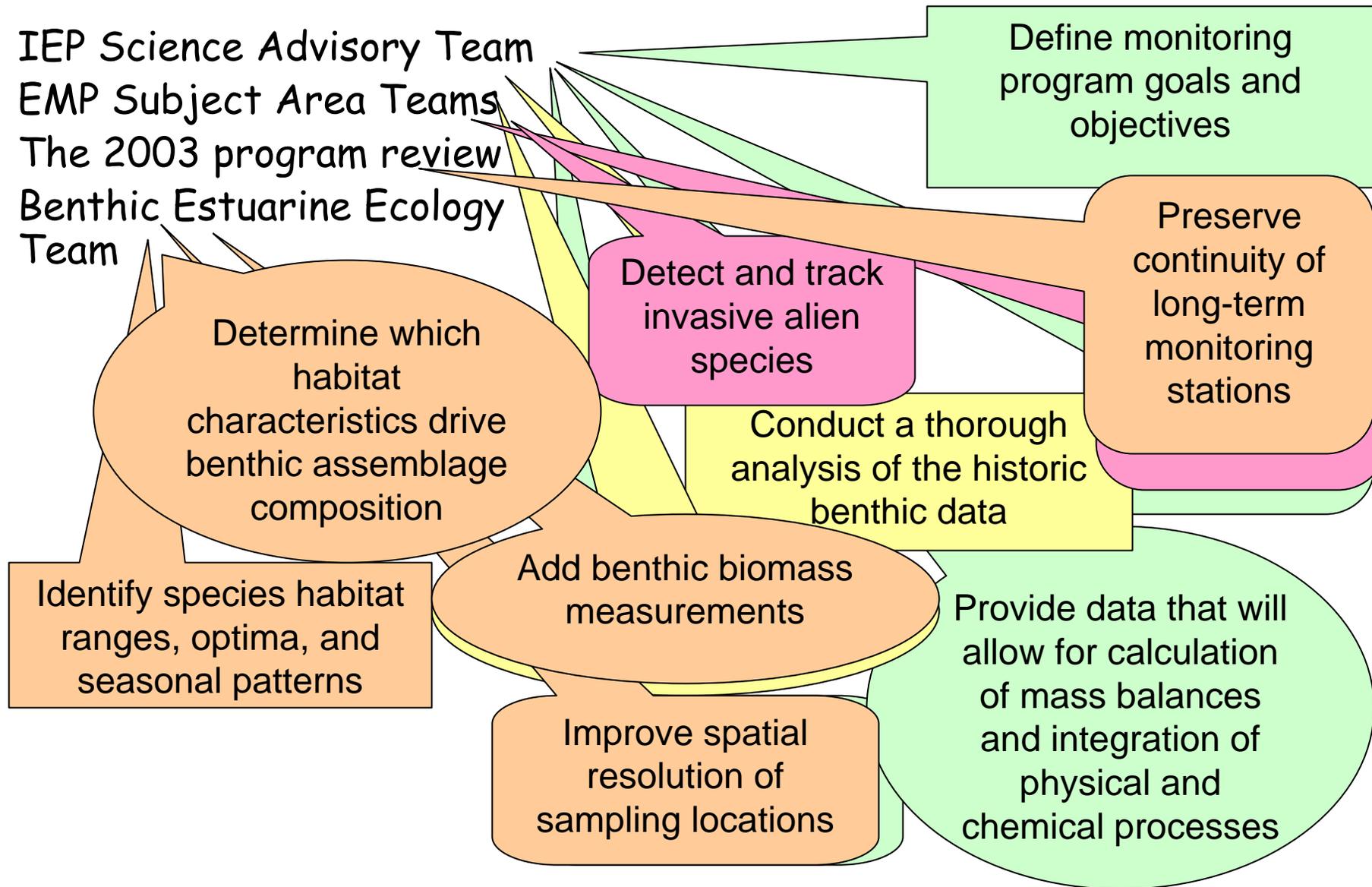
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The current paradigm is shaped by scientific review... and management

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Define monitoring program goals and objectives

Determine which habitat characteristics drive benthic assemblage composition

Detect and track invasive alien species

Preserve continuity of long-term monitoring stations

Conduct a thorough analysis of the historic benthic data

Identify species habitat ranges, optima, and seasonal patterns

Add benthic biomass measurements

Provide data that will allow for calculation of mass balances and integration of physical and chemical processes

- EMP Management:

Plan for no budget increases!

Improve spatial resolution of sampling locations

Three priorities were identified that could satisfy all demands

Plan for no budget increases!

1. Preserve continuity of long-term monitoring stations

2. Improve spatial resolution of sampling location\$\$

3. Add benthic bioma\$\$ measurements

**Data Analysis,
Research,
Special Studies,
Proposal Writing,
Refinement of Goals
+ Assessment of Monitoring Costs**

Balance

Why must there be change?

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- Monitoring goals evolve

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- Sampling or analytical methods evolve

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BUT!!

- No monitoring program can satisfy everyone. The program design must focus on the monitoring goals.

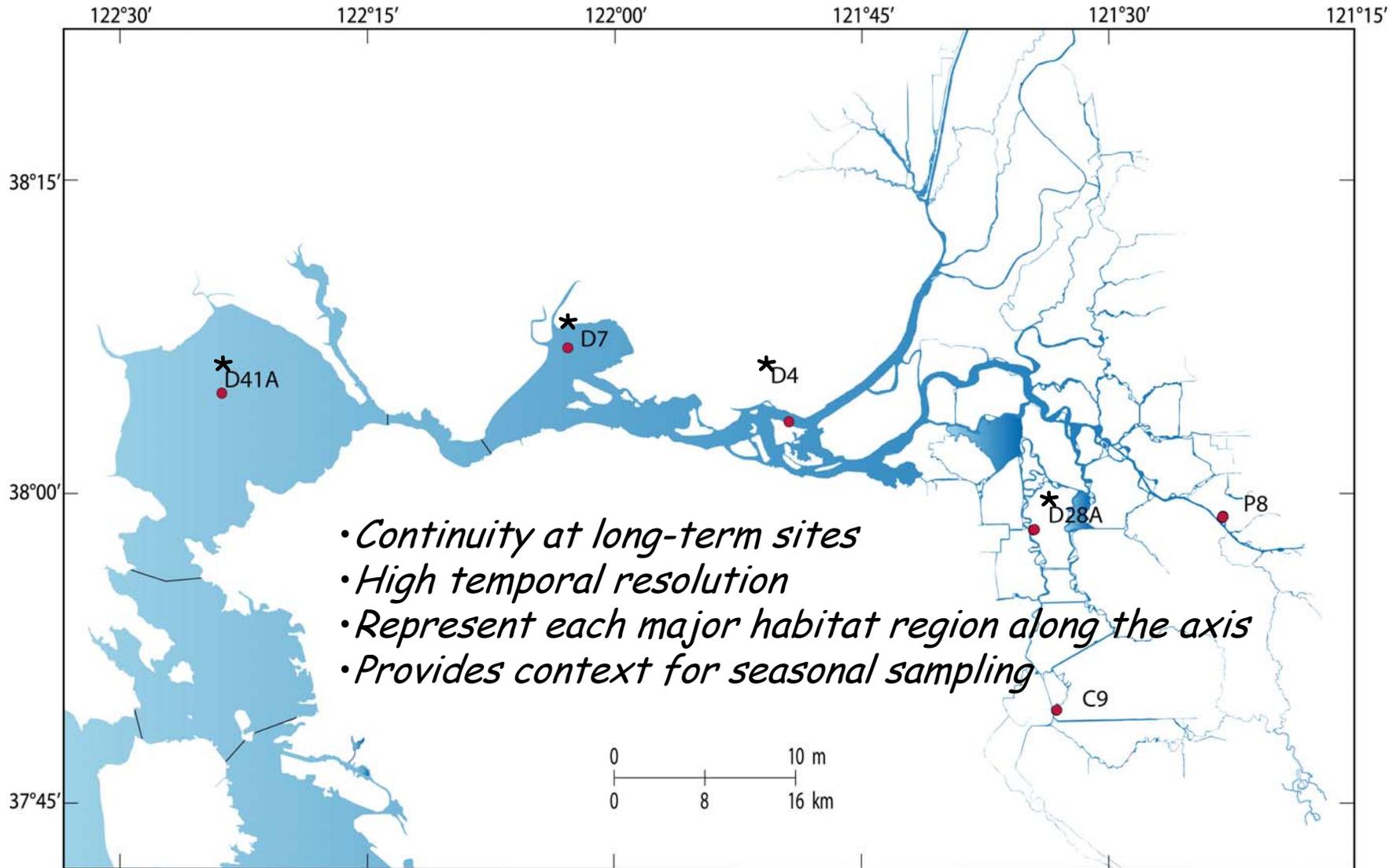
Our program's specific goals

1. Preserve the continuity of the long-term record
2. Detect and track invasive species
3. Document the patterns of assemblage composition at various temporal and spatial scales
4. Document the patterns of biomass in key species

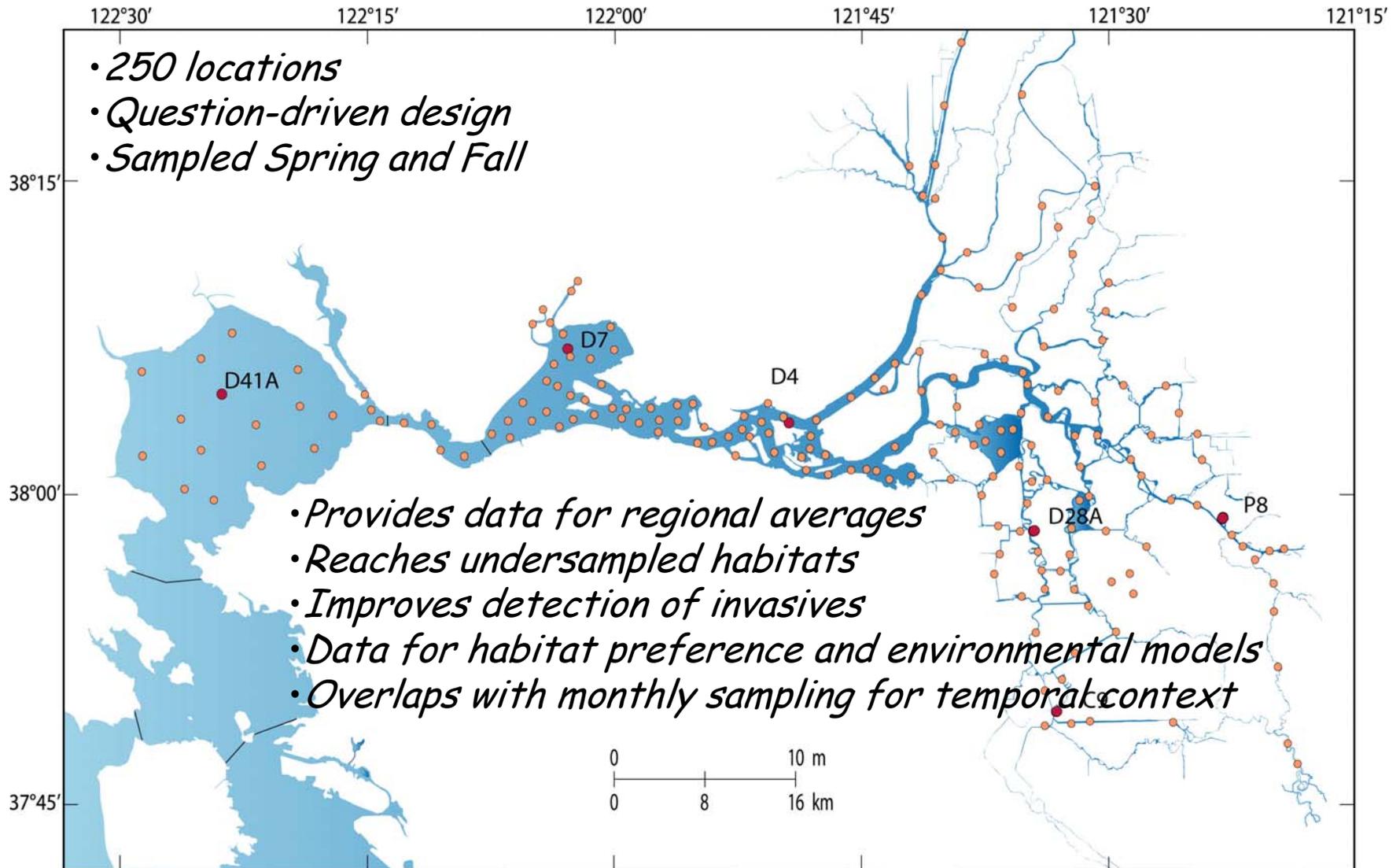
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1) Monthly sampling at 'sentinel' sites



2) Spatially distributed sampling events



3) Adding Biomass to the monitoring data

- Historic sample analysis counted individuals, identified to species
- Data analyses show that changes in benthic assemblage function correspond to changes in ecosystem function
- Biomass data would be used to assess rates and mass transfers associated with benthos

3) Adding biomass to the monitoring data

- Comprehensive biomass measurements are expensive!
- Little outside funding could be found
- Question-based data development
 - Species known to have large-scale effects
 - Species that are important in the food web
 - Species that are important to other studies (opportunistic data development)

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Research and data analysis guided the selection of temporal and spatial scales for the monitoring plan

The details will be discussed

Thursday at 11:45

*Can you teach a long-term benthic monitoring program new tricks?
Assessment and redesign to address different scales,
by Marc Vayssières*

Thank You!

- Thanks to IEP EMP (DWR) for supporting my work on the review.
- Thanks also to Marc Vayssières (DWR) for data analysis

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EMP: <http://iep.water.ca.gov/emp/>