Biological Health of the Malibu Creek Watershed

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Heal the Bay's Mission

- Making southern California's coastal waters and watersheds, including Santa Monica Bay, safe, healthy and clean
- Use science, education, community action, and advocacy to achieve our mission


Malibu
Downtown Los Angeles
Point Dume
Santa Monica
Santa Monica Bay
Long Beach
Palos Verdes Peninsula
Santa Catalina Island

Stream Team Monitoring Program

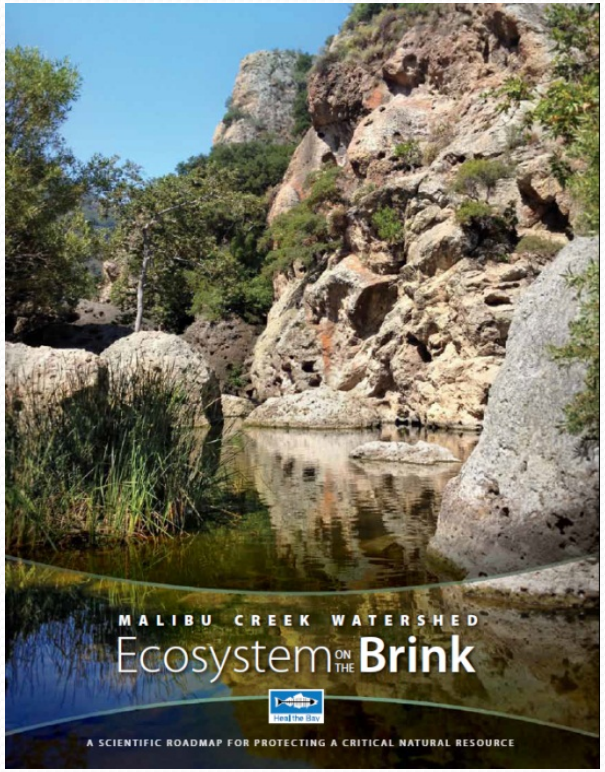
- Started in 1998
- Citizen science program
- Goals to determine and promote the environmental health of the Malibu Creek watershed
  - Collect high quality useable data
  - Monitor stream and water quality conditions
  - Restore stream and riparian habitats
  - Inform local and state-wide policy action related to water and stream quality

Stream Team Program

- Volunteer statistics
  - Since 1998:
    - Over 6,000 volunteers
    - Over 40,000 hrs in watershed from staff and volunteers
  - Currently have over 100 active volunteers
  - In 2013, volunteers donated over 600 hours of time

Malibu Creek Watershed Report

- First time that Stream Team data have been comprehensively analyzed
- Evaluates 12 years of data collected by Heal the Bay's Stream Team staff and volunteers
- Assess the habitat, water quality, and biota of the Malibu Creek Watershed



Malibu Creek Watershed

- 35 miles west of Los Angeles
- Second largest watershed draining to Santa Monica Bay – 110 mi²
- Less than 25% developed

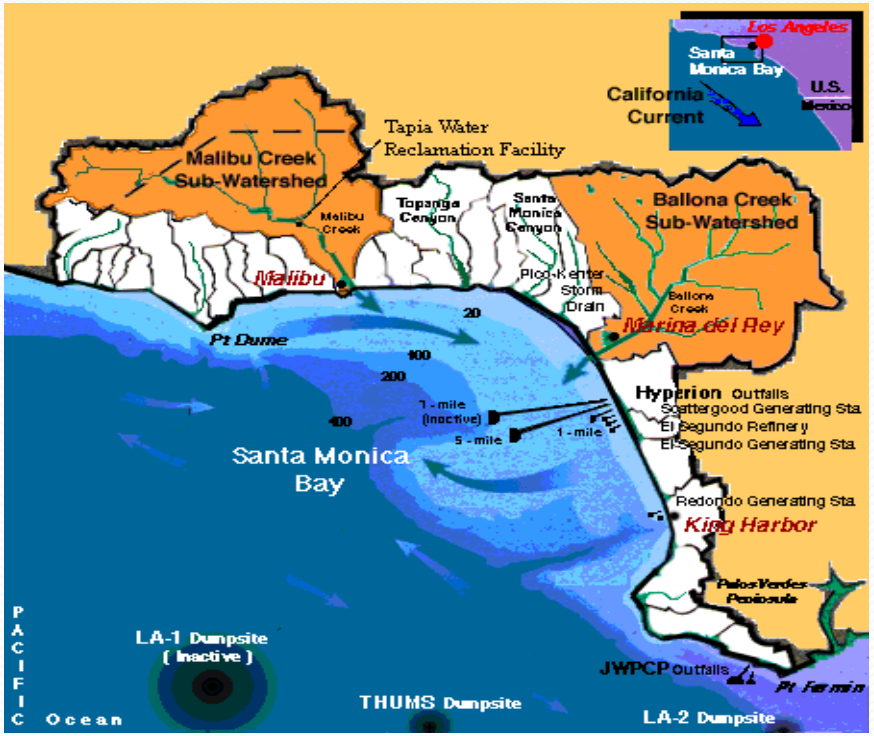
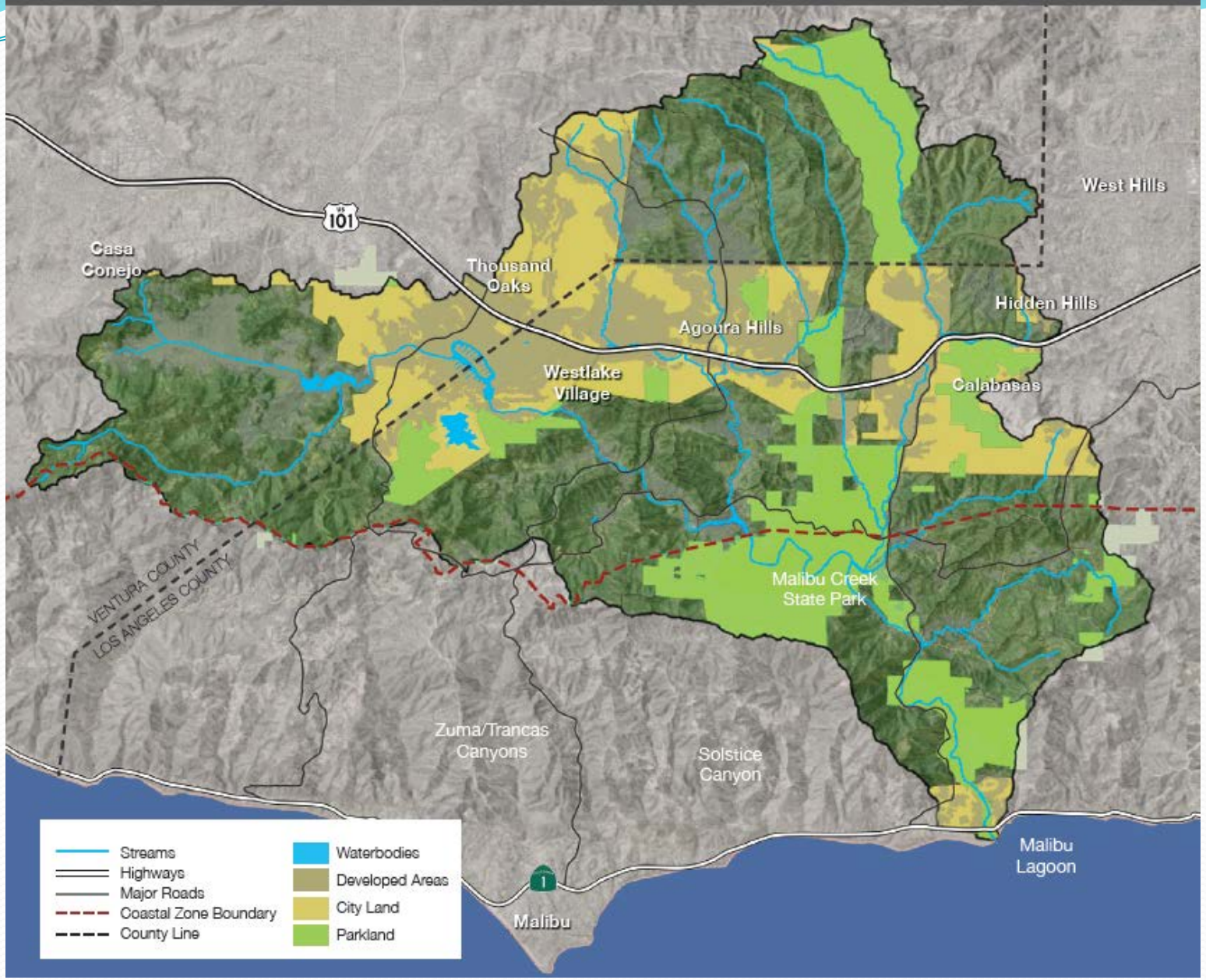


Figure 1-1: Map of the Malibu Creek Watershed



Stream Team Current Projects

- Water chemistry
  - 6 times/year at 12 sites
- Bioassessment
  - Yearly at 4-12 sites
- Freshwater swimming study
  - Pilot project over summer 2014 at 3 sites

Water Chemistry Sampling

- Monthly data from 11-19 sites since 1998
  - Fecal Indicator Bacteria (total coliform, *E. coli*, *Enterococcus*)
  - Nutrients (nitrate, ammonia, phosphate)
  - pH
  - Dissolved Oxygen
  - Turbidity
  - Conductivity
  - Air & water temperature
  - Algae

Figure 1-2: Map of Heal the Bay Monitoring Sites

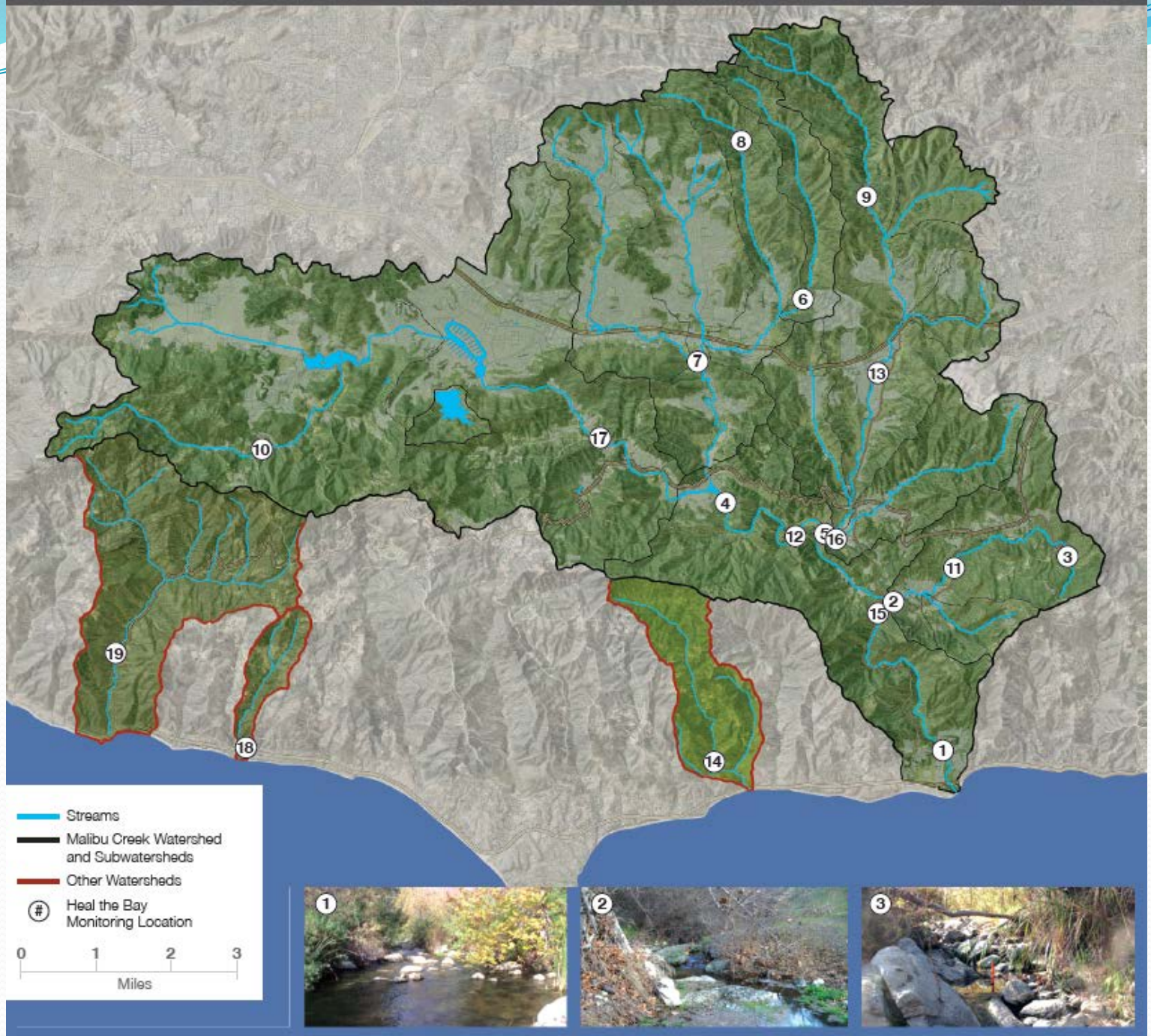
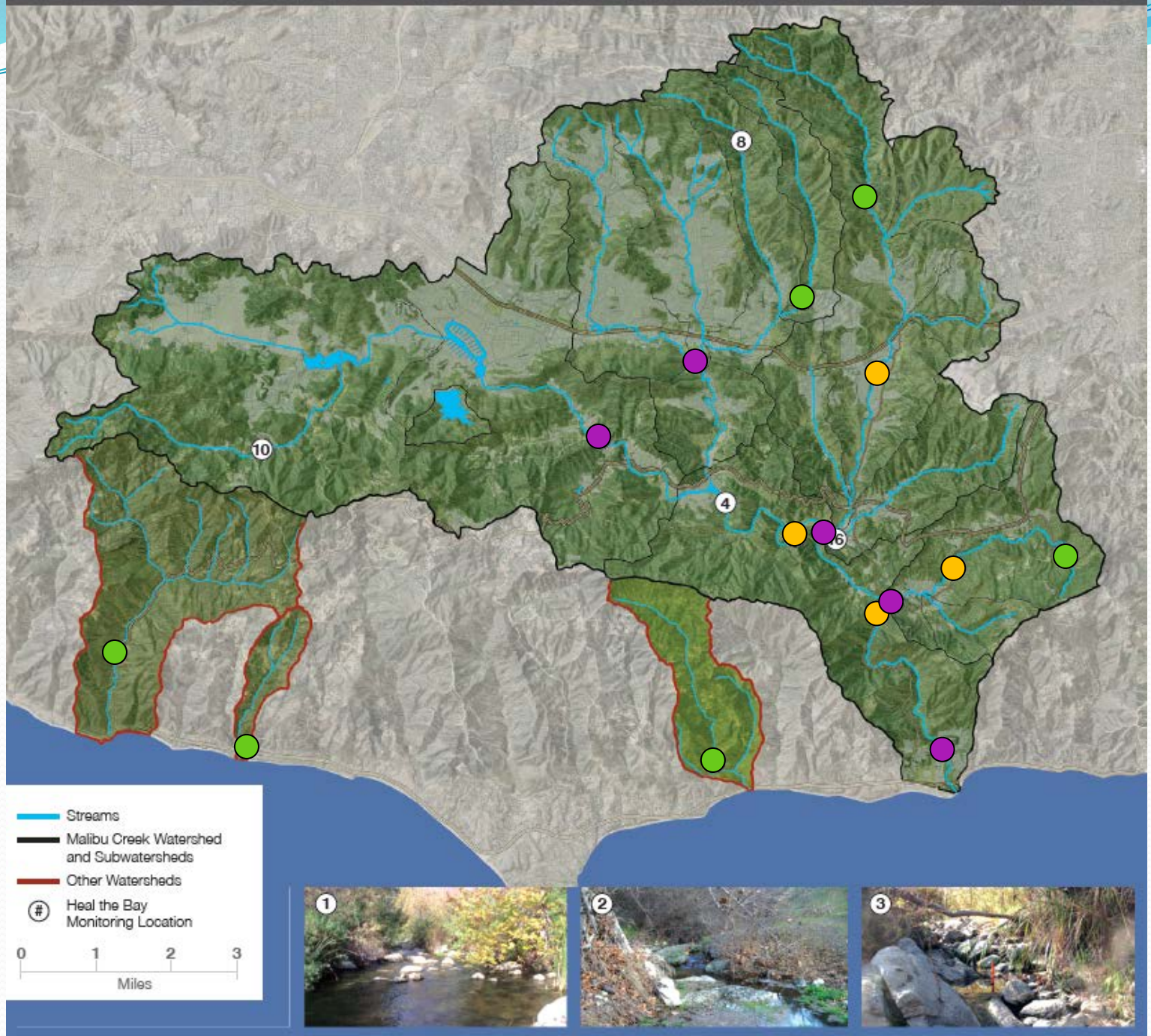
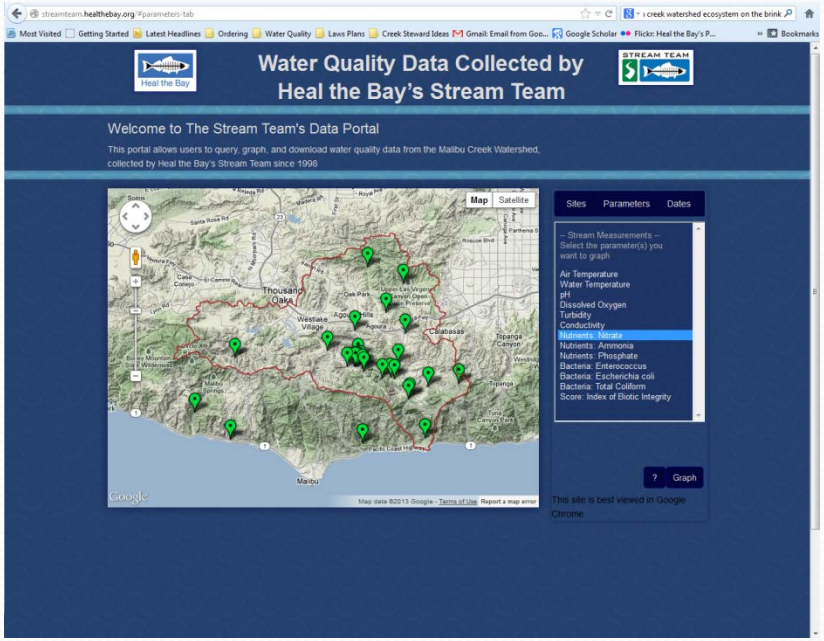


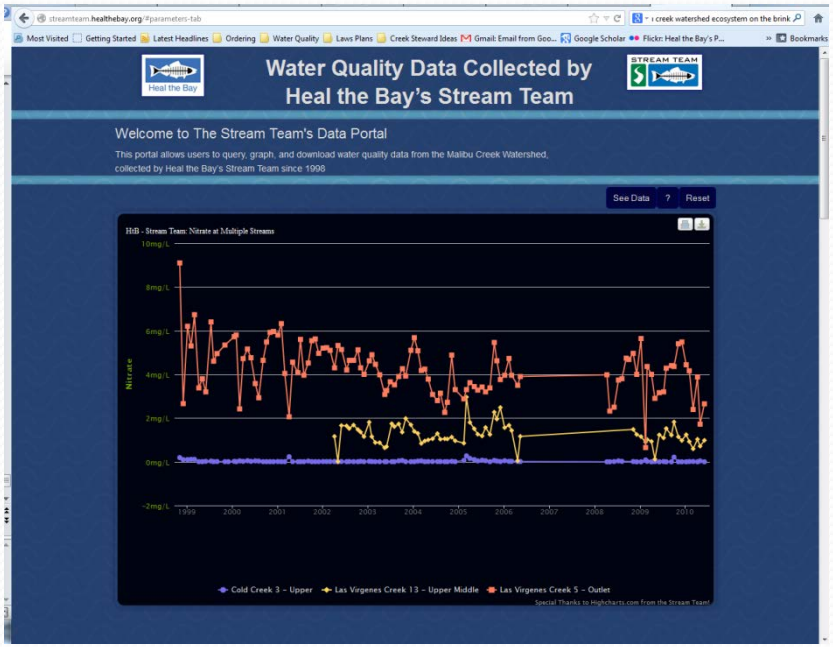
Figure 1-2: Map of Heal the Bay Monitoring Sites



Data are publically available

- www.streamteam.healthebay.org
- View, graph, download all Stream Team data





Policy Outcomes: Listings

- Data used to place stream reaches on Clean Water Act section 303(d) list of Impaired Waterbodies for CA
- Submitted data in 2006, 2008, 2010 to Los Angeles Regional Water Quality Control Board

Policy Outcomes: Listings

- Malibu Creek is listed for:
  - Nutrients (algae)
  - Bacteria
  - Benthic macroinvertebrates
  - Fish barriers (dams)
  - Invasive species
  - Scum/foam unnatural
  - Sedimentation/siltation
  - Trash

Bioassessment Monitoring

- 2000-2006: California Stream Bioassessment Protocol (CSBP) twice a year
- 2008-current: State Surface Water Ambient Monitoring Protocol (SWAMP) once a year
  - Physical habitat
  - Benthic macroinvertebrate sampling

Benthic Macroinvertebrates

Top row: Pollution Tolerant BMI (left to right); Scud, Midge, Snail, Leech. Bottom row: Sensitive BMI larvae (left to right); Dragonfly, Mayfly, Caddisfly, Stonefly.
Photo credit: California Department for Fish and Game, Aquatic Bioassessment Laboratory

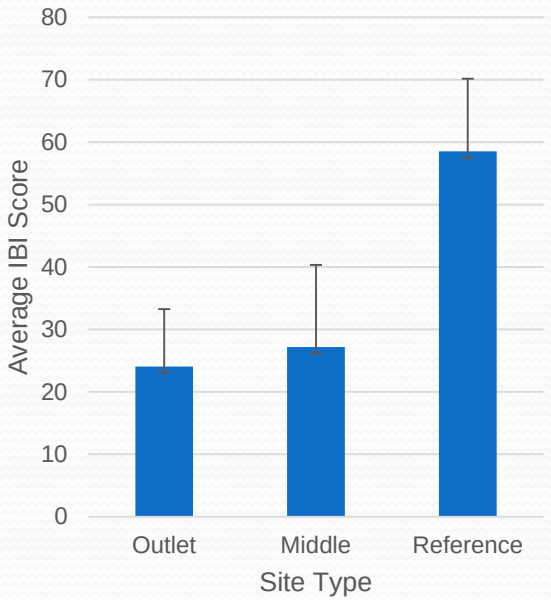
Bioassessment Monitoring

- Use benthic macroinvertebrate data to generate Index of Biological Integrity (IBI)
- Southern California Coastal IBI based on 7 metrics; scale from 0-100
- Score of 39 or lower indicates biological impairment

Excellent	Good	Fair	Poor	Very Poor
81-100	61-80	41-60	21-40	0-20

IBI Decreases from Upper to Lower Watershed

Site	Site #	Average IBI	Average Category	Number Samples
Upper Cold Creek	R3	74	Good	16
Mid-Cold Creek	M11	51	Fair	12
Outlet Cold Creek	O2	38	Poor	11
Upper Las Virgenes Creek	R9	42	Fair	9
Mid-Las Virgenes Creek 1	M13	19	Very Poor	8
Mid-Las Virgenes Creek 2	M30	21	Poor	1
Outlet Las Virgenes Creek	O5	26	Poor	12
Cheeseboro Creek	R6	51	Fair	7
Triunfo Creek	O17	14	Very Poor	10
Medea Creek	O7	19	Very Poor	11
Mid-Malibu Creek 1	M12	23	Poor	14
Mid-Malibu Creek 2	M15	23	Poor	14
Outlet Malibu Creek	O1	23	Poor	12
Solstice Creek 1	R14	66	Good	13
Lachusa Creek	R18	54	Fair	12
Arroyo Sequit	R19	63	Good	13



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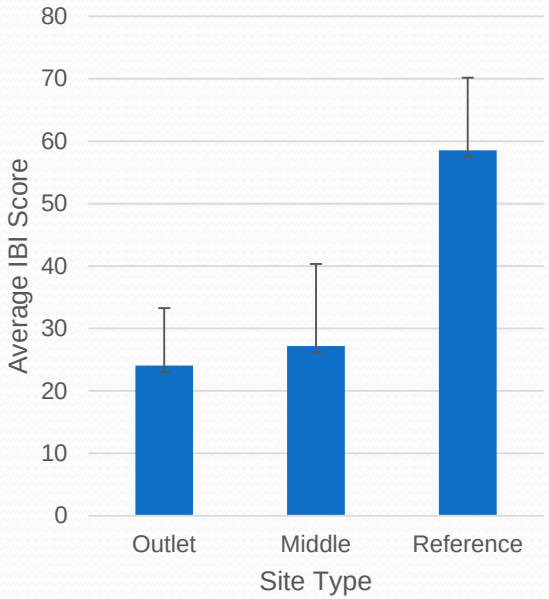
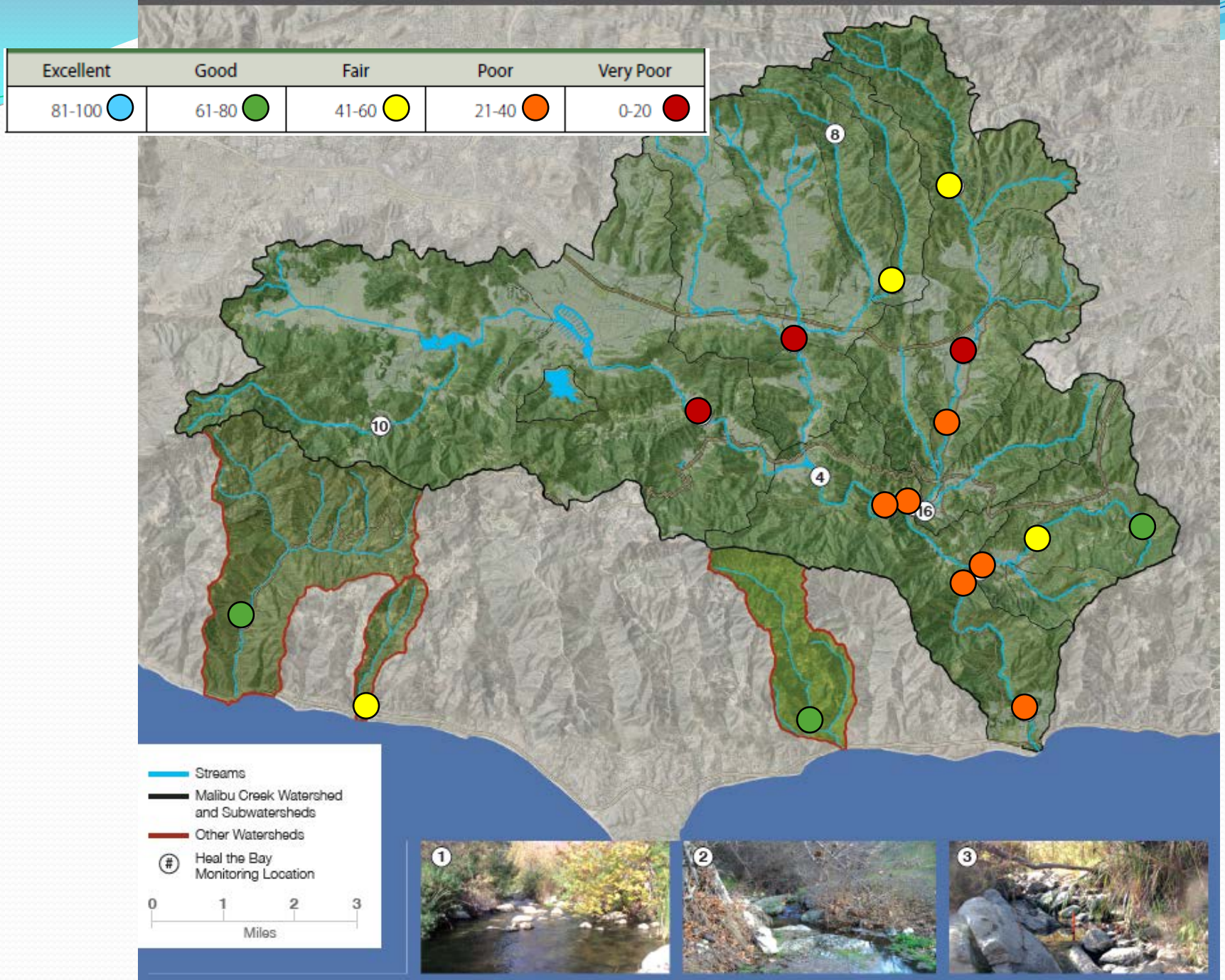
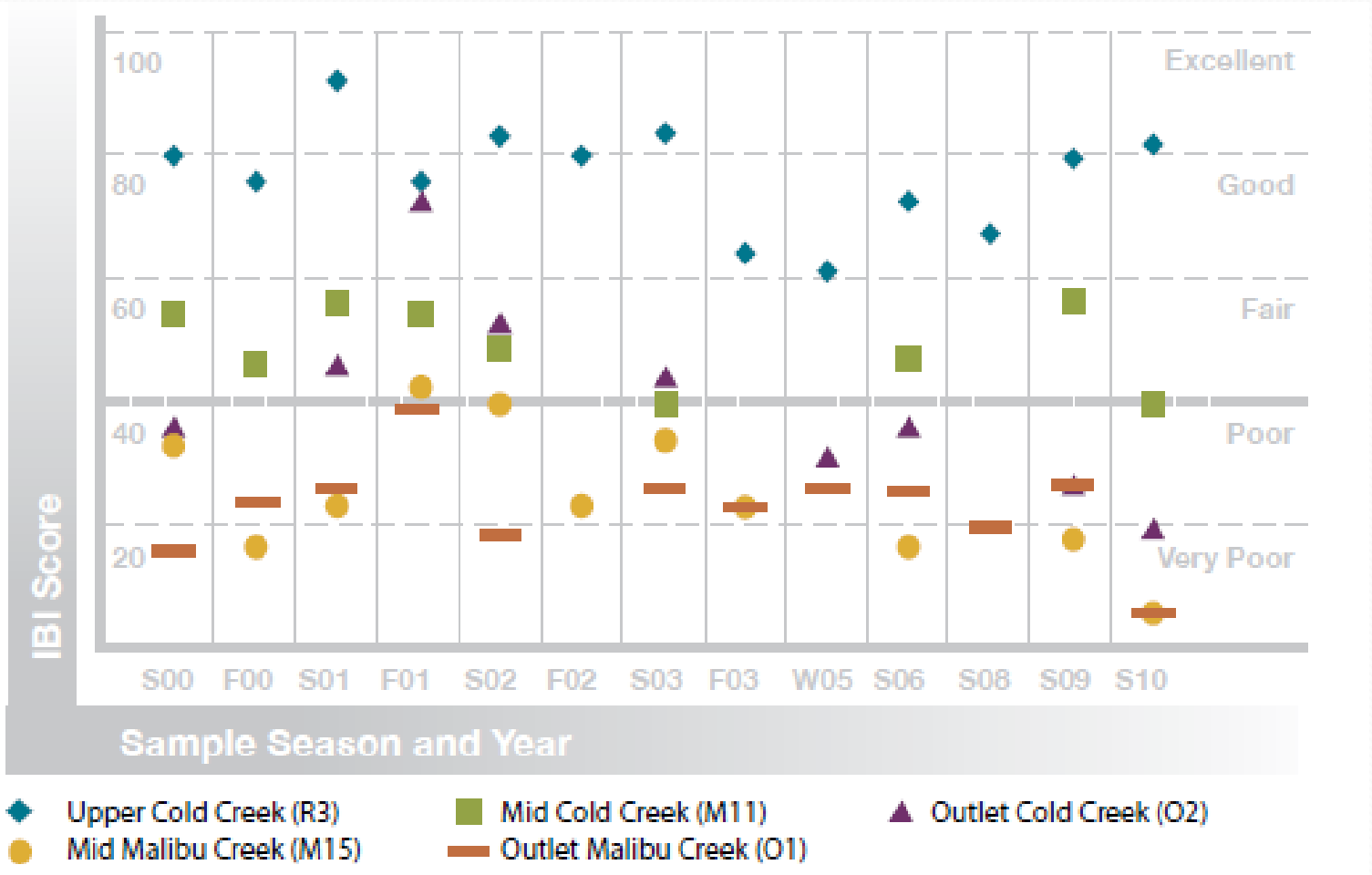


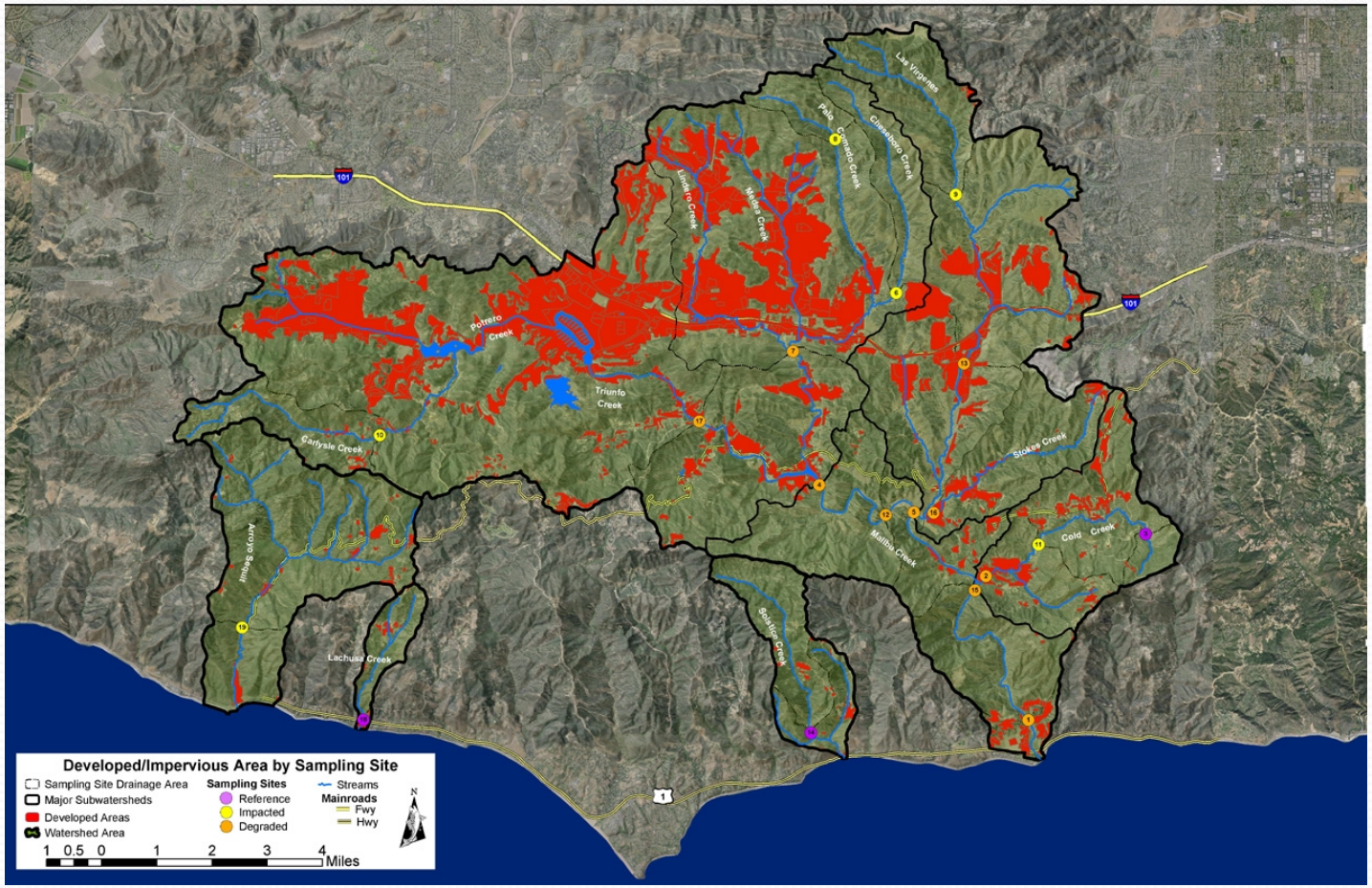
Figure 1-2: Map of Heal the Bay Monitoring Sites



IBI scores over time for 5 sites



Developed/Impervious Area



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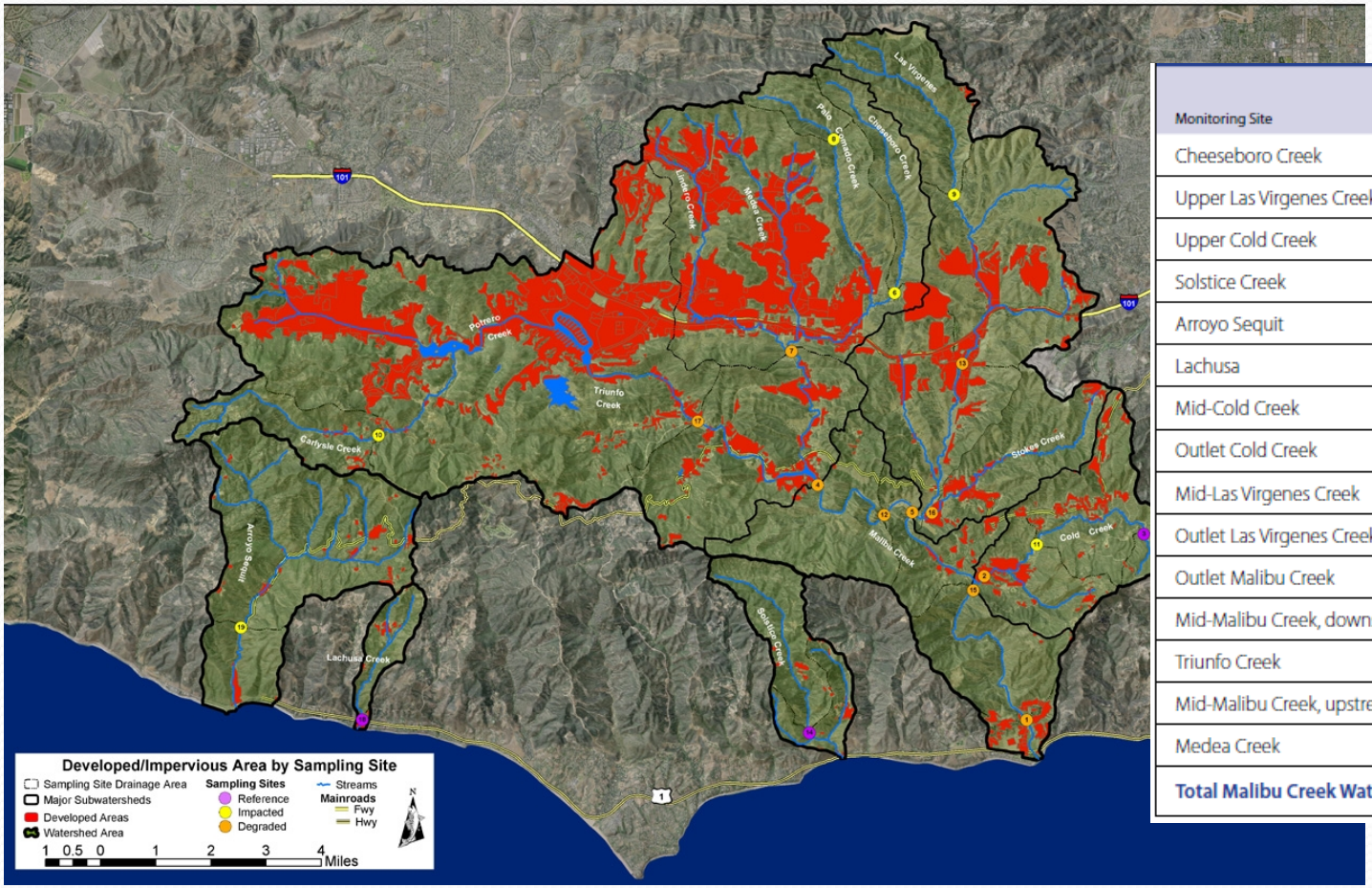
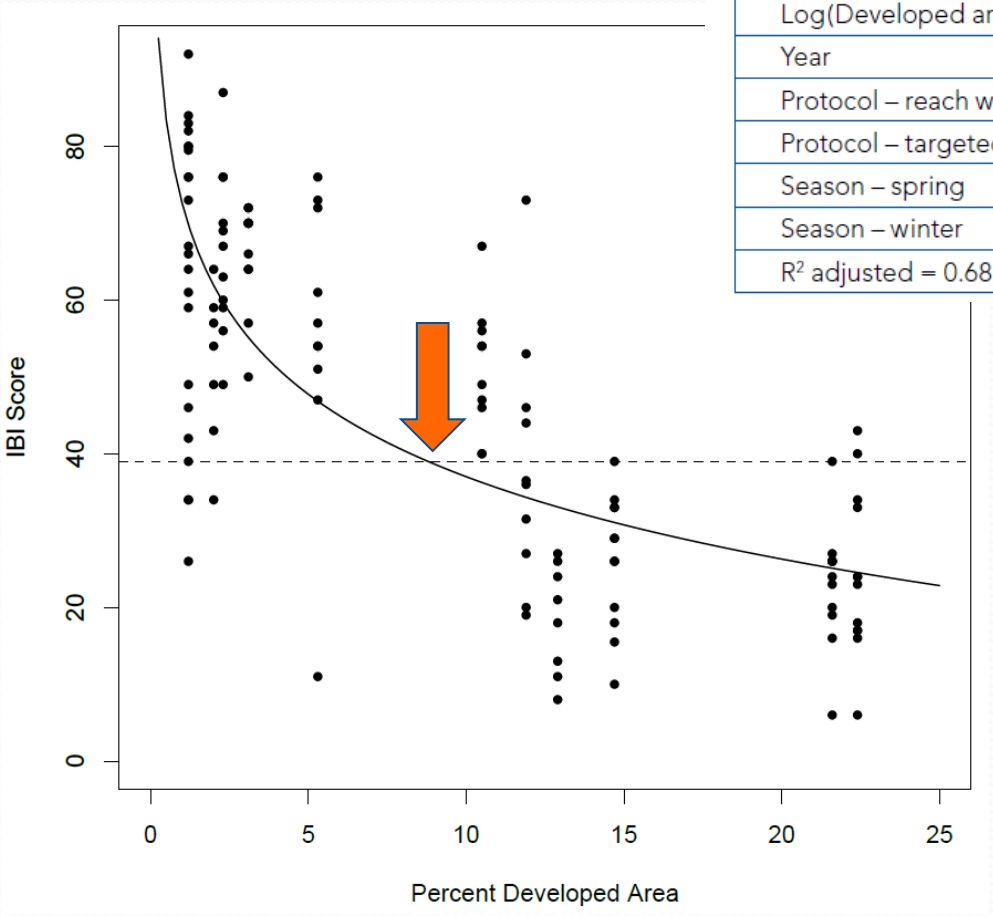


Monitoring Site	Site Name	% Impervious Surface Area Upstream of Site
Cheeseboro Creek	R6	2.1%
Upper Las Virgenes Creek	R9	2.4%
Upper Cold Creek	R3	2.5%
Solstice Creek	R14	2.8%
Arroyo Sequit	R19	2.9%
Lachusa	R18	4.1%
Mid-Cold Creek	M11	5.4%
Outlet Cold Creek	O2	6.1%
Mid-Las Virgenes Creek	M13	8.6%
Outlet Las Virgenes Creek	O5	9.2%
Outlet Malibu Creek	O1	11.7%
Mid-Malibu Creek, downstream	M15	12.1%
Triunfo Creek	O17	13.2%
Mid-Malibu Creek, upstream	M12	14.1%
Medea Creek	O7	21.2%
Total Malibu Creek Watershed		**11.9%**

IBI and % Development

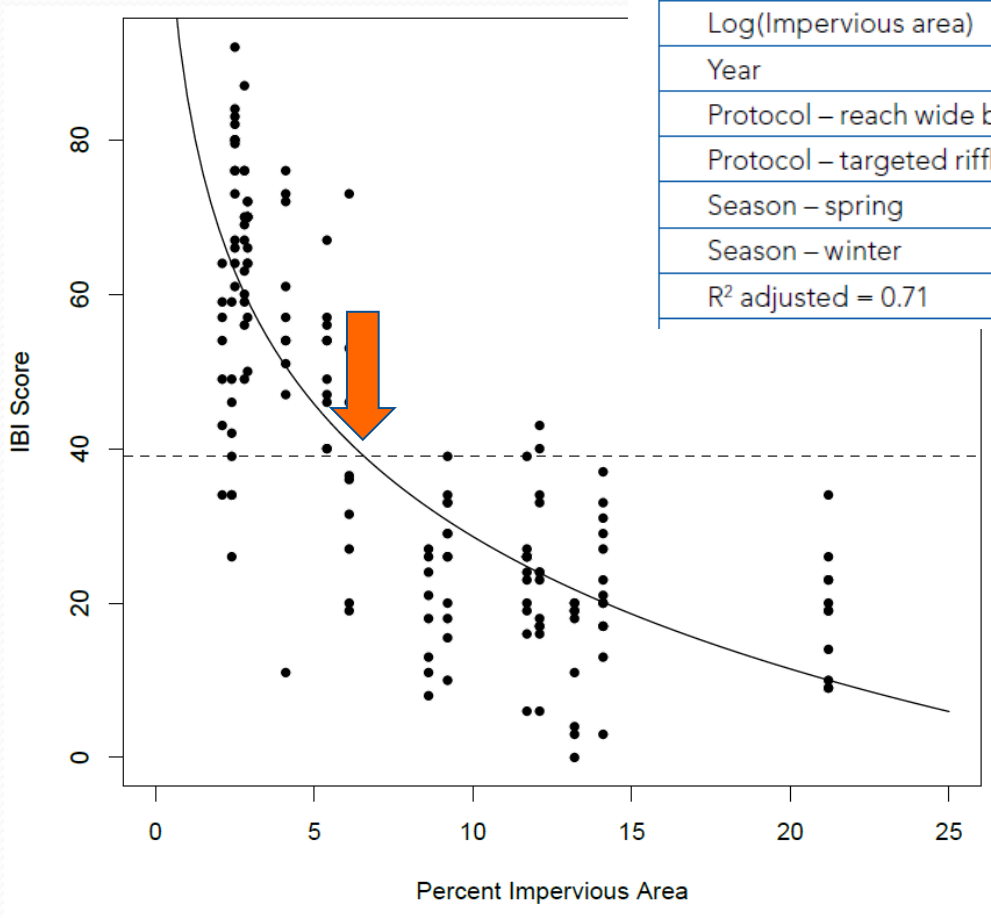
Independent Variable	Coefficient	Std. Error	t-value	p-value
Model 2				
Log(Developed area)	-15.92	0.90	-17.71	<0.001
Year	-1.87	1.11	-1.69	0.09
Protocol – reach wide benthos	6.05	9.16	0.66	0.51
Protocol – targeted riffle composite	-3.44	6.03	-0.57	0.57
Season – spring	-2.41	2.84	-0.85	0.40
Season – winter	-4.54	5.72	-0.79	0.43
R^2 adjusted = 0.68				



Best-fit trendline crosses
IBI=39 at 8.8% developed area

IBI and % Impervious Area

Independent Variable	Coefficient	Std. Error	t-value	p-value
Model 1				
Log(Impervious area)	-25.54	1.35	-18.94	<0.001
Year	-2.03	1.06	-1.91	0.06
Protocol – reach wide benthos	7.26	8.75	0.83	0.41
Protocol – targeted riffle composite	-2.90	5.76	-0.50	0.61
Season – spring	-3.12	2.71	-1.15	0.25
Season – winter	-4.91	5.46	-0.90	0.37
R^2 adjusted = 0.71				



Best-fit trendline crosses
IBI=39 at 6.6% impervious area

Conclusions & Future directions

- Evidence of biological degradation in watershed
  - Advocate for limits on development and imperviousness
  - Promote low impact development (LID)
- Additional stressor assessment
- Examine SWAMP physical habitat variables

Policy Outcomes: TMDL

- Benthic macroinvertebrate TMDL to address biological impairments in Malibu Creek & tributaries
- Submitted Heal the Bay's water chemistry and biological data and report to U.S. EPA
- Data were integral in the TMDL which determined that nutrients and sediment were the cause of biological impairments and set lower limits for both



Impacts of Invasive New Zealand Mudsnails

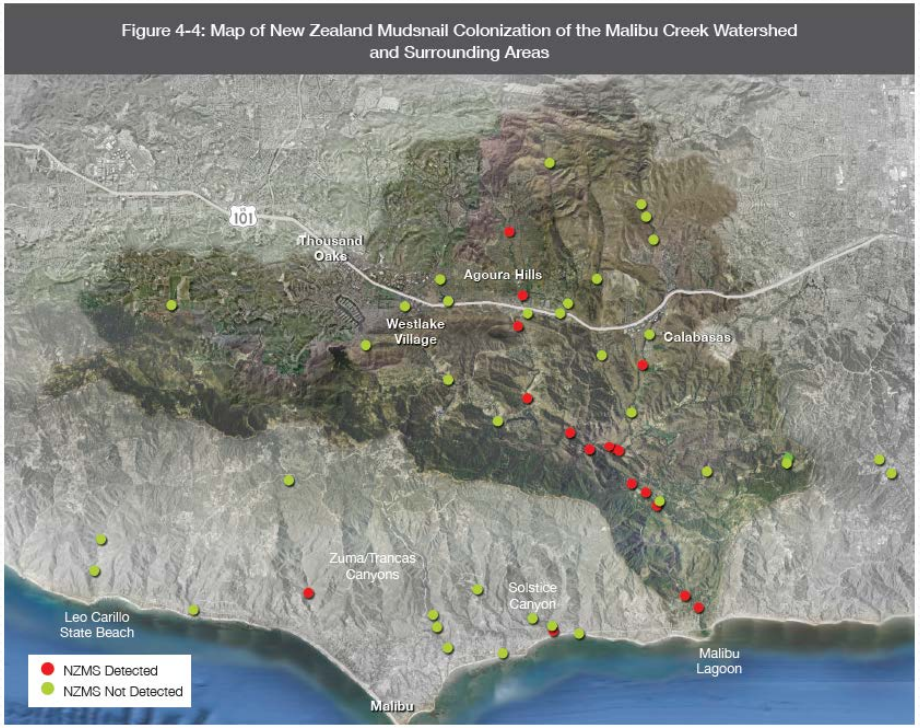
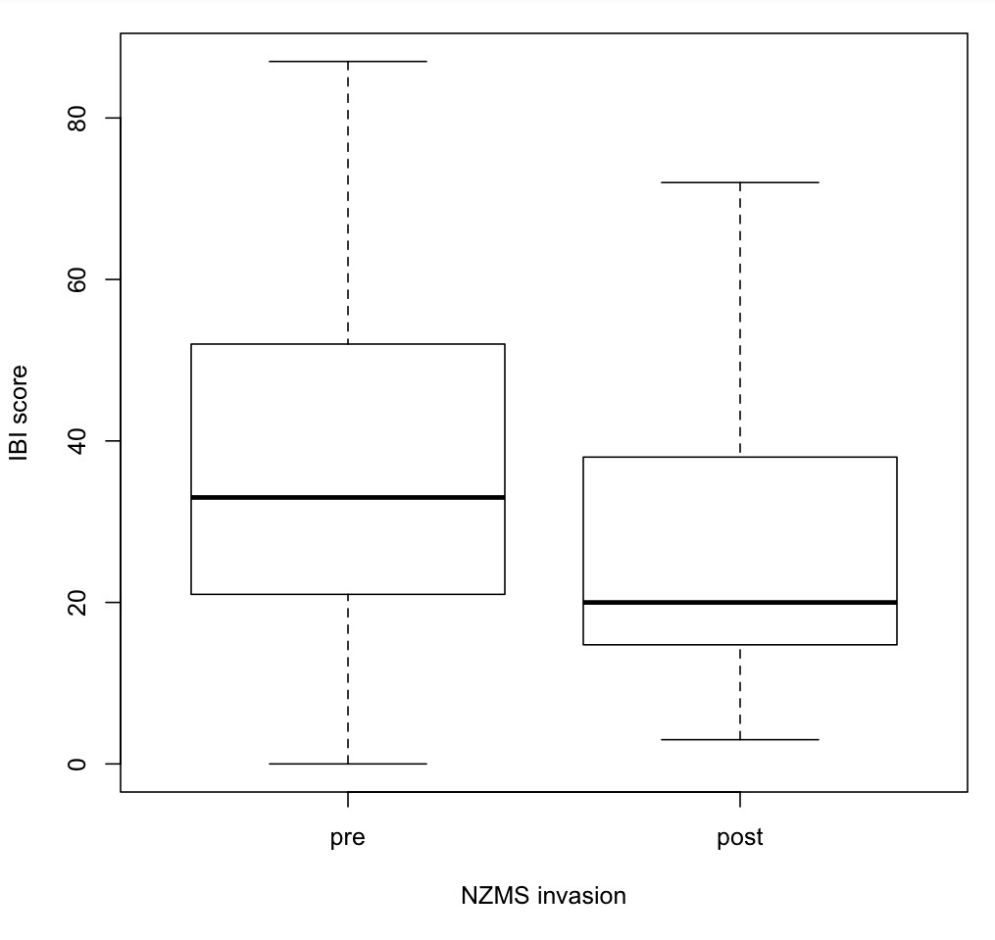


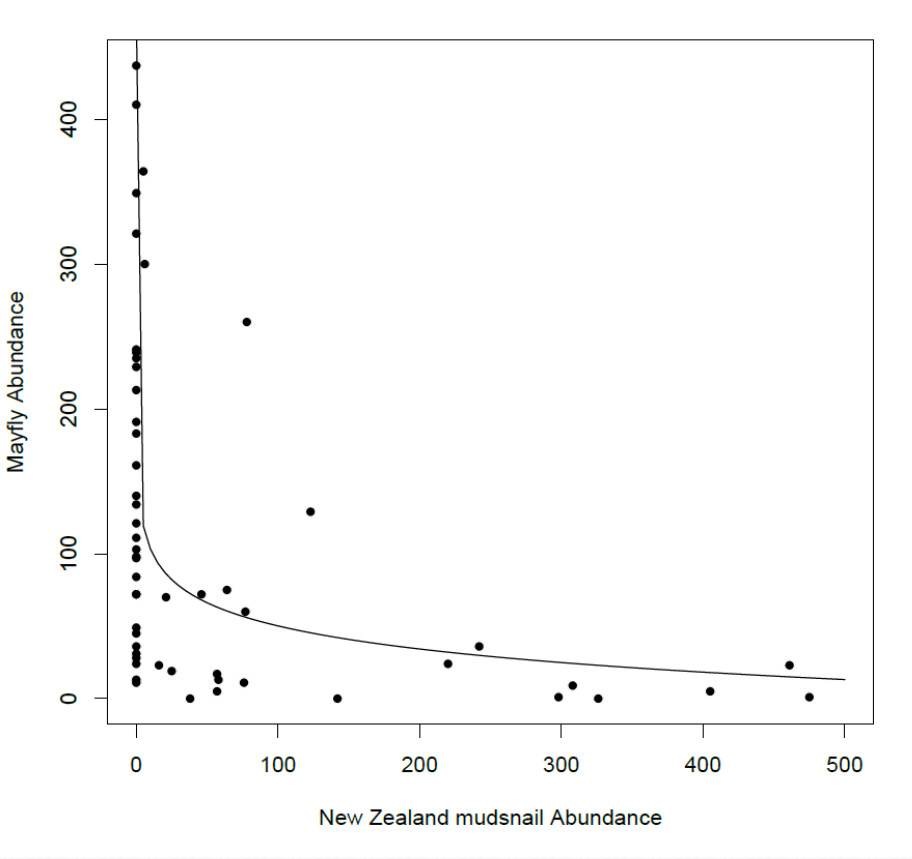
FIGURE 4-4: New Zealand mudsnails (NZMS) were detected at red locations, and were not detected at green locations (surveys through 2008). Monitoring was conducted by Heal the Bay, SMBRC, and UCLA.

IBI scores are lower post-NZMS invasion



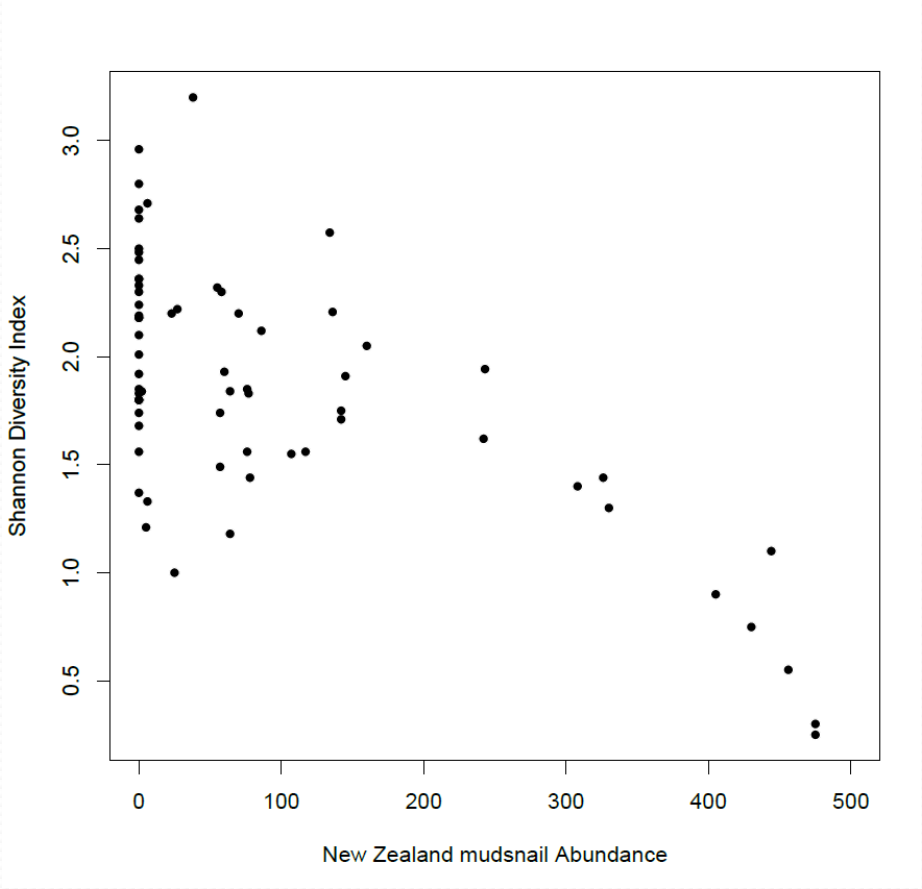
- Data from 12 sites 2000-2013
- Significant difference: T_{89}=-2.494, p=0.015

NZMS impacts on benthic macroinvertebrates



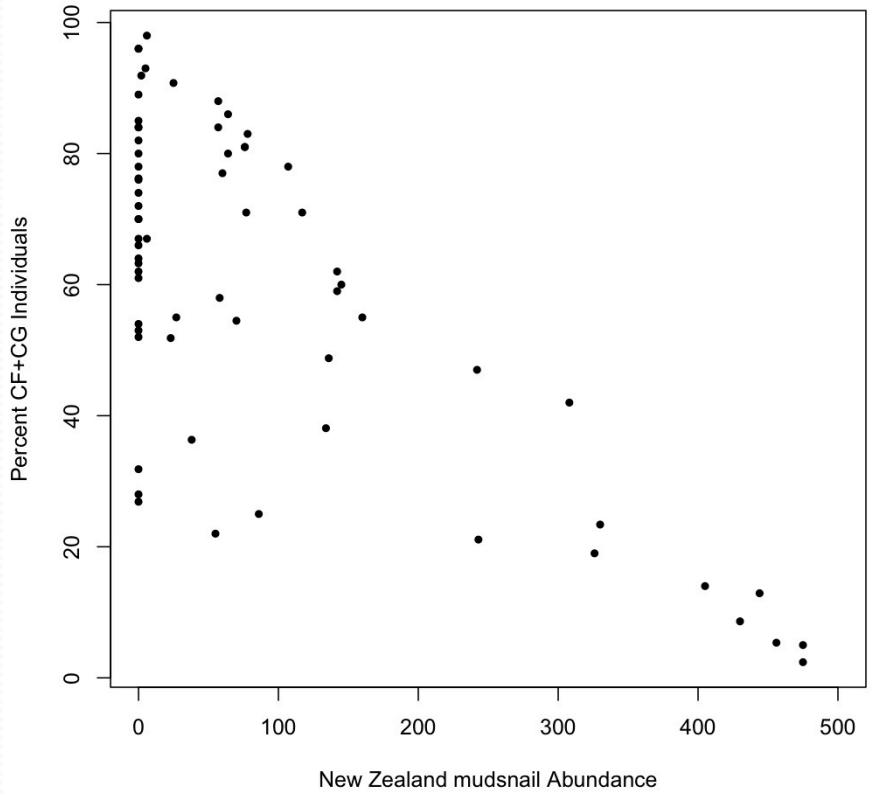
- Mayfly (*Baetis*) abundance is negatively related to NZMS abundance

NZMS impacts on diversity



- Benthic macroinvertebrate diversity decreases as NZMS abundance increases

NZMS impacts on CF+CG



- Percent CF+CG individuals decreases as NZMS abundance increases

Future Directions

- Examine response of other taxa and metrics to NZMS abundance/presence
- Include other explanatory factors: water quality, rainfall
- Also examining impacts of invasive crayfish on BMI

Acknowledgements

- Stream Team volunteers and interns
- Heal the Bay staff
- Partners: National Park Service, State Parks, Mountains Restoration Trust, RCD-SMM, The Bay Foundation
- Jim Harrington
- Funding agencies