

State of the Malibu Creek Watershed: Results from 12 Years of Citizen Monitoring

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Heal the Bay: Santa Monica, CA

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Outline

- Introduction
- Stream Team monitoring program
- Results of monitoring
 - Water quality
 - Bioassessment
 - Stream Health Index
- Recommendations

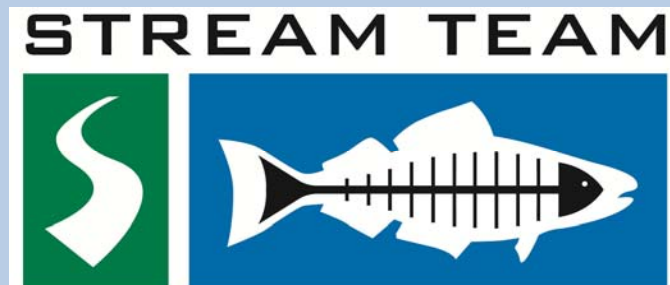
Background: Heal the Bay

- Mission: making southern California's coastal waters and watersheds, including Santa Monica Bay, safe, healthy and clean
- Founded in 1985, Stream Team in 1998



Background: Stream Team

- Citizen based program
- Objectives to determine and promote the environmental health of the watershed
 - Collect high quality useable data
 - Monitor stream and water quality conditions
 - Restore stream and riparian habitats
 - Inform local and state-wide legislation related to water and stream quality



Malibu Creek Watershed

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



Stream Team Monitoring Program

- Approach to citizen science
 - Over 6,000 volunteers
 - Staff & volunteers: over 40,000 hrs in watershed
 - Promote stewardship
 - Train volunteers
 - Cost-effective



Three Elements of Monitoring



Stream Walk



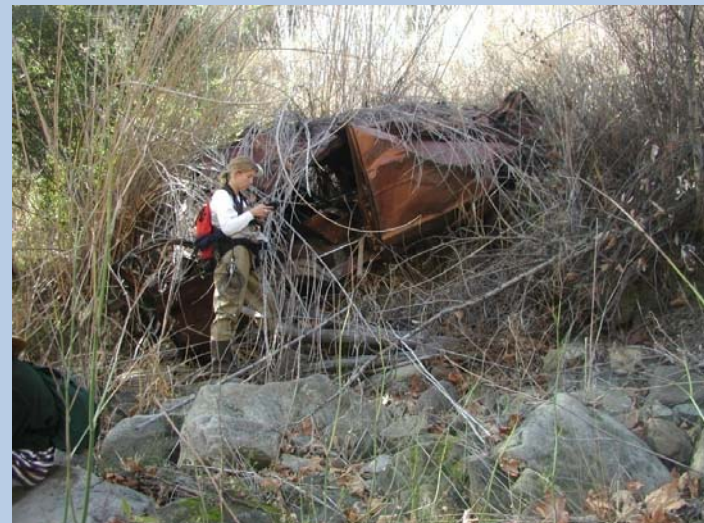
Water Chemistry



Biological Assessment

Stream Walk: 1999-2003

- Mapped 70 miles for:
 - Illegal dump sites
 - Invasive vegetation
 - Impacting land uses
 - Discharge points and outfalls
 - Unstable bank conditions
 - Artificial streambank modifications
 - Barriers to fish passage



Water Chemistry Sampling

SITES

- Reference Sites/
Minimally Impacted
- Middle Sites
- Outlet Sites



Water Chemistry Sampling

- Monthly high quality data from 11-19 sites
 - Bacteria (total coliform, *E. coli*, *Enterococcus*)
 - Nutrients ($\text{NO}_3+\text{NO}_2\text{-N}$, $\text{NH}_3\text{-N}$, PO_4)
 - pH
 - Dissolved Oxygen
 - Turbidity
 - Conductivity
 - Air & water temperature
 - Algae



Bioassessment Monitoring

- 2000-2006: California Stream Bioassessment Protocol (CSBP) twice a year
- 2007-2010: SWAMP SOP once a year
 - Physical Habitat
 - Benthic macroinvertebrate sampling
 - Generate Index Biological Integrity (IBI) score



Practical Uses of Data

- List reaches of watershed on 303(d) list of impaired waterways
- Develop TMDLs for certain pollutants in watershed
- Influence Tapia wastewater treatment plant permits
- Identify stream barriers to be removed

Results of Monitoring

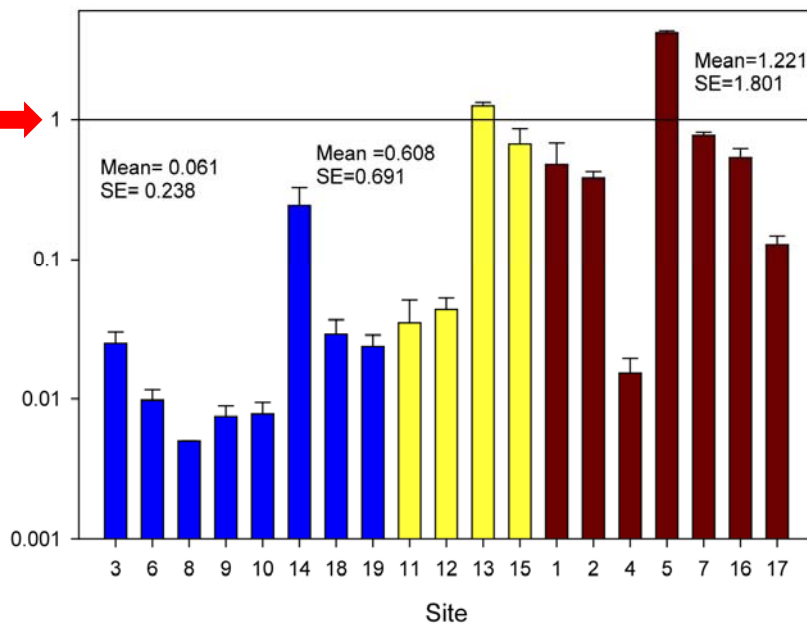
- Water quality
 - Nutrients
 - Bacteria
- Bioassessment
- Stream Health Index (SHI)



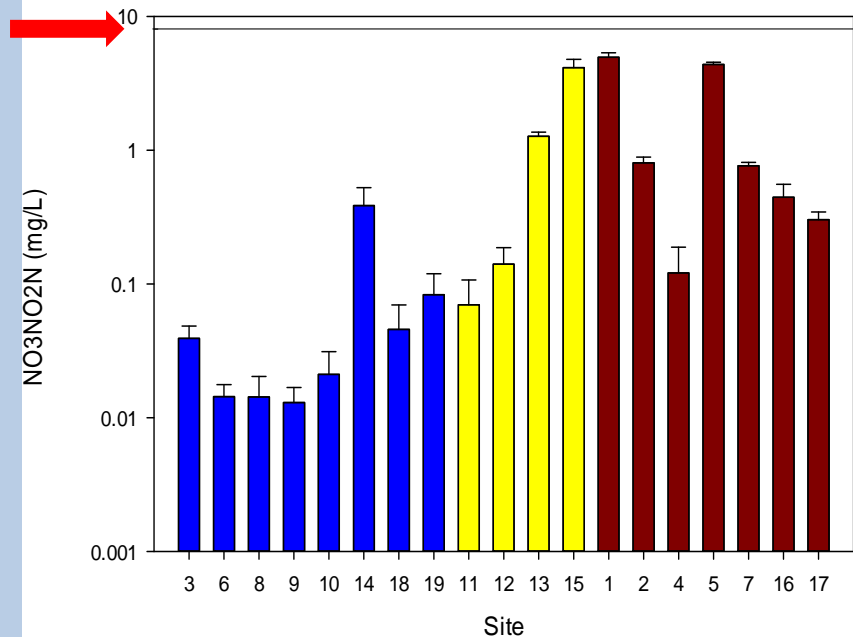
Results: Nutrient levels are high

- Increasing trend from upper to lower watershed

Mean Nitrogens Dry



Mean Nitrogens Wet Season

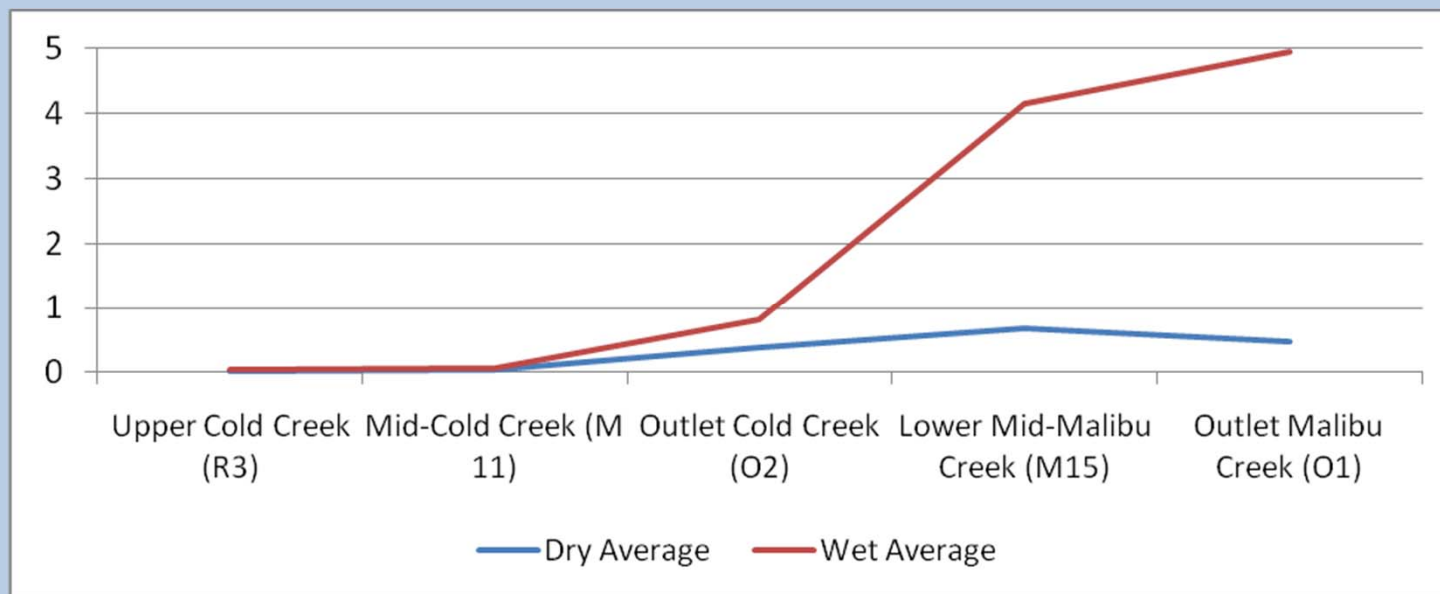


■ Reference Sites ■ Middle Sites ■ Outlet Sites

→ US EPA total Nitrogen TMDL for dry and wet seasons

Results: Nutrient levels are high

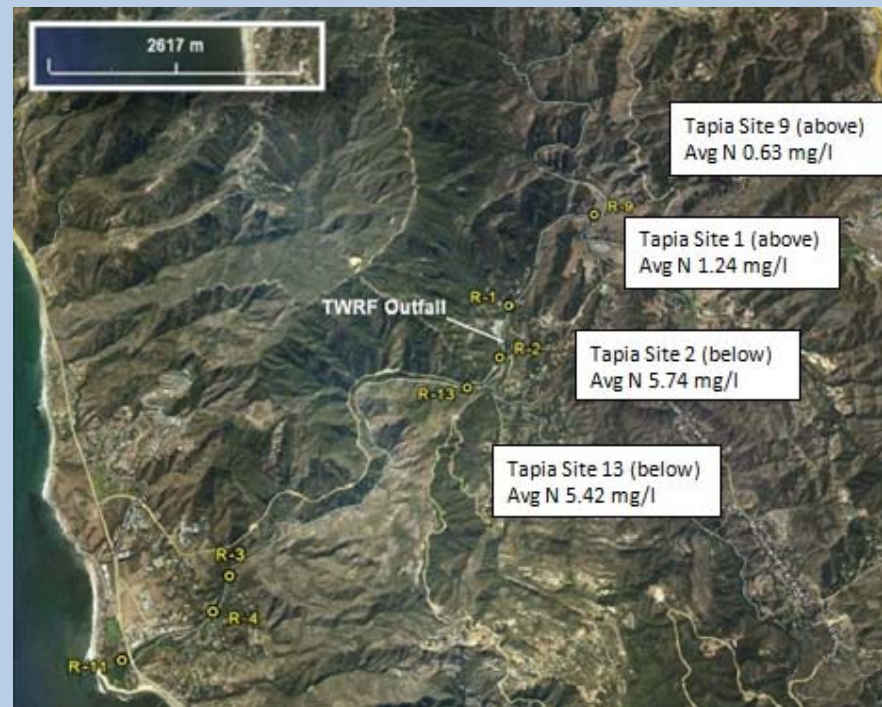
- Increasing trend from upper to lower watershed



Average Total Nitrogen (mg/L) by site along transect

Results: Nutrient levels are high

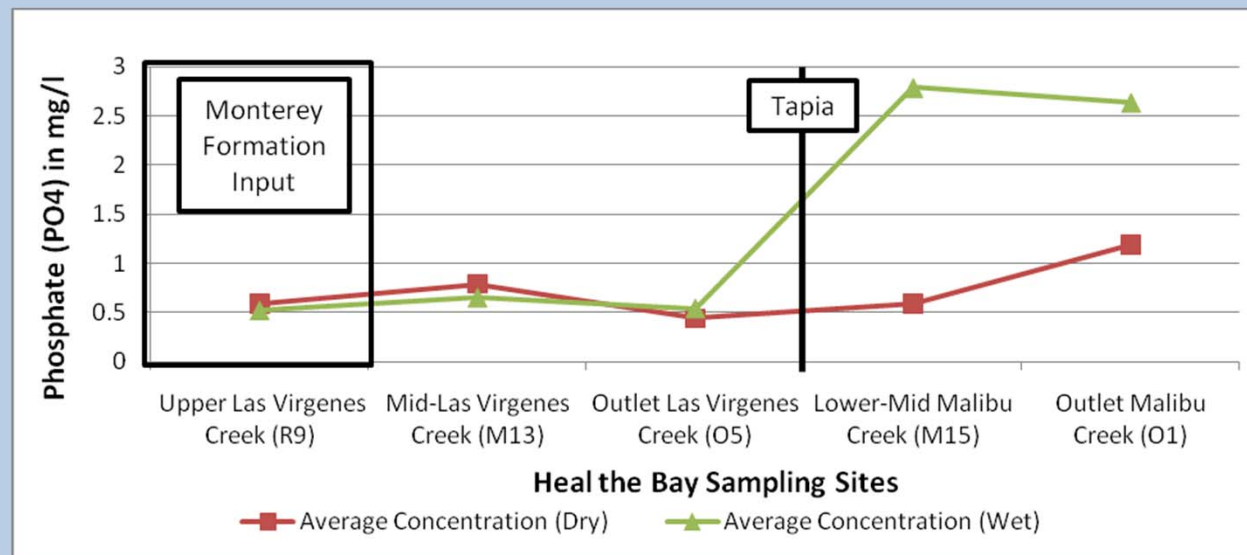
- Contributing factors
 - Wastewater treatment plant, agricultural facilities, golf courses, runoff from residential areas



Average Total Nitrogen (mg/L) by site along transect from 2006-2009 wet seasons

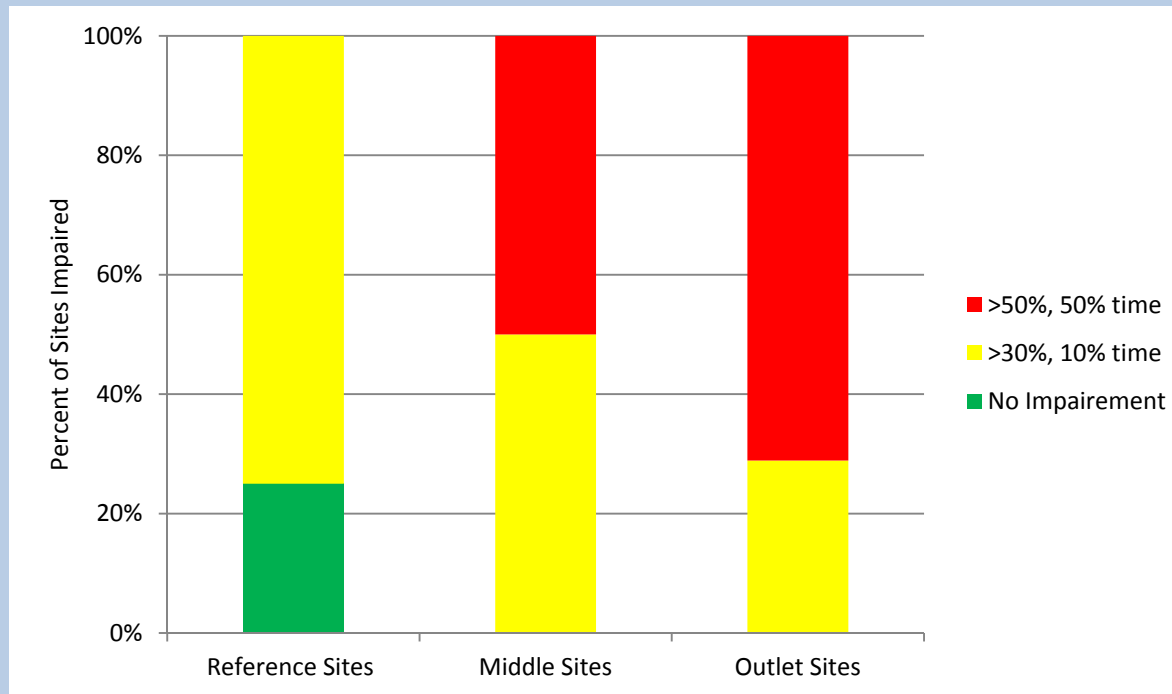
Results: Nutrient levels are high

- Contributing factors
 - Wastewater treatment plant, agricultural facilities, golf courses, runoff from residential areas



Average Total Phosphate (mg/L) by site along transect
TMDL of 0.1 mg/L

Results: Algal Impacts



Algal nuisance level impairment by site type between 2001 and 2003

Results: Bacteria levels increase from upper to lower watershed

Fecal Indicator Bacteria Exceedances by Site Type from Upper to Lower Watershed

	<i>E Coli</i> Exceedances (>235/100ml)		<i>Enterococcus</i> Exceedances (>61/100ml)	
	Percent Exceeding (Wet Season)	Percent Exceeding (Dry Season)	Percent Exceeding (Wet Season)	Percent Exceeding (Dry Season)
Reference	9%	5%	17%	40%
Middle	39%	22%	48%	54%
Outlet	46%	24%	45%	62%

Results: Bacteria

- Contributing factors
 - Failing/old septic systems
 - Lower watershed has no centralized wastewater treatment plant
 - Runoff from agricultural & equestrian facilities
 - Runoff from residential areas

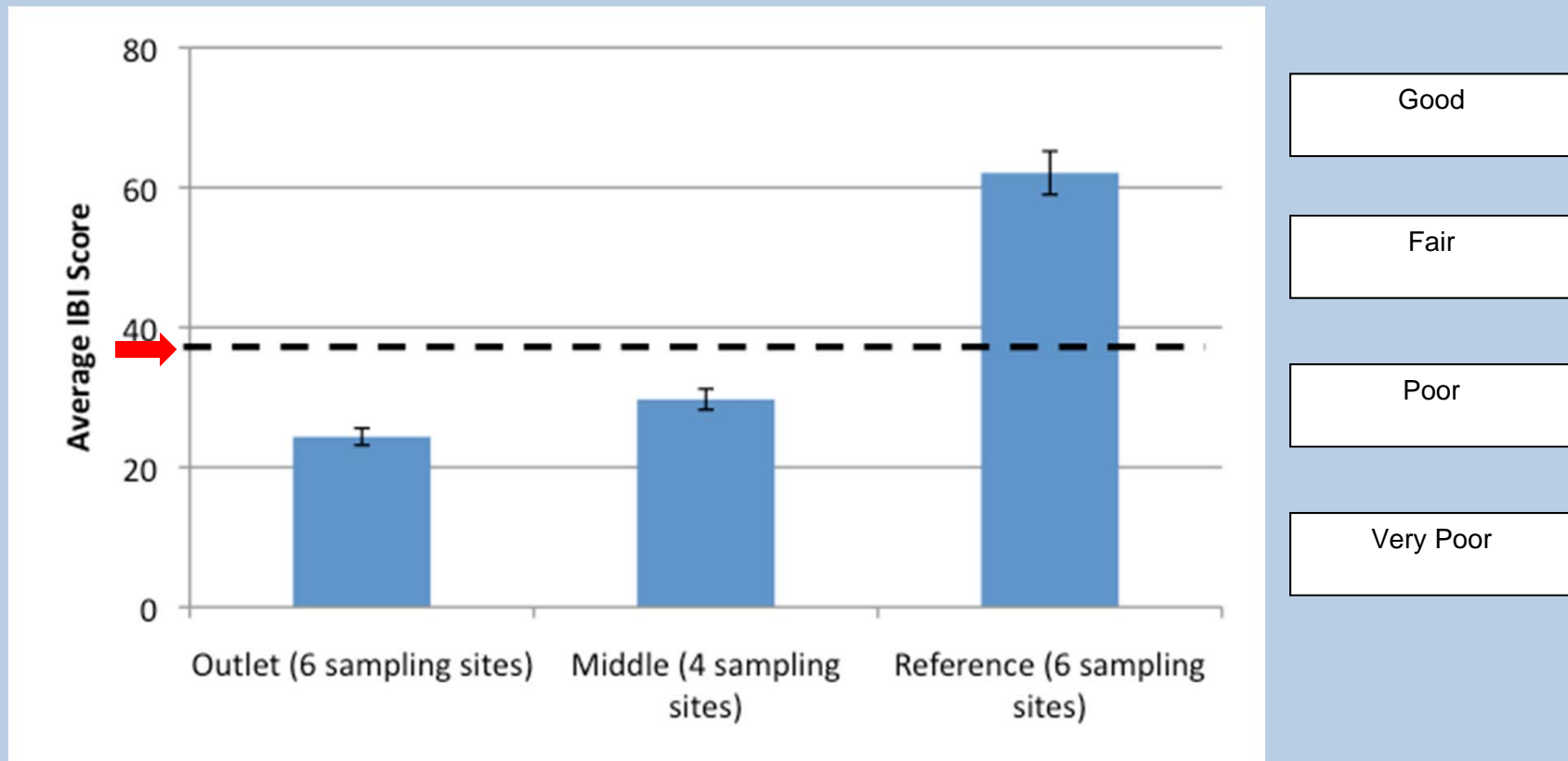


Results: Bioassessment

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

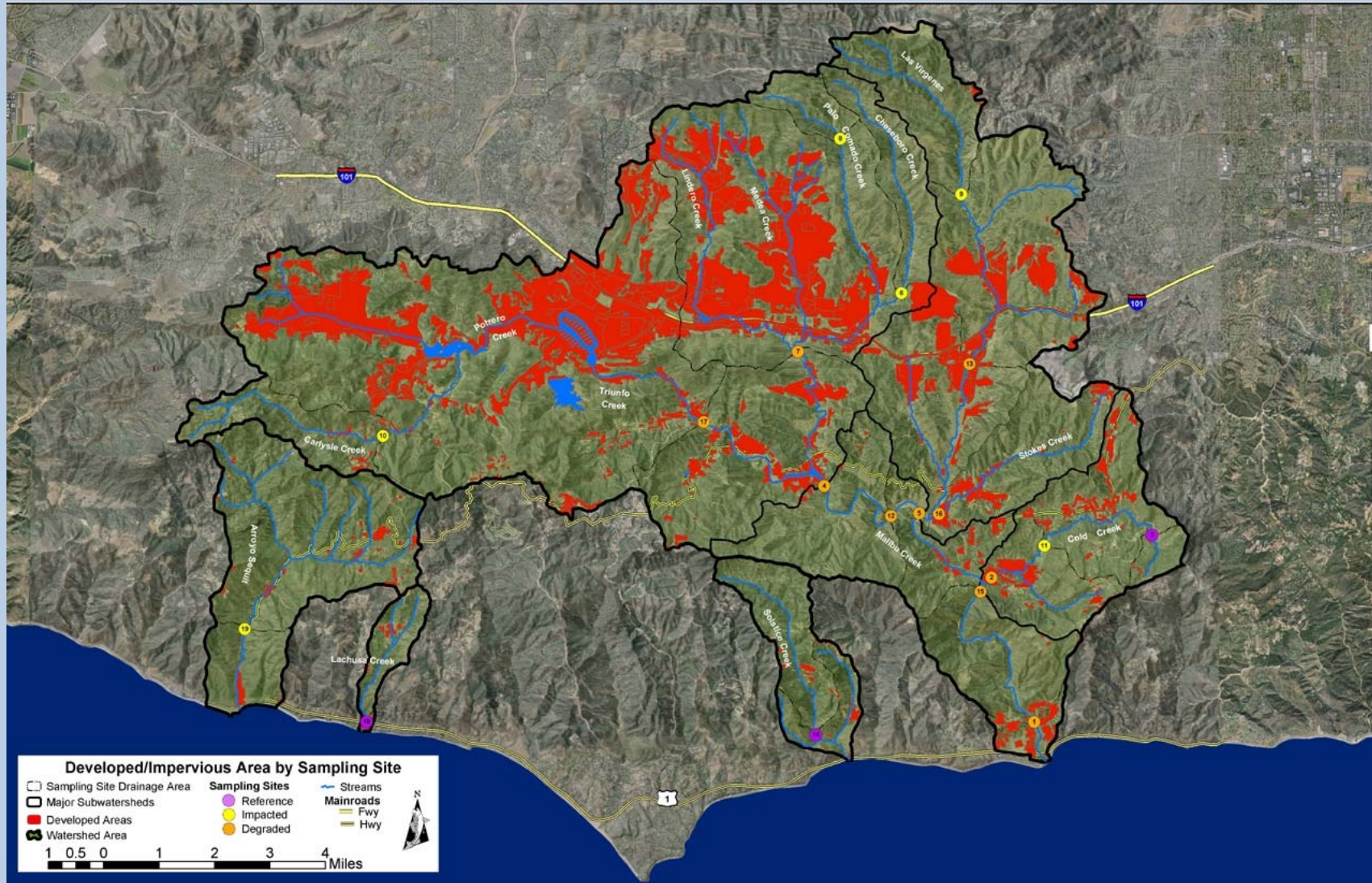


Results: IBI decreases from upper to lower watershed

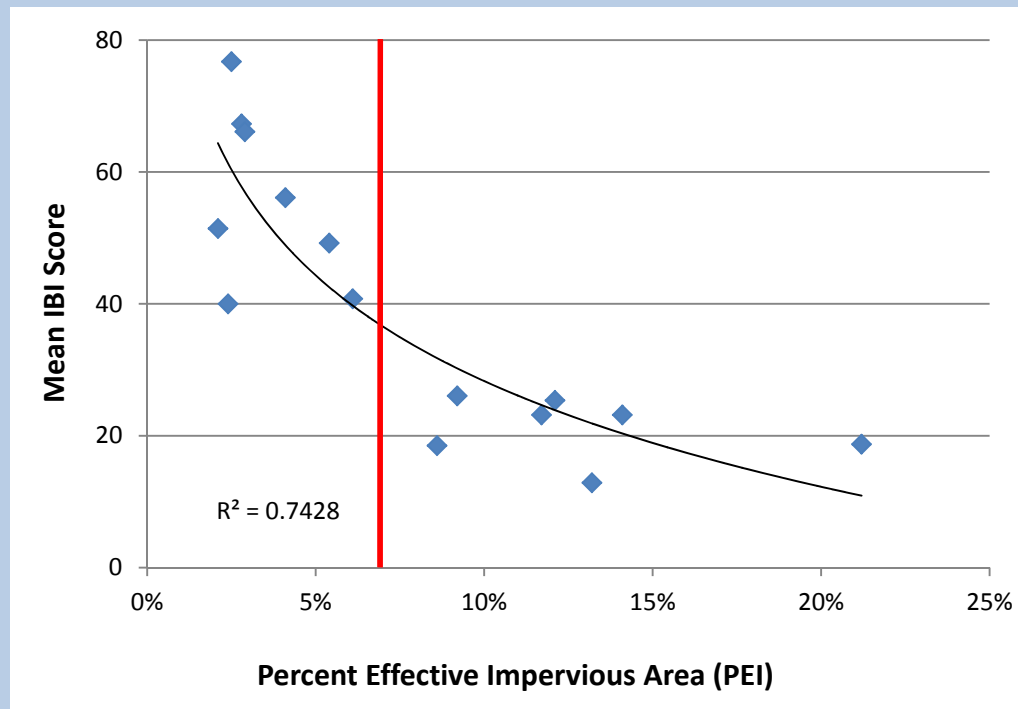


➔ State Water Resources Control Board threshold of 39 for biological impairment of macroinvertebrates

Developed/Impervious Area



Results: IBI influenced by Percent Effective Impervious area (PEI)



- Good
- Fair
- Poor
- Very Poor

Negative biological impacts around 6.5% PEI

Stream Health Index

- Basic attempt at integrating water quality, biological condition, physical habitat
- 27 point scale (9 for each element)
 - Water quality: total nitrogen, phosphate, fecal indicator bacteria
 - Biological condition: IBI score and colonization by invasive NZMS
 - Physical habitat: PEI, quantity of discharge pipes, area of streambank modification, and area of associated unstable banks

Stream Health Index

Stream Health Index					
Monitoring Site	Water Quality Score (out of 9)	Biotic Condition Score (out of 9)	Physical Habitat Score (out of 9)	Total Score (out of 27)	Mean Total Score by Site Type
Outlet Malibu Creek (O1)	2	3	0	5	8.5
Outlet Cold Creek (O2)	4.5	7	6	17.5	
Outlet Las Virgenes Creek (O5)	2.5	3	0	5.5	
Medea Creek (O7)	2.5	1	0	3.5	
Triunfo Creek (O17)	6	3	2	11	
Mid-Cold Creek (M11)	7	7	6	20	10
Mid-Malibu Creek, upstream of Tapia's Outfall(M12)	7	3	0	10	
Mid-Las Virgenes Creek (M13)	1	1	2	4	
Mid-Malibu Creek, downstream of Tapia's Outfall (M15)	3	3	0	6	22.4
Upper Cold Creek (site R3)	9	9	9	27	
Upper Las Virgenes (R6)	7	7	9	23	
Upper Las Virgenes Creek (site R9)	6	5	9	20	
Soltice Creek (site R14)	7	9	6	22	
Lachusa (site R18)	7	9	4	20	
Arroyo Sequit (site R19)	8	9	6	23	

Stream Health Index Conclusions

- Evidence of degradation is widespread throughout Malibu Creek Watershed
- Degradation occurs in predictable patterns
- Results can be used to inform targeted management and monitoring actions

Recommendations

- Integrated
 - Implementing low impact development (LID) measures in developed areas to reduce negative impacts of PEI
 - Adoption of stream protection ordinances with buffers of >100 ft from the outer edge of riparian canopy



Recommendations

- Water quality
 - Stronger nutrient and bacteria limits
 - Lower total N TMDL for wet-weather from 8 mg/L to 1 mg/L
 - Develop and execute implementation plan for TMDLs (nutrients, bacteria, trash)



Recommendations

- Biological
 - Implement best management practices to reduce sedimentation, nutrients, bacterial pollution from agriculture facilities
 - Stream barrier removal and incentivizing bioengineered solutions to streambank stabilization



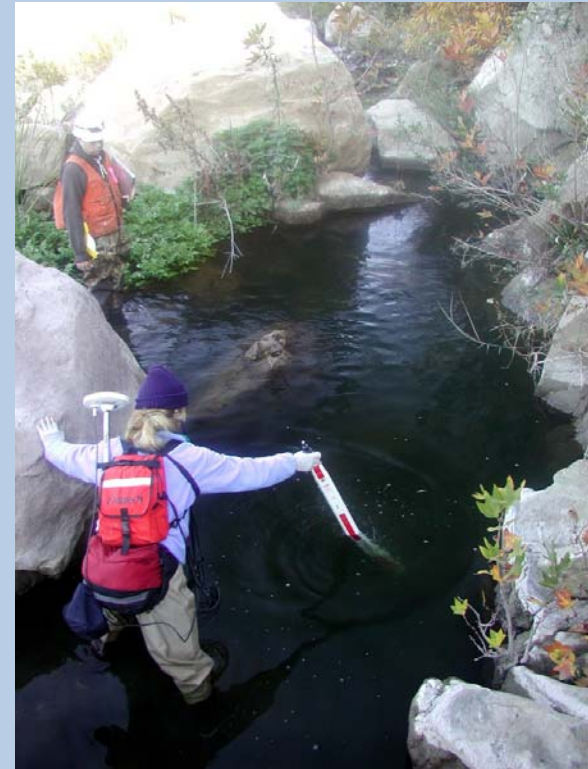
Recommendations

- Biological
 - Control against spread of invasive species and build metrics into stream health assessment that include invasive species



Conclusions

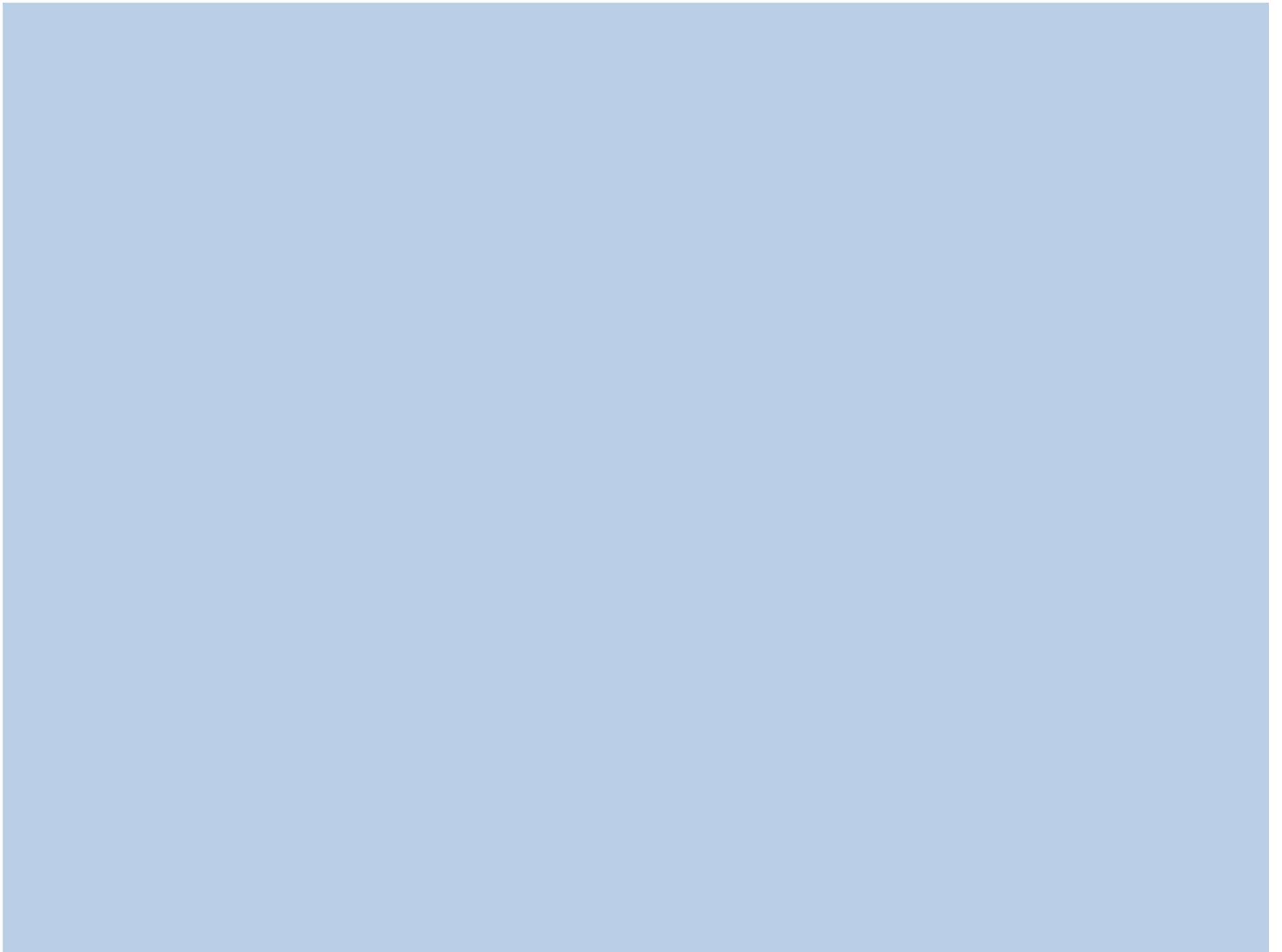
- Long-term citizen monitoring shows widespread degradation in Malibu Creek Watershed
- Action must be taken to protect natural resources



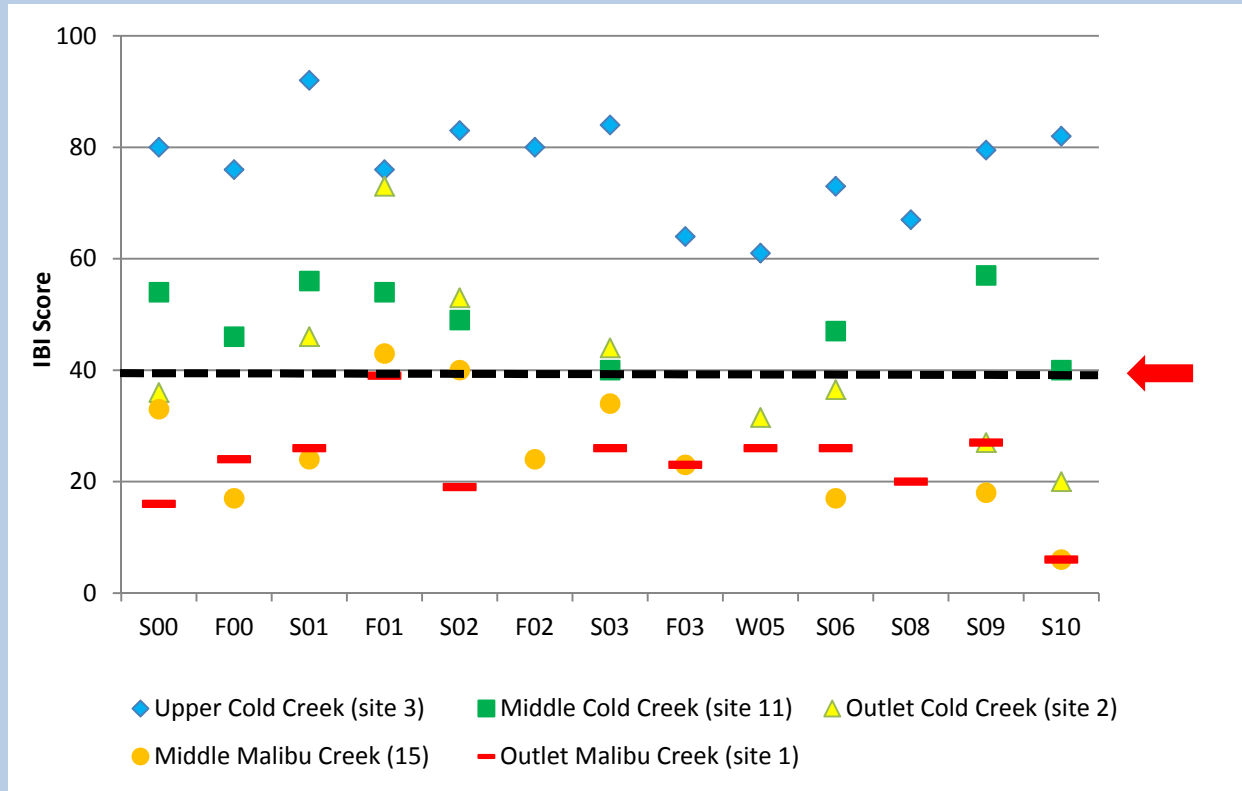
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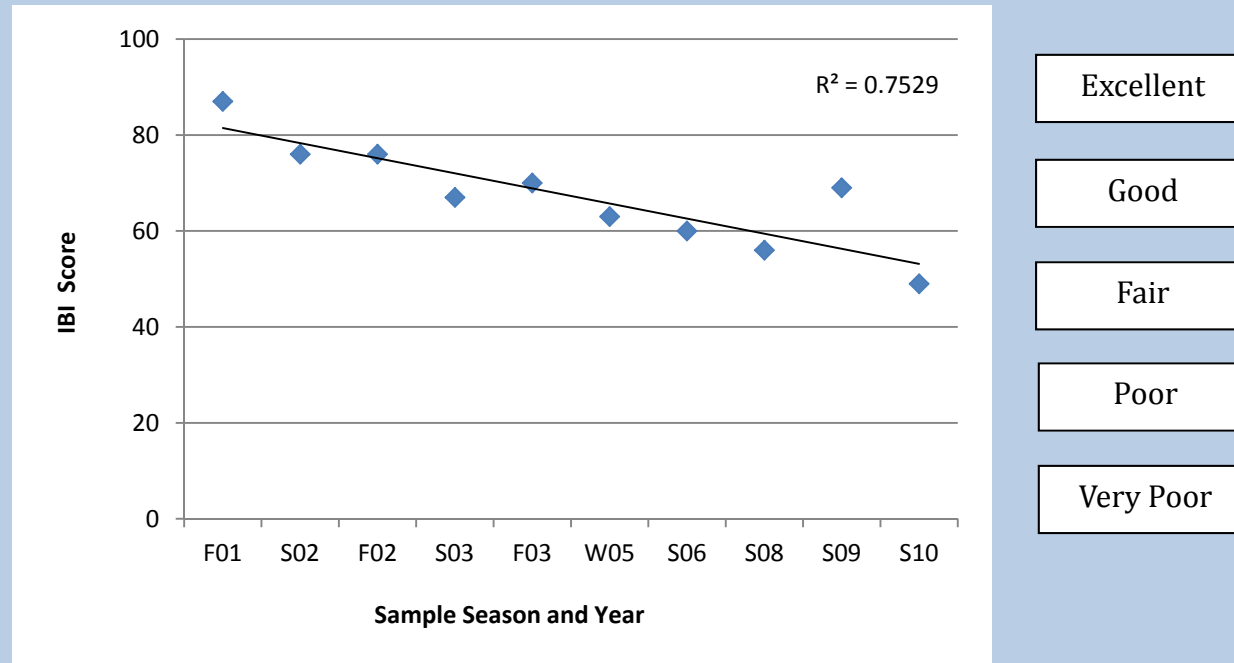


Results: IBI decreases from upper to lower watershed



Average IBI scores for regularly monitored sites in a transect from upper Cold Creek to the outlet of Malibu Creek by season and year (S=Spring, F=Fall, W=Winter)

Results: IBI decreasing over time in Solstice Creek



- May be due to invasive New Zealand Mud Snails
- The impacts of NZMS on low IBI scores was minimal

Mapping Results: Stream Banks

- Unstable stream banks
 - 19.6 linear miles (29%) of eroding stream banks

- Streambank Modifications
 - 20.9 linear miles (31%) are armored



Mapping Results: Impairments



- 17.7 linear miles (26.0%) impaired by invasive vegetation
- 22.1 linear miles (31.3 %) impaired by sediment

Steelhead Analysis



Barrier Removal



Restoration

