

# West Maui Priority Watershed: Progress towards site-graduation

USCRTF Florida  
Meeting, August 9,  
2017

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Watershed & Coastal Management  
Coordinator*







New Implementation Projects



# Wahikuli Restoration

- CORAL-NOAA cooperative agreement
- Sediment retention practices in Wahikuli and Honokowai watersheds

Exploring concept of “recharge & Recreation” area to divert high flow and settle out fines combined with a public trail





# Floating Wetland

- Opportunistic LID projected led by CORAL
- Nutrient uptake by plants anticipated
- Piloting for potential use in other areas





# Vetiver for erosion control

- Proving effective for trapping sediment in road kickouts
- Planted in ~20 sites
- Testing for closing old roads
- Cost effective and low maintenance once established





# Facilities storm water management

- Partnering with three base-yard operators
- Storm water BMP assessment
- Improvement of one practice
- Workshop to highlight actions





# Task Force Assistance Opportunity

- Dam modifications
  - NRCS & USACE role in design and oversight
  - Ways to help with retrofit design?



# Task Force Assistance Opportunity

- Injection wells lawsuit
  - Next appeal is Oct.12<sup>th</sup> in Honolulu
  - Position piece based on science completed in area and priority status from USCRTF?
  - What can be done to assist?
  - FWS testify? EPA role may be complicated...





West Maui Programmatic Checklist, Aug. 2017	n/a	No	IP	Yes
Committed Federal (2) and local (1) partners				✓
Full time watershed coordinator				✓
Finalized WMP w/ EPA's 9 elements (% completed)				✓
Stakeholder input included in WMP				✓
WMP institutionalized as official policy		✗		
Implementation agreement		✗		
NPDES general permit active				✓
NPDES MS-4 stormwater program active	n/a		?	
Enforcement action taken at problem sites			≈	
Centralized wastewater collection/treatment		✗		✓
Agriculture BMPs implemented			≈	
Ecological monitoring program				✓
Adaptive WMP evaluation process				✓

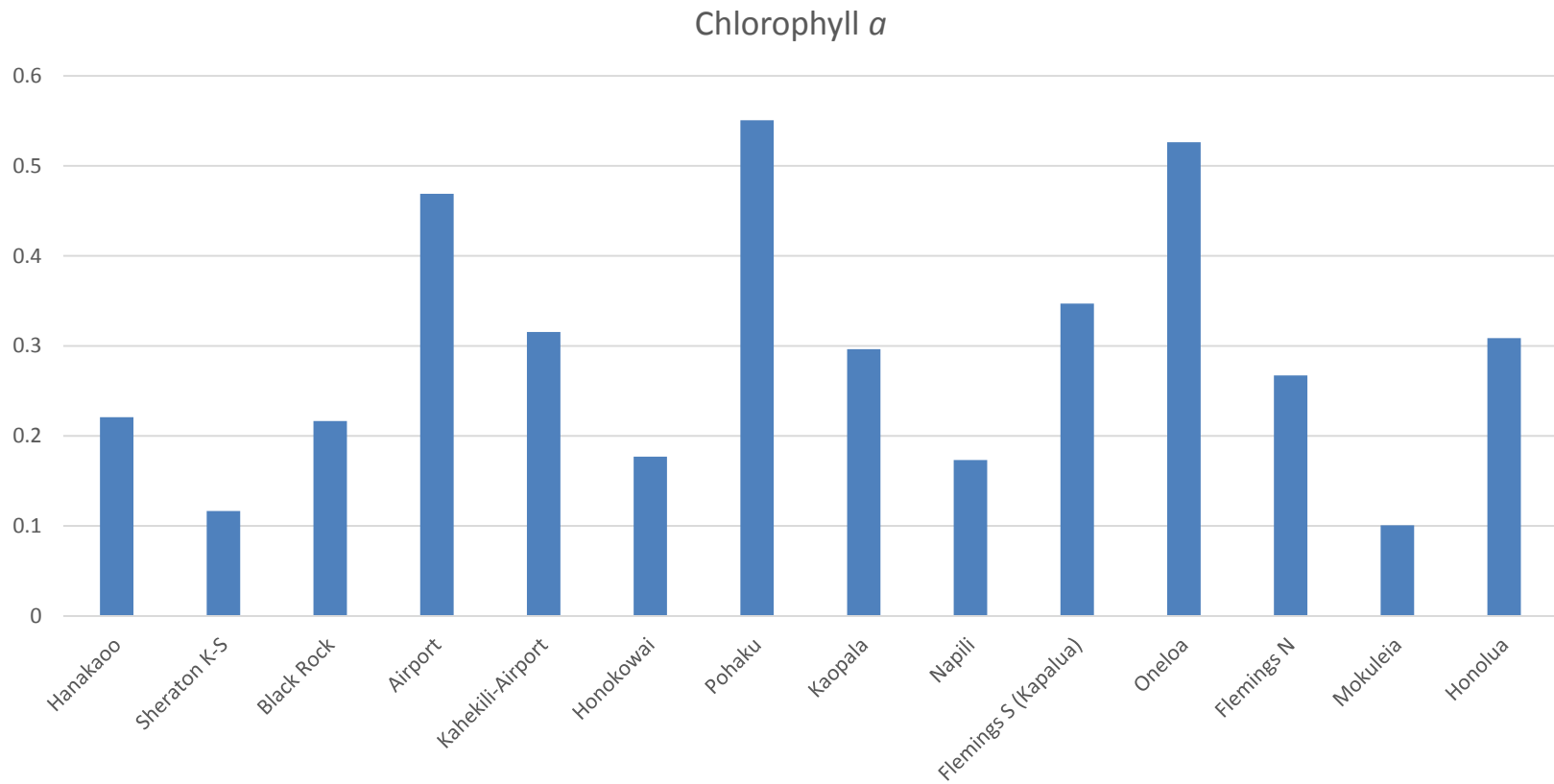




# Ecosystem Indicators

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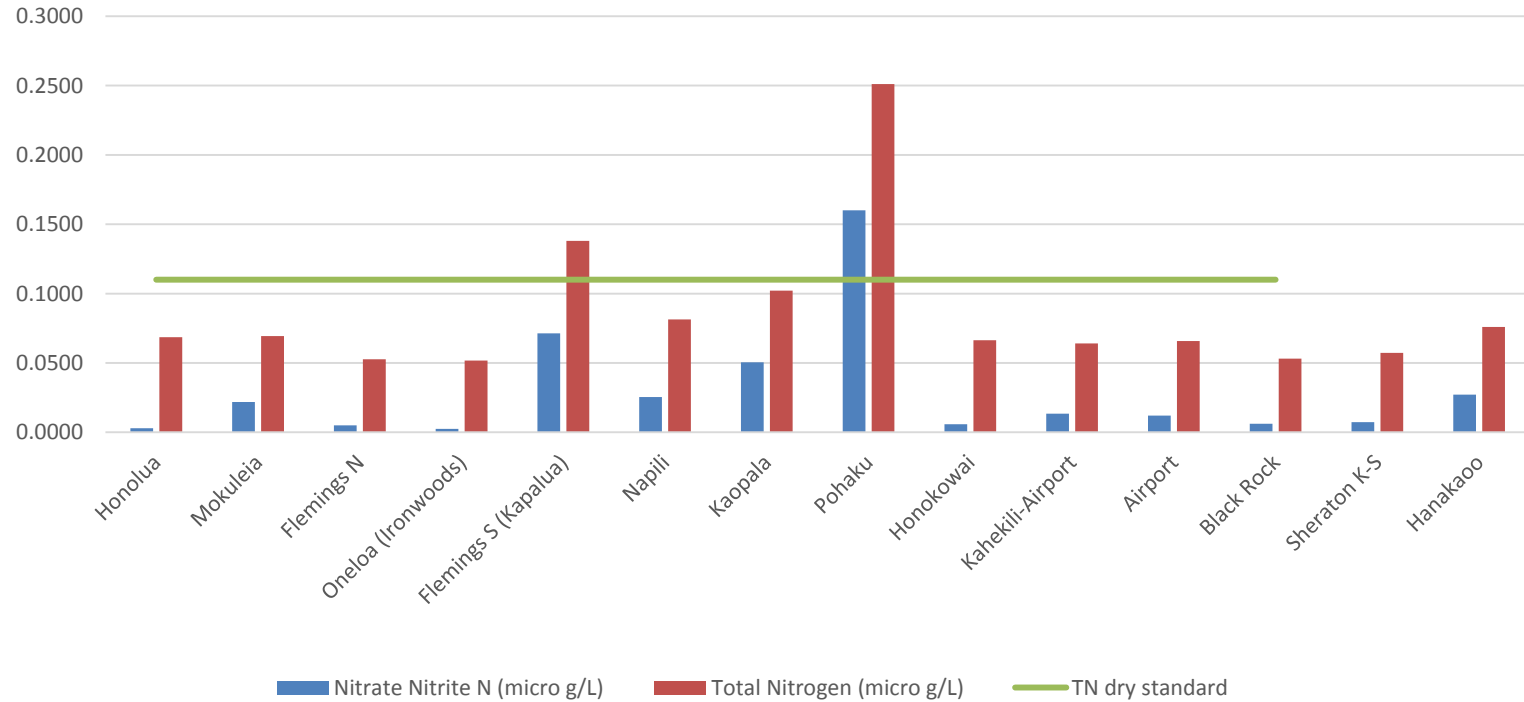


# Chlorophyll *a*

(DOH data, 2015-2016)- no longer collected



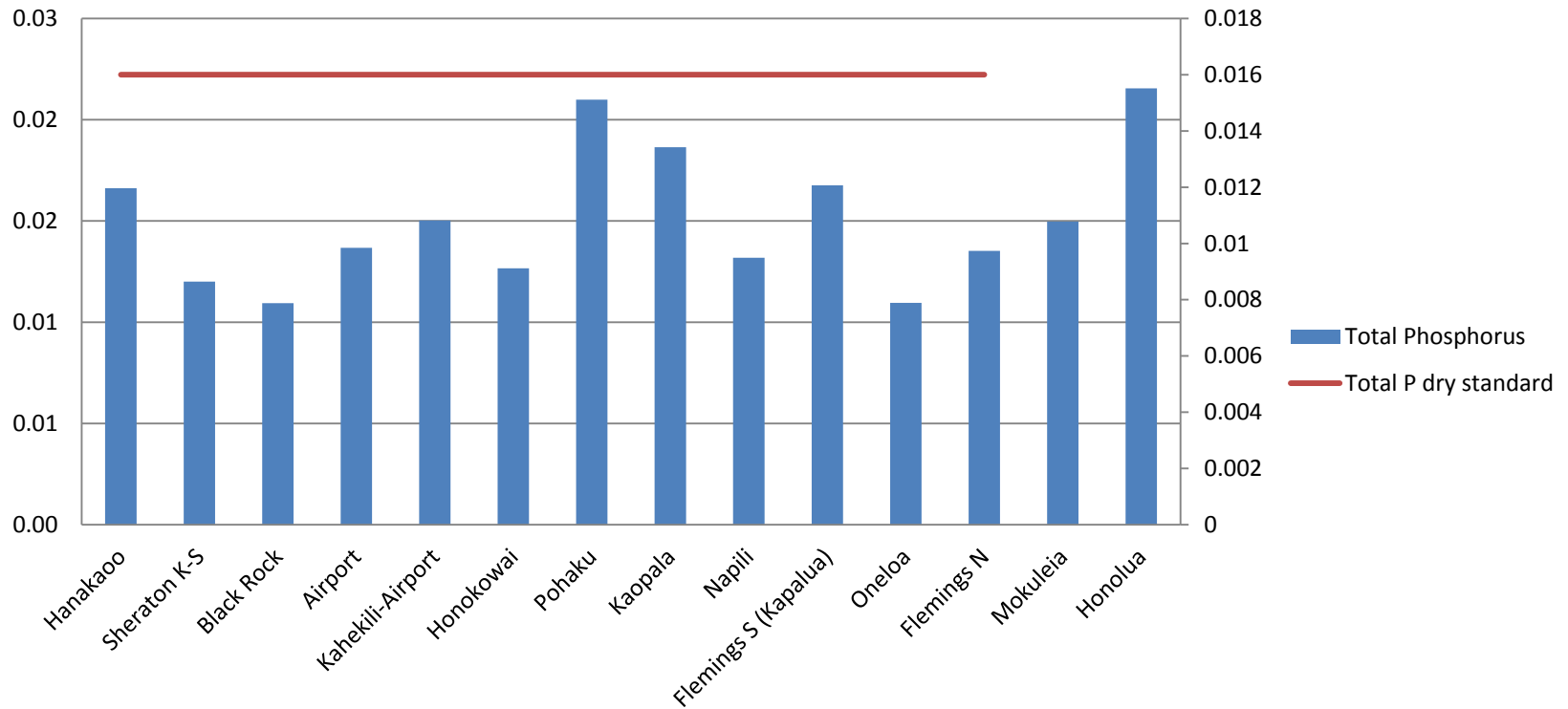
# Nitrate Nitrite and Total N for West Maui



Total N (DOH data, 2015-2016)



## Total Phosphorus

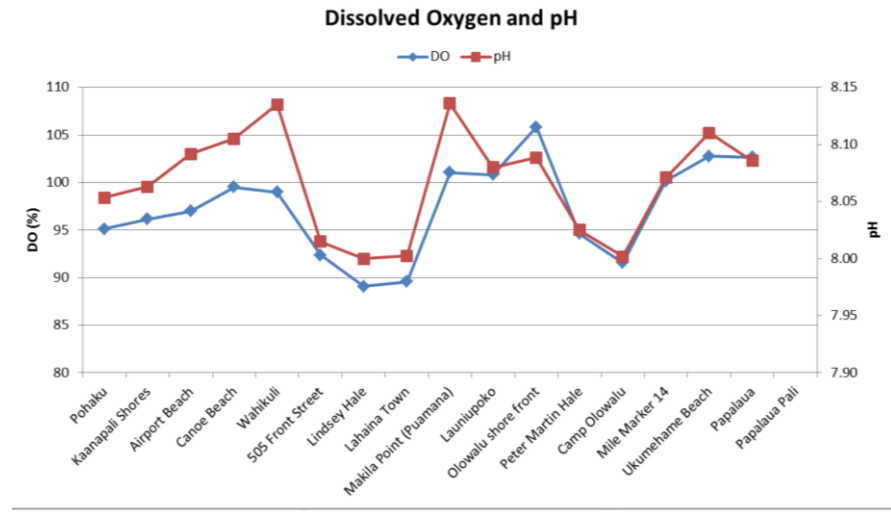


Total Phosphorus  
(DOH data, 2015-2016)



# Dissolved Oxygen

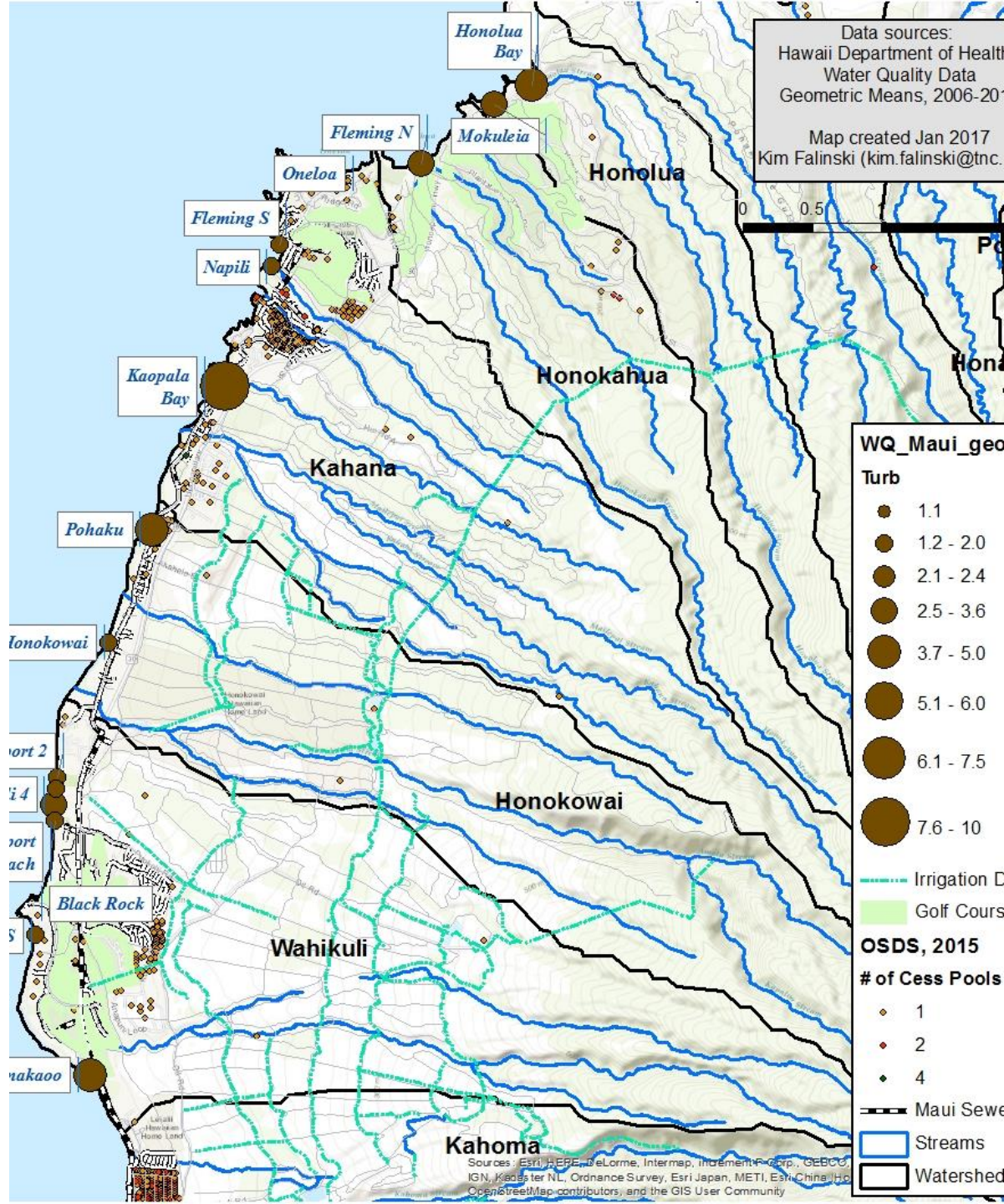
- DOH and now citizen science data (Hui O Ka Wai Ola)
- Northern sites started collection this summer



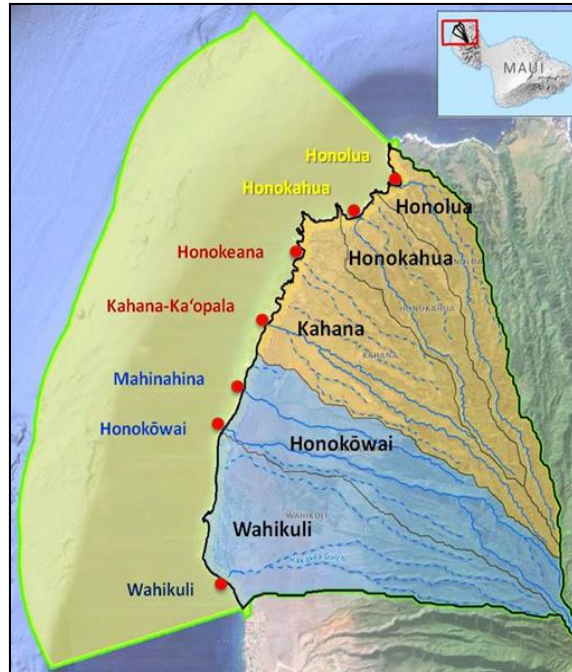
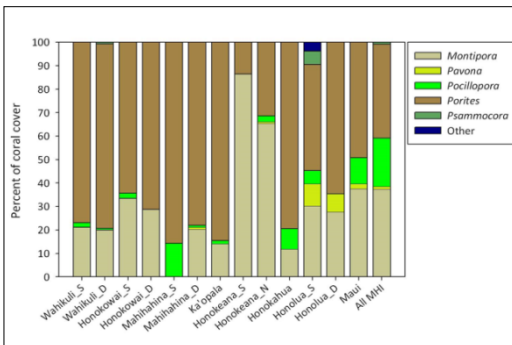
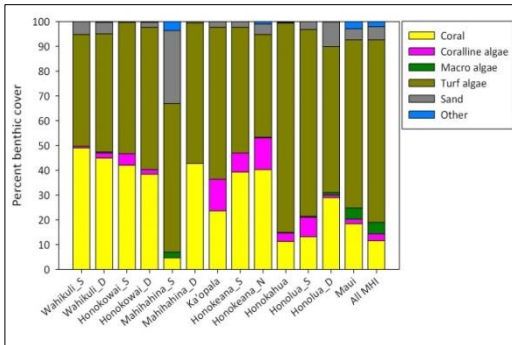


# Turbidity

- All sites exceed state standard
- Just started sampling in Kahana area modeled as largest potential sediment contributor
- Kaopala- highest values and little healthy coral in this section of coast
- Re-suspension and longshore currents influence high values in some areas, i.e. Pokahu

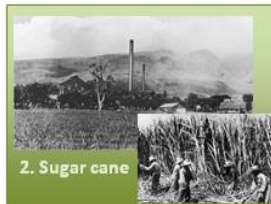


# Coral reef baseline assessments for LBSP impacts: West Maui



## Land-based pollution West Maui

### 1. Early settlers



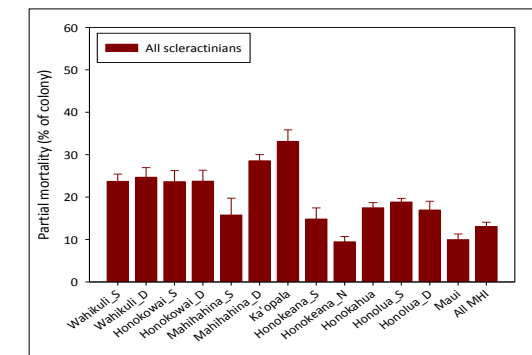
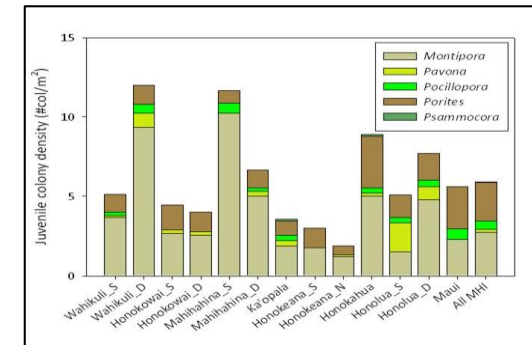
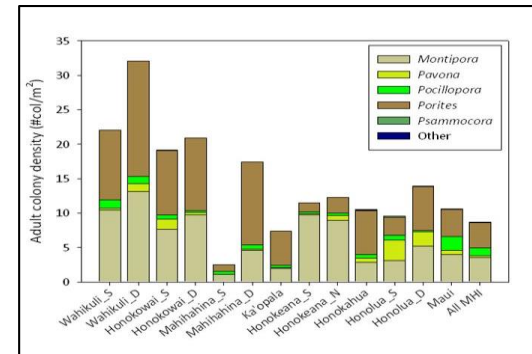
### 2. Sugar cane



### 3. Pineapple



### 4. Urbanization/tourism





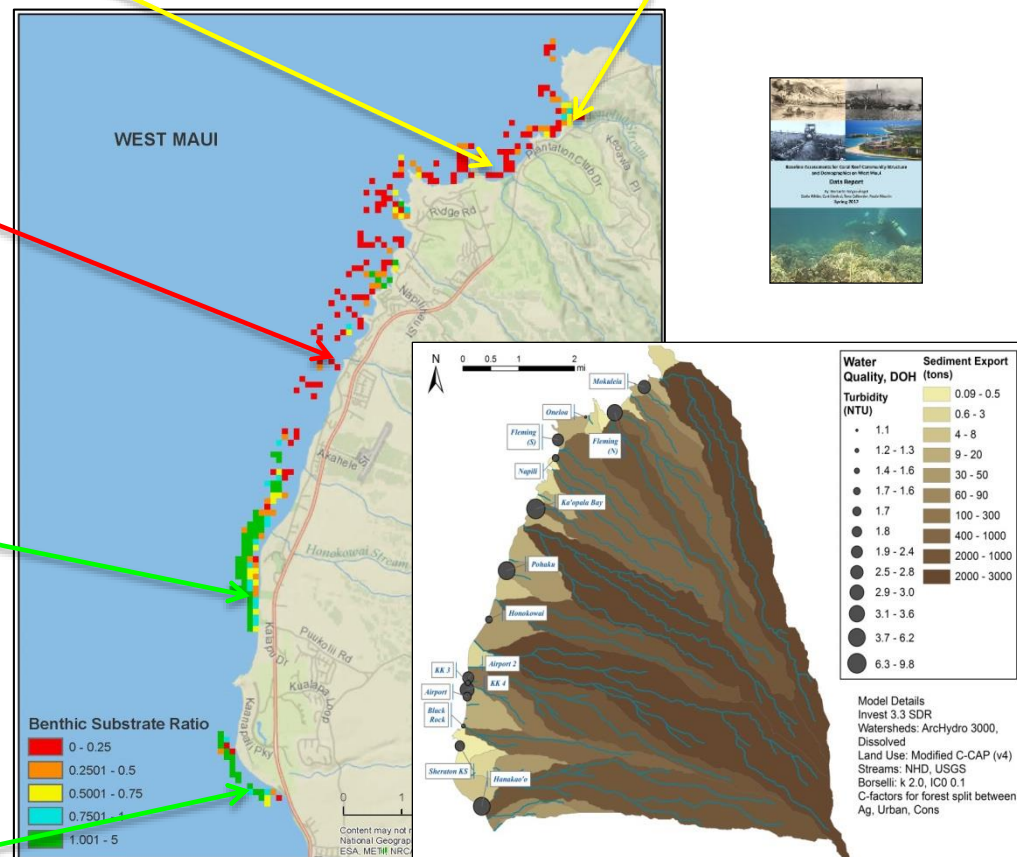
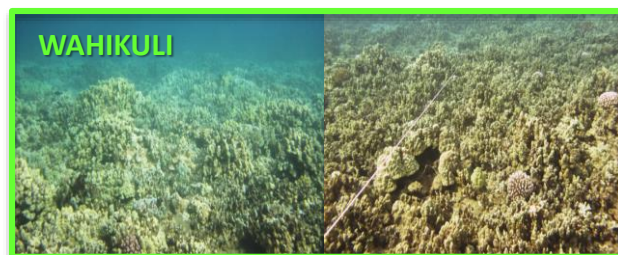
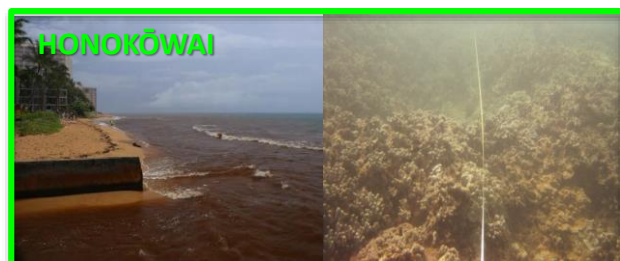
# Coral taxonomic richness: West Maui

Scleractinian coral richness at the different survey sites off West Maui. Sites are listed in geographical order from south to north. WAH: Wahikuli; HON: Honokōwai; MAH: Mahinahina; KAO: Ka'opala; HOE: Honokeana; HOK: Honokahua; HOA: Honolulu. S: shallow; D: deep; n: north; s: south.

CORAL SPECIES	WAH-S	WAH-D	HON-S	HON-D	MAH-S	MAH-D	KAO-S	HOE-s	HOE-n	HOK-S	HOA-D	HOA-S
<i>Cyphastrea ocellina</i>			X									
<i>Leptastrea bewickensis</i>					X							
<i>Leptastrea purpurea</i>												X
<i>Leptoseris incrustans</i>											X	
<i>Leptoseris mycetoseroides</i>											X	
<i>Montipora capitata</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Montipora flabellata</i>							X		X	X		X
<i>Montipora incrassata</i>			X									X
<i>Montipora patula</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Pavona chiriquiensis</i>										X		
<i>Pavona duerdeni</i>	X	X								X	X	X
<i>Pavona maldivensis</i>	X		X			X						
<i>Pavona varians</i>	X	X	X	X		X	X	X	X	X	X	X
<i>Pocillopora damicornis</i>			X				X	X	X			
<i>Pocillopora eydouxi</i>	X	X	X		X		X	X		X		X
<i>Pocillopora meandrina</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Pocillopora woodjonesi</i>												X
<i>Porites bernardi</i>											X	
<i>Porites brighami</i>		X									X	
<i>Porites compressa</i>	X	X	X	X		X	X	X	X	X	X	X
<i>Porites duerdeni</i>	X						X	X	X	X	X	X
<i>Porites evermanni</i>	X	X								X		
<i>Porites lichen</i>	X	X										
<i>Porites lobata</i>	X	X	X	X	X	X	X	X	X	X	X	X
<i>Porites monticulosa</i>							X			X	X	
<i>Porites solida</i>		X				X					X	
<i>Psammocora nierstraszi</i>												X
<i>Psammocora stellata</i>	X									X		
<b>TOTAL</b>	<b>13</b>	<b>12</b>	<b>11</b>	<b>6</b>	<b>6</b>	<b>8</b>	<b>11</b>	<b>9</b>	<b>9</b>	<b>14</b>	<b>14</b>	<b>14</b>

Courtesy of Bernardo Vargas- Angel, NOAA

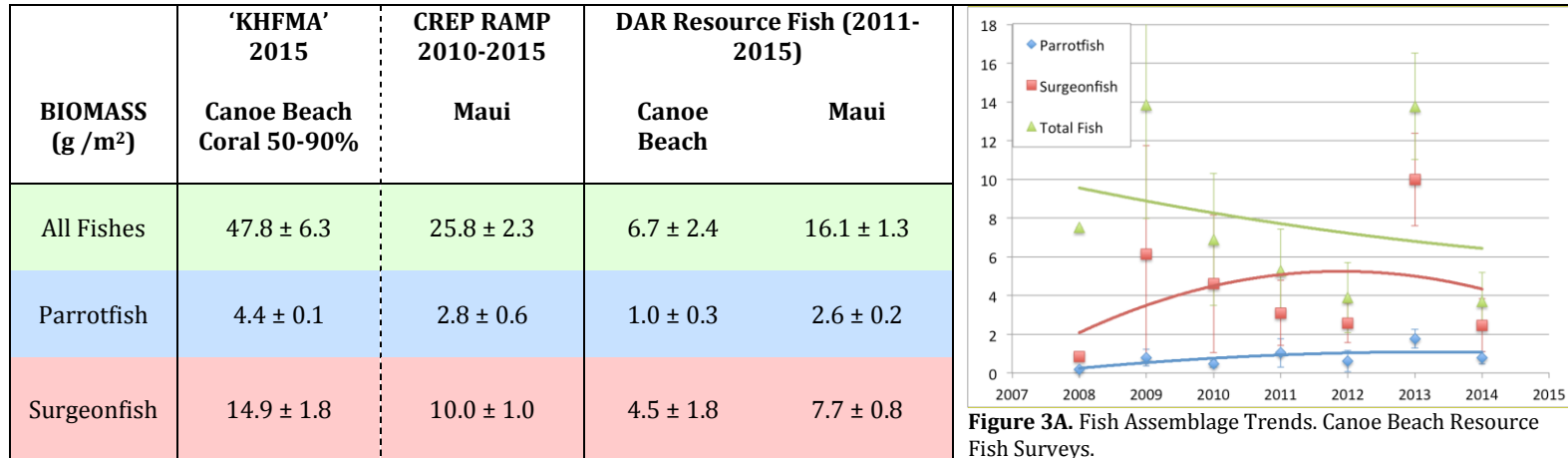
# Coral reef condition: West Maui



Courtesy of Bernardo Vargas- Angel, NOAA



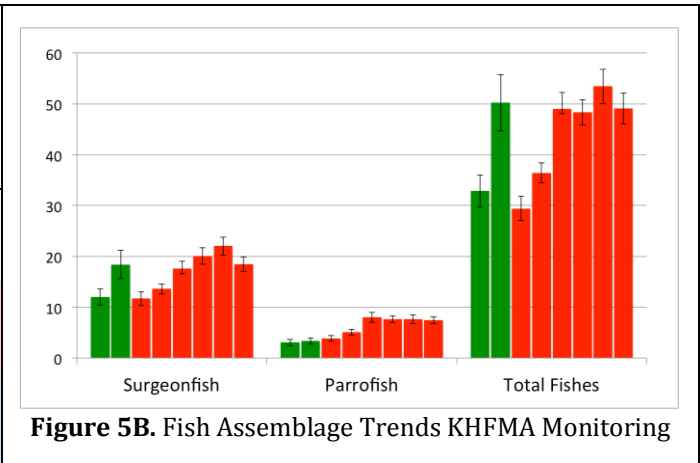
# Herbivorous Fish Mass- Wahikuli



Mean  $\pm$  SE fish biomass from Canoe Beach DAR Resource Fish site and from 'KHFMA' surveys. Note that Maui resource fish average comes from all other resource fish sites at comparable depth in Maui. 'KHFMA' survey data used here are surveys conducted in 2015 in Coral 50-90% habitat. KHFMA data are compared against averages of CREP surveys around Maui in 2010-2105.

# Herbivorous Fish Mass- KHFMA

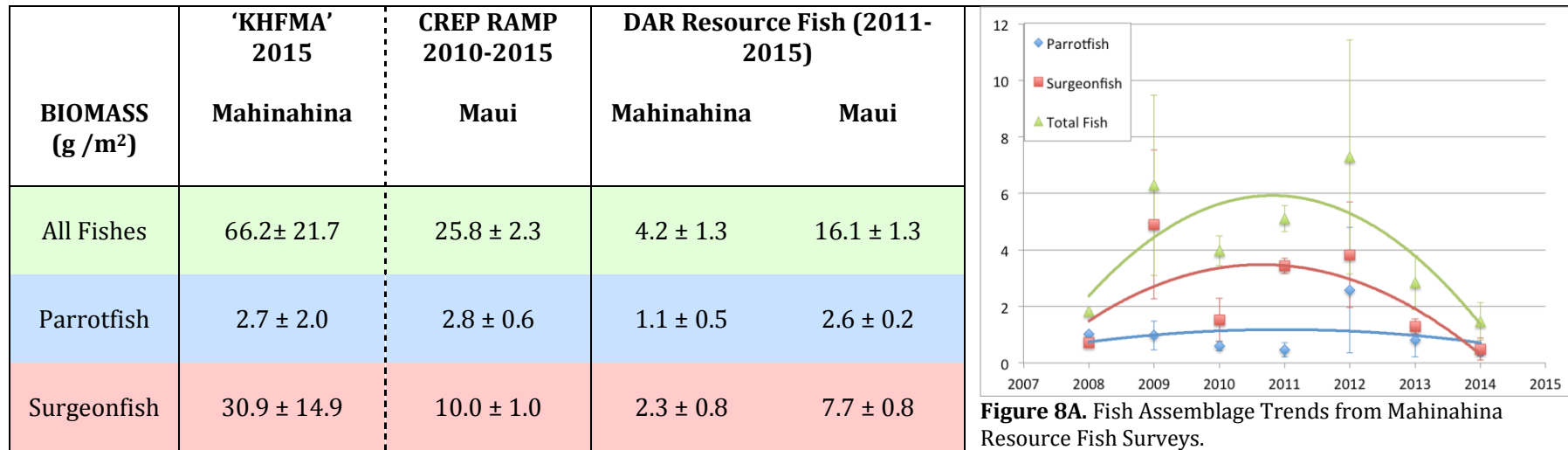
BIOMASS (g /m <sup>2</sup> )	KHFMA DAR-CREP		CREP RAMP	
	5-yr Ave (2011-15)	Recent (2015)	Maui	All MHI
All Fishes	47.3 ± 2.9	49.1 ± 3.0	25.8 ± 2.3	26.3 ± 1.1
Parrotfish	7.2 ± 0.5	7.4 ± 0.6	2.8 ± 0.6	2.4 ± 0.2
Surgeonfish	18.3 ± 1.4	18.5 ± 1.4	10.0 ± 1.0	9.3 ± 0.4



**Biomass (g m<sup>-2</sup>).** Data are Mean ± SE. CREP RAMP Comparisons are for sites in <60ft of water from 2010 to 2015. Note that differences in survey methods mean that biomass estimates are not exactly comparable (i.e. different methods yield somewhat different biomass estimates). Trends show annual biomass visually marked as green (pre-closure years) and red (post establishment of KHFMA).



# Herbivorous Fish Mass- Honokowai



**Mean ± SE fish biomass from Mahinahina DAR Resource Fish site and 'KHFMA' surveys.** Note that Maui resource fish average comes from all other resource fish sites at comparable depth in Maui. 'KHFMA' survey data used here are surveys conducted in 2015 in Coral 10-50% and Coral 50-90% habitat (light and dark blue habitats in figure 8). KHFMA data are compared against averages of CREP surveys around Maui in 2010-2105.



# Herbivorous Fish Mass- Northern Watersheds

Data synthesis: Ivor Williams, NOAA

- Mean herbivore biomass across the northern 3 watersheds is ~21 to 23 g/m<sup>2</sup> (~70-80% KHFMA in recent yrs)
- mostly surgeonfishes - only about ~1g /m<sup>2</sup> is parrotfish
- By comparison, in 2016 KHFMA parrotfish biomass was 9.7 g/m<sup>2</sup> and Olowalu parrotfish biomass is 6.3 g/m<sup>2</sup> from recent years.
- large portion of biomass is herbivore/detritivores such as *Acanthurus olivaceus*, *A. dussumieri*, *A. blochii* - feed on diatoms and detritus on sandy areas around the fringes of reef habitat
- In summary - total 'herbivore' biomass not bad.. but parrotfish are very scarce (~1/10 of biomass level inside KHFMA) – less meaningful for resilience



# Sediment Accumulation

USGS 2015 Data

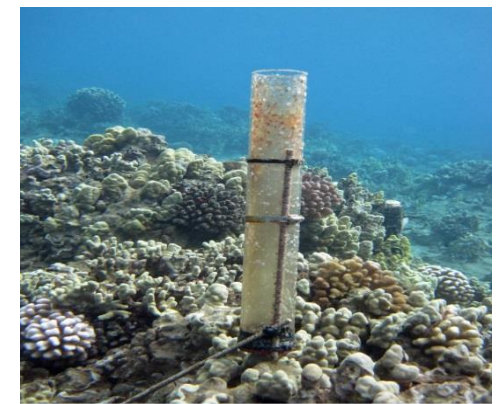
Location	Type	% Gravel	% Sand	% Silt	% Clay	D50 (mm)	Bulk %CaCO <sub>3</sub>	Sand %CaCO <sub>3</sub>	Silt %CaCO <sub>3</sub>	Clay %CaCO <sub>3</sub>	Weight (g)	Area (cm <sup>2</sup> )	# Days	Accumulation (mg/cm <sup>2</sup> /d)
Mahinahina	trap	0.06	75.10	20.26	4.58	0.14	68.36	79.48	62.15	49.92	89.10	140.95	181	3.49
Honokawai	trap	0.00	37.03	44.43	18.53	0.03	39.51	77.02	61.61	50.99	34.60	140.95	181	1.36
Wahikuli	trap	0.00	93.81	4.58	1.61	0.16	55.85	60.22	33.40	29.72	22.50	140.95	181	0.88

## SEDIMENT

Location	Type	% Gravel	% Sand	% Silt	% Clay	D50 (mm)	Bulk %CaCO <sub>3</sub>	Sand %CaCO <sub>3</sub>	Silt %CaCO <sub>3</sub>	Clay %CaCO <sub>3</sub>	Weight (g)	Area (cm <sup>2</sup> )	# Days	Accumulation (mg/cm <sup>2</sup> /d)
Mahinahina	pod	0.50	91.91	5.49	2.10	0.18	68.42	78.81	53.40	38.87	129.30	729.29	181	0.98
Honokawai	pod	0.28	65.34	25.28	9.10	0.10	69.46	75.38	64.10	51.21	92.60	729.29	181	0.70
Wahikuli	pod	1.36	94.66	3.21	0.77	0.17	47.51	48.81	31.25	26.06	1622.00	729.29	181	12.29

## Synthesis from Curt Storlazzi, USGS:

- Mahinahina - most energetic
- Wahikuli –least energetic
- Reflected in the grain sizes and relative trap versus pod accumulation rates
- A lot more terrestrial material is entering in the northern part of the study area, but persists more in the southern part
- If exposure (= intensity x duration), then Honokowai is the worst - moderate intensity and moderate duration, with Mahinahina having high intensity but low duration and Wahikuli being the opposite.



Photos: Bernardo Vargas-Angel, NOAA

# Sediment Toxicity Testing

- Not done
- Not budgeted or planned





# Implementation Plan- excerpt

Short Term Implementation Projects	Skill set needed	Area	Notes
Nutrient reduction in Kaanapali Golf Lagoon	bio-remediation expert	WH	initial exploration with Lauren Roth; try trials with RTR if funded?
Honokowai Dam #8 retrofit	engineer	WH	USACE may have feedback
Stabilize kick-outs in Wahikuli and Honokowai watersheds			
Rain garden installation at Lower Honoapiilani church	consultant	WH	
Green Streets project by Honokowai Beach Park	consultant	WH	challenged by the length of time to get anything through COM- need 3 year grant
Kahana Basin Cleaning out & drainage retrofit	engineer	KHH	USACE ideas?
Agricultural Land Sediment Retention Project to assess and address Push Piles and Stabilization of Stream Crossings Stabilization	soil conservationist/engineer	All	Pursue with vetiver under current grants?
Conservation fencing in the upper watershed	conservation partner	All	Two funding sources upcoming- DAR/NOAA and DOH
Stabilize roadside Erosion (Honoapi'ilani Highway and Lower Road)	engineer	All	Is this really a priority in the scheme of things?
Golf Courses and Landscaping BMP Management Plans	landscape consultant	All	
Ala Hoku Subdivision- dirt road stabilization and/or modify the nearby underground sedimentation basin to increase holding and functionality	engineer	KHH	need to investigate further
Hydrodynamic Separator in Napili Plaza parking lot	engineer	KHH	need to research technology
Kalo loi in lower portions of streams	traditional knowledge	All	Not clear on exact locations- pilots with CORAL in W-H?
Baseyard greening at Kapalua resort, Troon Golf and MLP	Consultant	KHH	



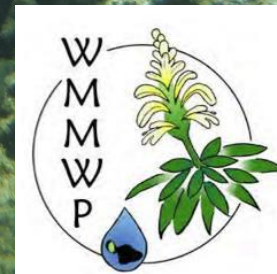
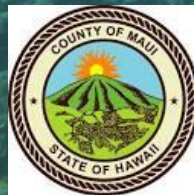
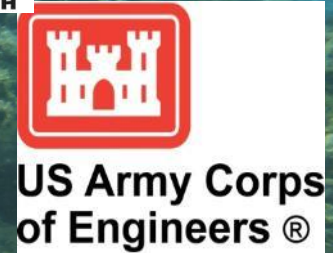
# Sustainability Plan

- Mechanism for sustainable funding
- Institutionalization of watershed coordinator
- Institutionalization of ongoing regular monitoring of ecosystem indicators
- Codification of local government and community leadership and involvement
  - Water quality actions
  - Resource-related actions





# Mahalo to our partners



- Overall updates on watershed management plan implementation -- what's new and what can the USCRTF help with if there are any implementation issues?
- Updates on progress using the Programmatic Checklist since last reported on in 2015 (for your convenience I've attached the 2015 updates).
- Status of monitoring any priority ecosystem indicators (see Section 3B of the WPI Strategy)
- Does your watershed have an implementation plan, or an implementation agreement (#6 on Programmatic Checklist)? If so, please share a summary.
- Sustainability Planning -- this is new and is a part of the WPI Strategy, Section 3C. Please provide an overview of items a-d of Section 3C in your presentation.



# Note:

- the value of NOAA's National Coral Reef Monitoring Program (NCRMP) in providing a backdrop and reference against which to compare the site-specific data collected in this project.