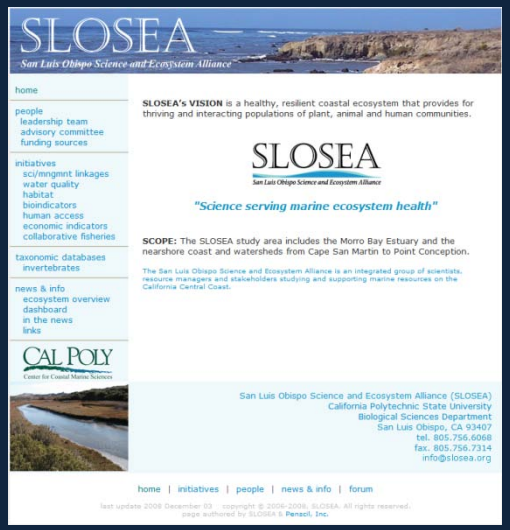
Do people impact SLO County shorelines by the simple act of walking around to explore tidepools ?

Are We Loving Our Tidepools to Death ?

Brought to you by:



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TENERA – Intertidal Studies

- Visitor impacts / resource stewardship (MBNMS, GFNMS)
- Fitzgerald Marine Reserve resource assessment (San Mateo Co.)
- Diablo Canyon North Ranch coastal access monitoring (PG&E)
- Regional tidepool workgroup (MBNMS, GFNMS, CBNMS, CDF&G)
- Managed access plans (Hollister Ranch Homeowner's Assoc.)
- Thermal effects studies (PG&E, Duke, Mirant)
- Exxon Valdez oil spill recovery (NOAA)
- Landslide impacts / Big Sur (Caltrans)
- Mussel bed and red algal assemblage recovery (U.S. MMS)
- Waterfront development (U.S. Coast Guard, Harbor Depts., Private)
- Pipeline removal impacts to surfgrass / kelp beds (Santa Barbara Co.)
- California shoreline classification / GIS mapping (U.S. MMS)
- Stormwater effects to rocky intertidal zones (U.S. Air Force)
- Submarine cable decommissioning / removal (NOAA)

SUMMARY

- Manipulative experiment used to test visitor impacts to local shores.
- Experiment done in area not accessible to the public.
- Tested 3 foot traffic exposures = heavy, moderate, low.
- Subtle effects detected.
- Challenge = How to transfer test findings to reality.
- From our visitor surveys we estimate trampling exposures similar to our experiment occur on our local shores; therefore our shores probably experience impacts due to visitors.
- Larger impacts than the levels we detected probably occur on our shores, due to the cumulative, long-term effects of foot traffic.
- We are planning to test this in an additional field study.

We did not study collecting-poaching because

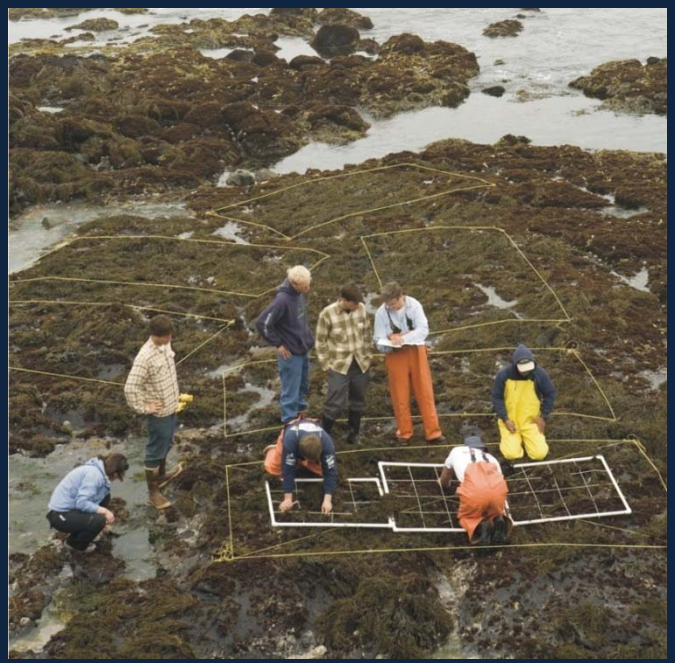
- Poaching (and collecting for souvenirs) is incidental & unpredictable over time & spatial scale
- Would need to know where poaching occurred to set study and find controls
- No baseline to determine pre-existing conditions for comparison purposes
- Illegal collecting is best addressed through enforcement, surveillance, and patrolling, all which are not SLOSEA functions

Trampling was studied because

- Visitor traffic is more regular and predictable
- Trampling is associated with all shore activities
- State Parks encourages coastal access
- A State Park goal is to ensure coastal access is balanced with resource protection and sustainability

We did our study in the rockweed zone because

- Rockweeds are in the upper-mid intertidal where people spend most time
- Rockweeds consist of single stipes supporting bushy fronds that can break from foot traffic ⟶ loss of whole plants
- Rockweeds have ecological value in providing habitat and cover for other species



Rockweed Zone Inhabitants

* Significant declines relative to controls

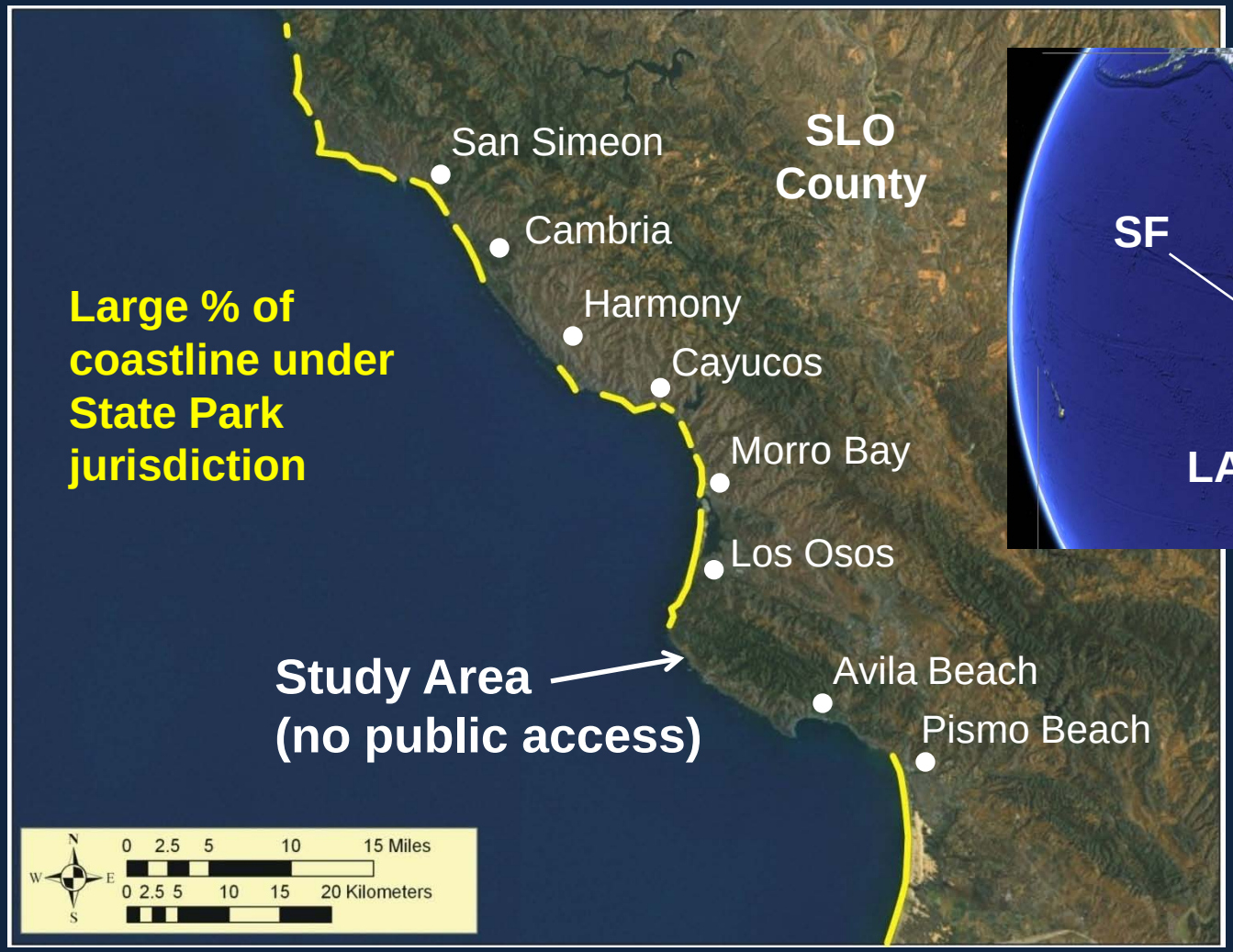
Challenges in Assessing Effects of Human Access and Management of Intertidal Resources

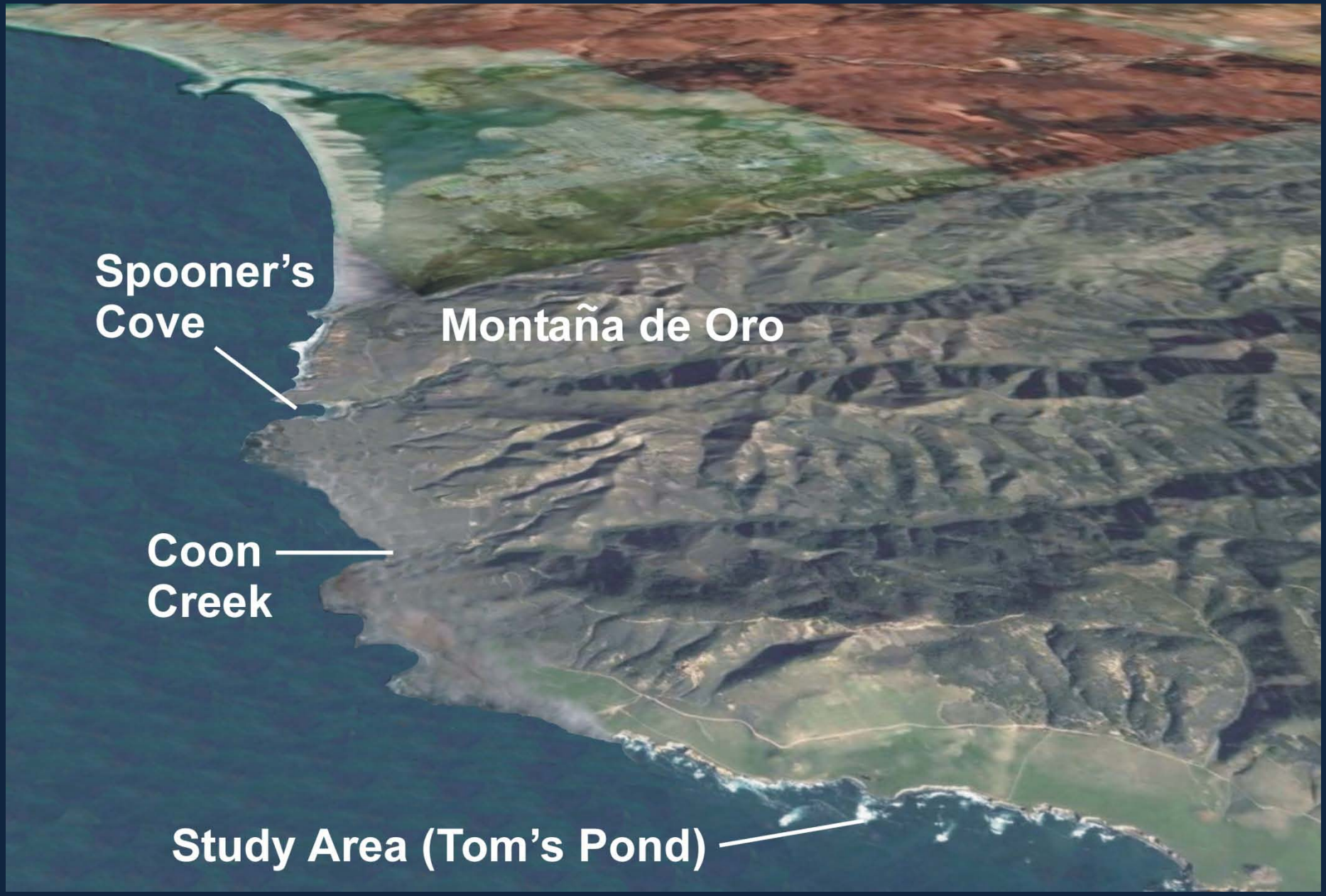
Goal: Balancing coastal access with resource protection

Needs

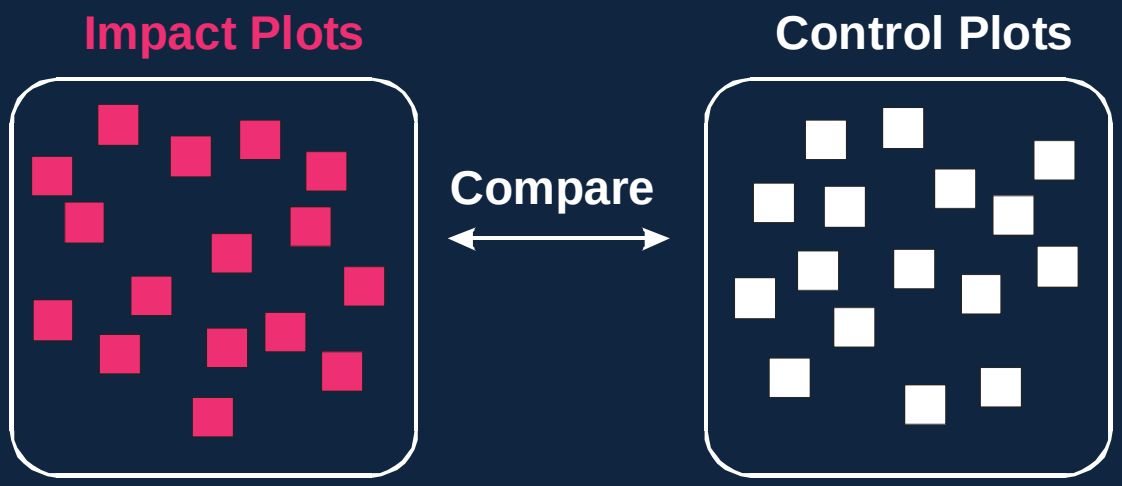
- Appropriate study design to separate visitor impacts from natural variation
- Certainty in study findings for making management decisions
- Criteria to determine how much impact is too much
- Tools and approaches for resource stewardship

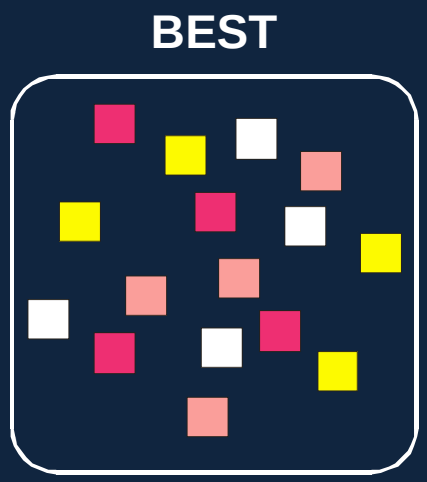
State Parks has concerns for resource stewardship of shorelines in San Luis Obispo County




Spooner's Cove
Montaña de Oro
Coon Creek
Study Area (Tom's Pond)

Study Design Considerations

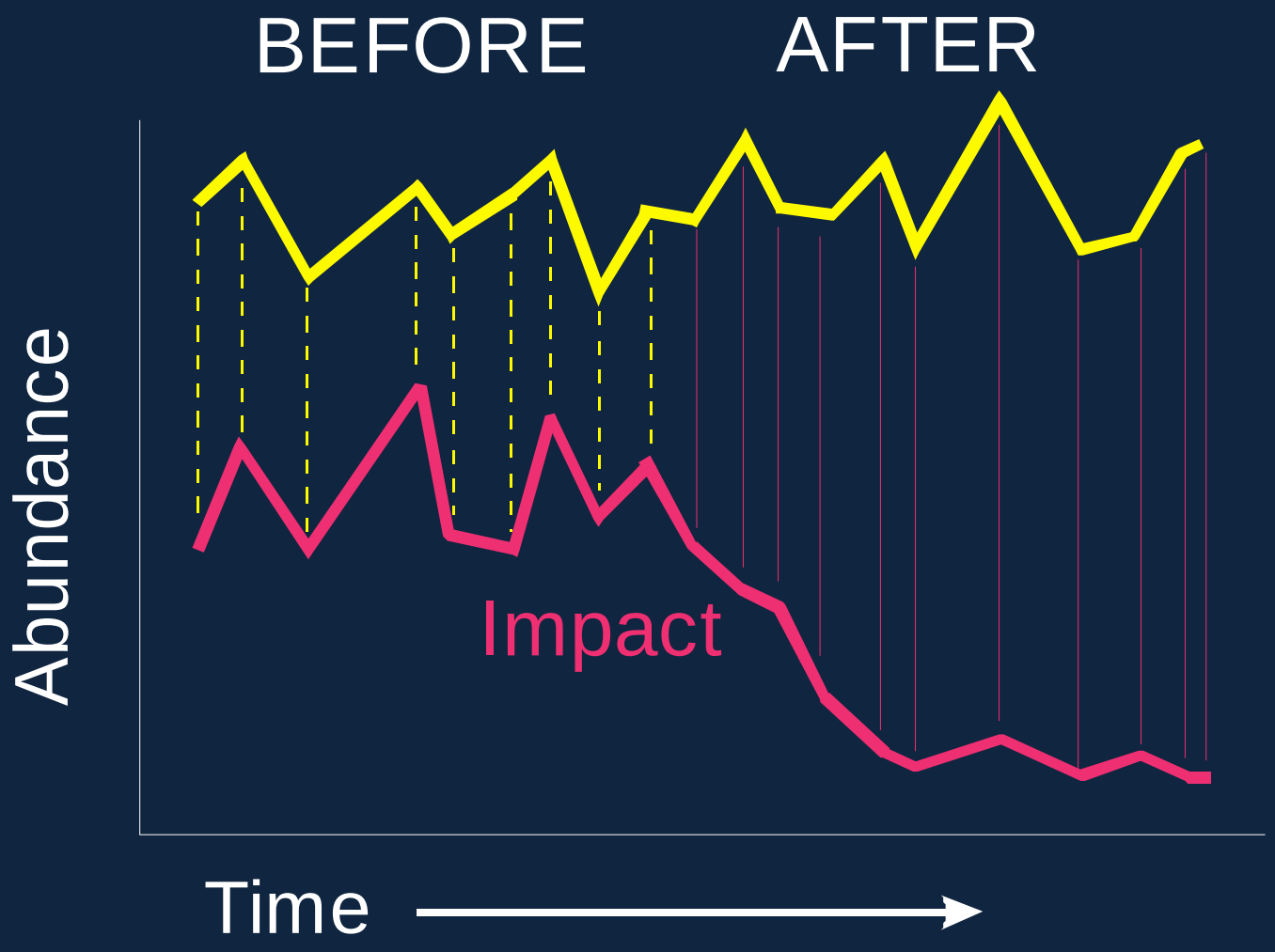




4 trampling exposures (treatments) each with four 2 m x 4 m plots

Control	Nobody
Light	2 people - 10 min.
Moderate	2 people - 20 min.
Heavy	4 people - 40 min.

Before-After-Control-Impact (BACI) Study



Foot Traffic Simulation

Activities

- find species
- count and compare numbers
- match species to pictures

Behavior observed

- walking
- kneeling
- standing still

51 People Helped

Tenera Environmental

Joel Carter
Jay Carroll
Gery Cox
Chris Ehrler
Zach Green
Andrew Harmer
Susan Helberg
Richard Hernandez
Mike Holmes
Scott Kimura
Charlie Oncea
Steve Pengilley
John Steinbeck
Jim Strampe
Jenny Vick
Shelly Witters

California State Polytechnic University, San Luis Obispo

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Anthony Baniaga
David Brewer
Lenora Brewer
Blake Brown
Nancy Brown
Curtis Brumit
Melissa Daugherty
Helen Dickson
Kate Downey
Sarah Gravem
Nate Hall
Tarah Herning
Serra Hoagland
Corbin Hodges
Rietta Hohman
Laurel Johnston
Karlien Lang
Patricia Laverty
Leslie Longbach
Erin Nakada
Andy Needles
Lisa Needles
Maggie Nichols
Dave Rassmussen
William Rudolph Moorehead
Michelle Seybert
Katie Spencer
Kyle Sumner
Elise Suronen
Jackie Swider
Andrew Taylor
Grant Waltz
Dean Wendt
Katherine Wilkin

Sampling & Foot Traffic Application

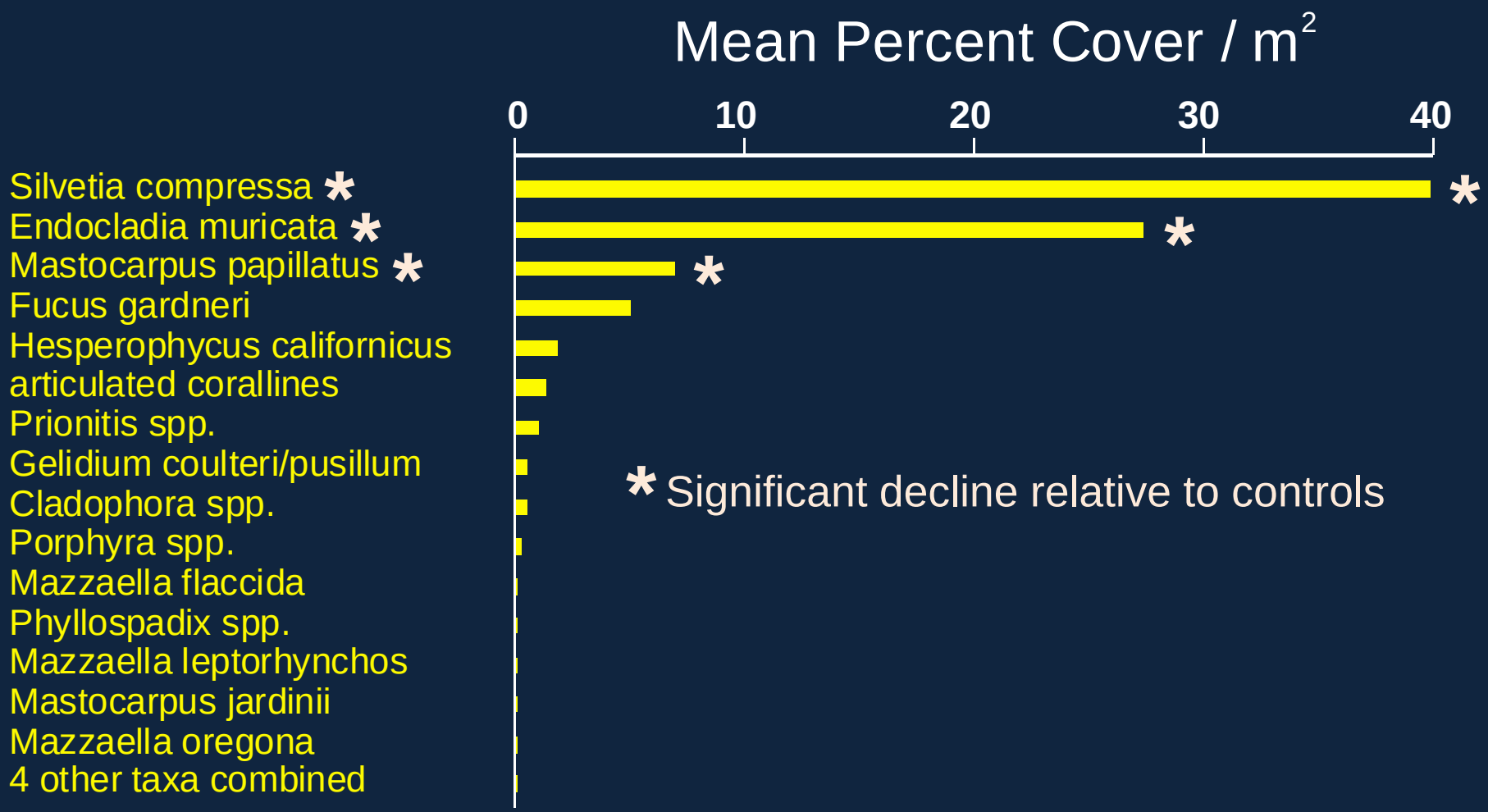
Three 1 m^2 quads / plot

SAMPLED >30 algal taxa
>90 invert taxa
1 seagrass species

METRICS

- % cover algae, sessile inverts, bare rock
- Counts of motile invertebrates
- Rockweed density and plant lengths

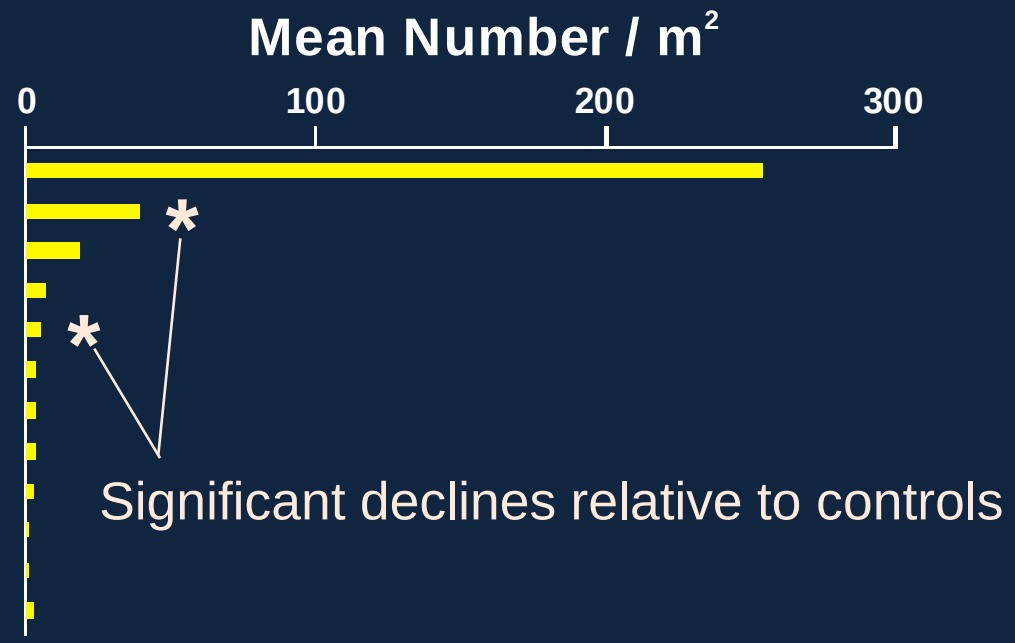
Baseline Algae



Baseline Invertebrates

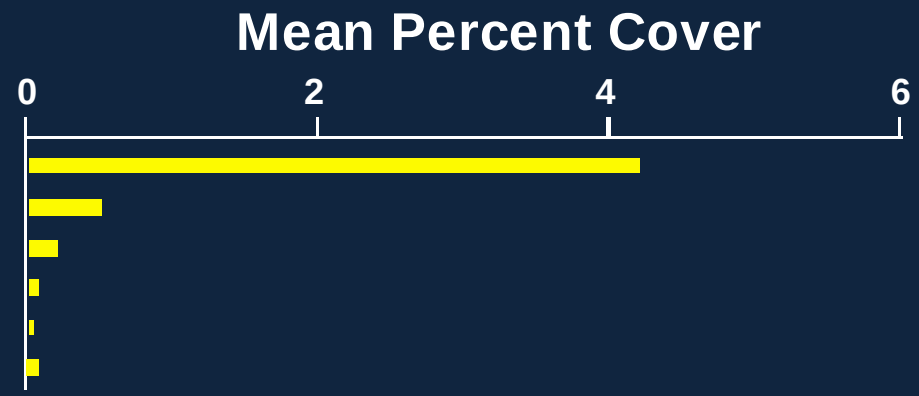
Count Taxa

- Chlorostoma (Tegula) funebralis
- * Lottiidae
- Pagurus spp.
- Acanthinucella spp.
- * Cyanoplax hartwegii
- Littorina spp.
- Lottia asmi
- Ocinebrina spp.
- Crepidula spp.
- Pachygrapsus crassipes
- Ischnochitonidae
- 21 other taxa combined

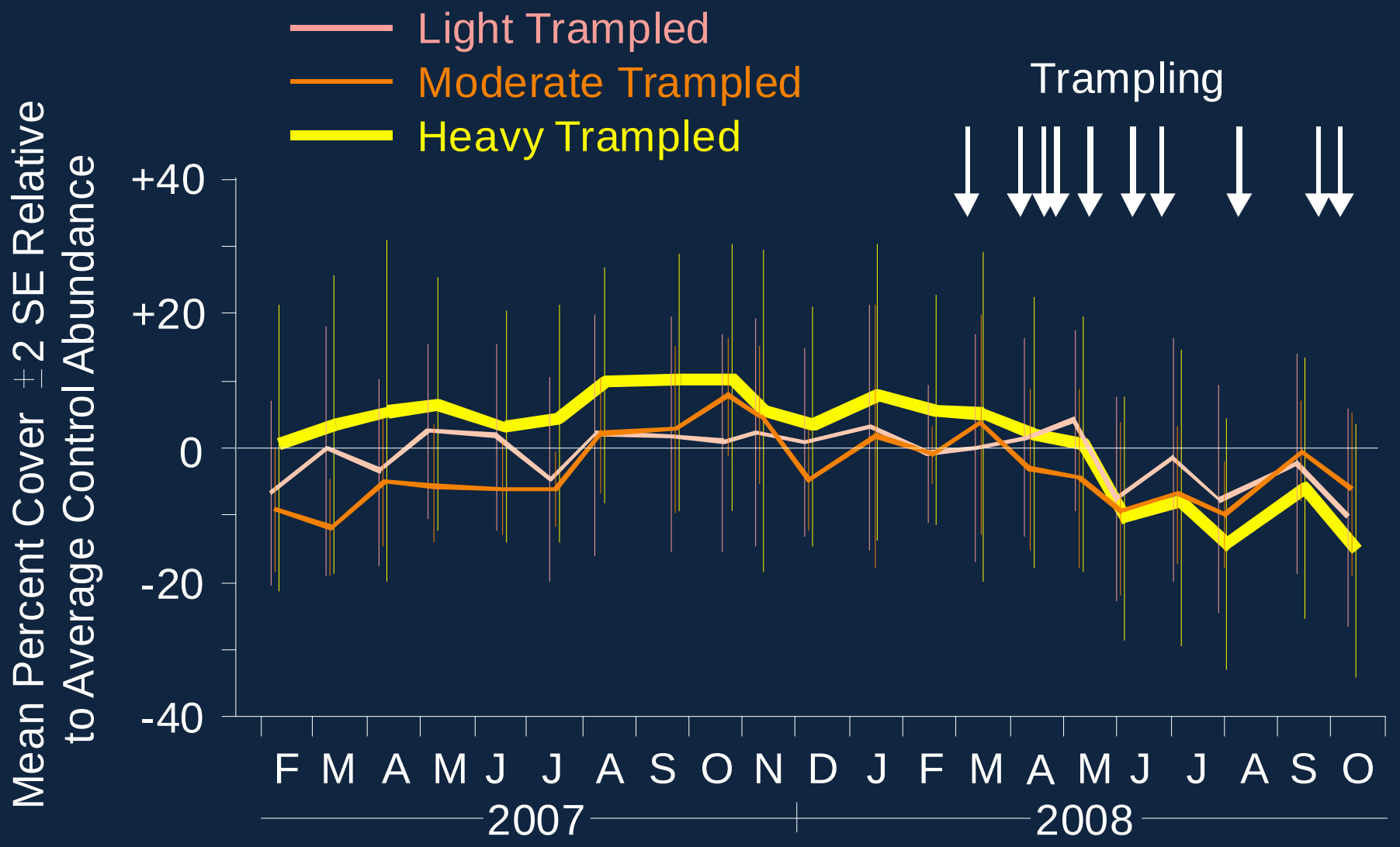


Coverage Taxa

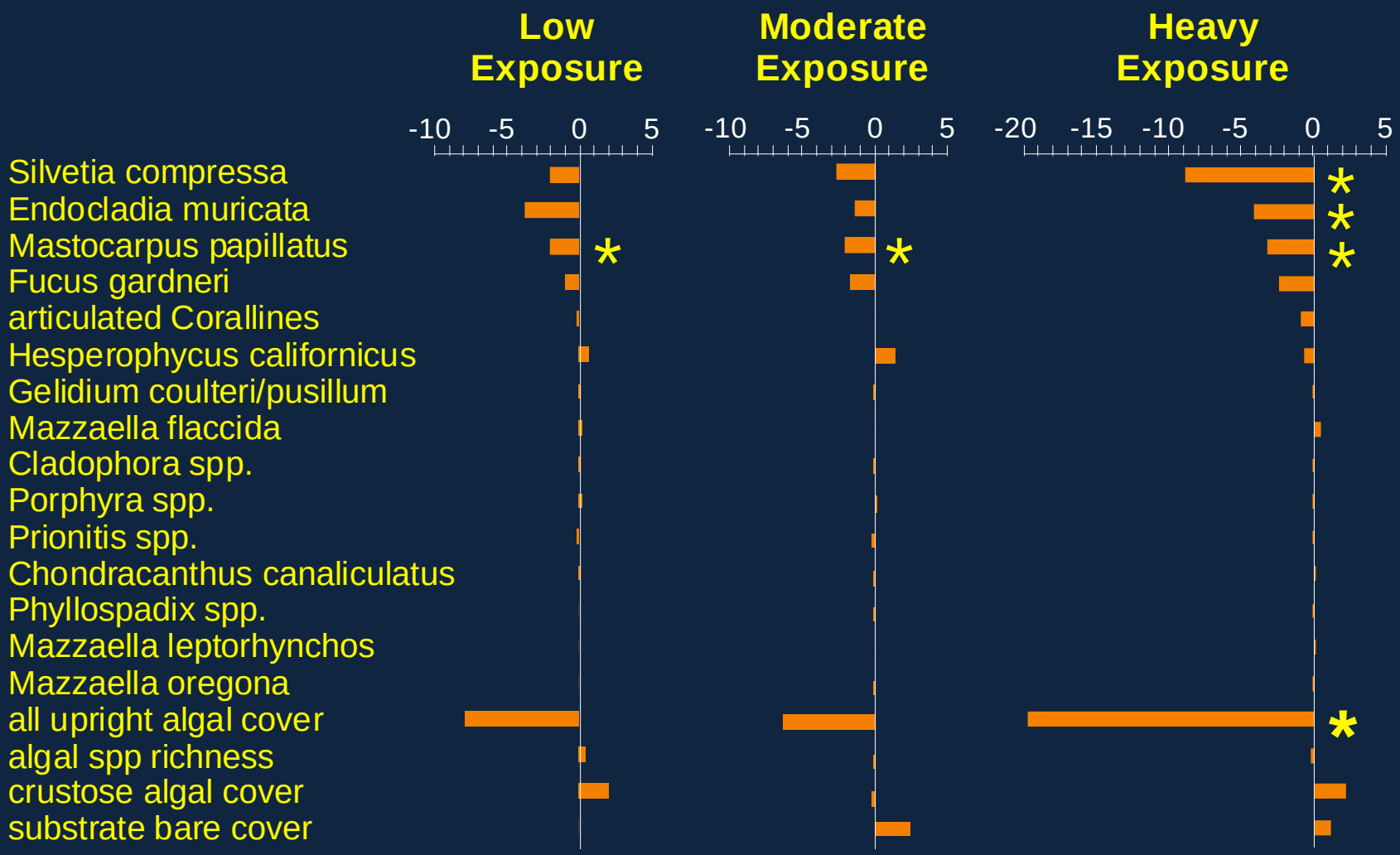
- Chthamalus fissus
- Anthopleura elegantissima
- Phragmatopoma californica
- Mytilus californianus
- Pollicipes polymerus
- other coverage taxa combined



Changes in Rockweed Cover Relative to Controls



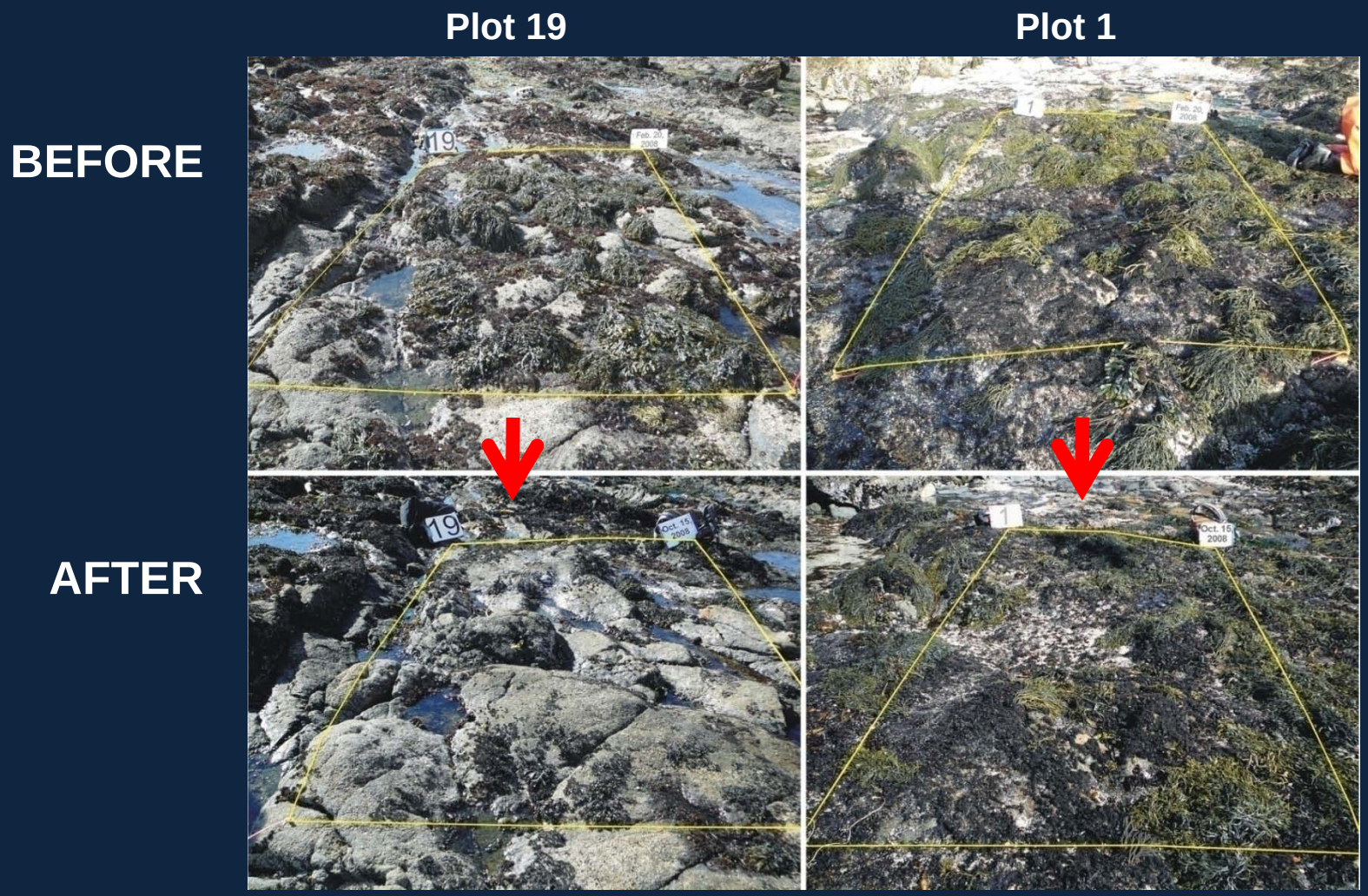
Change Relative to Controls



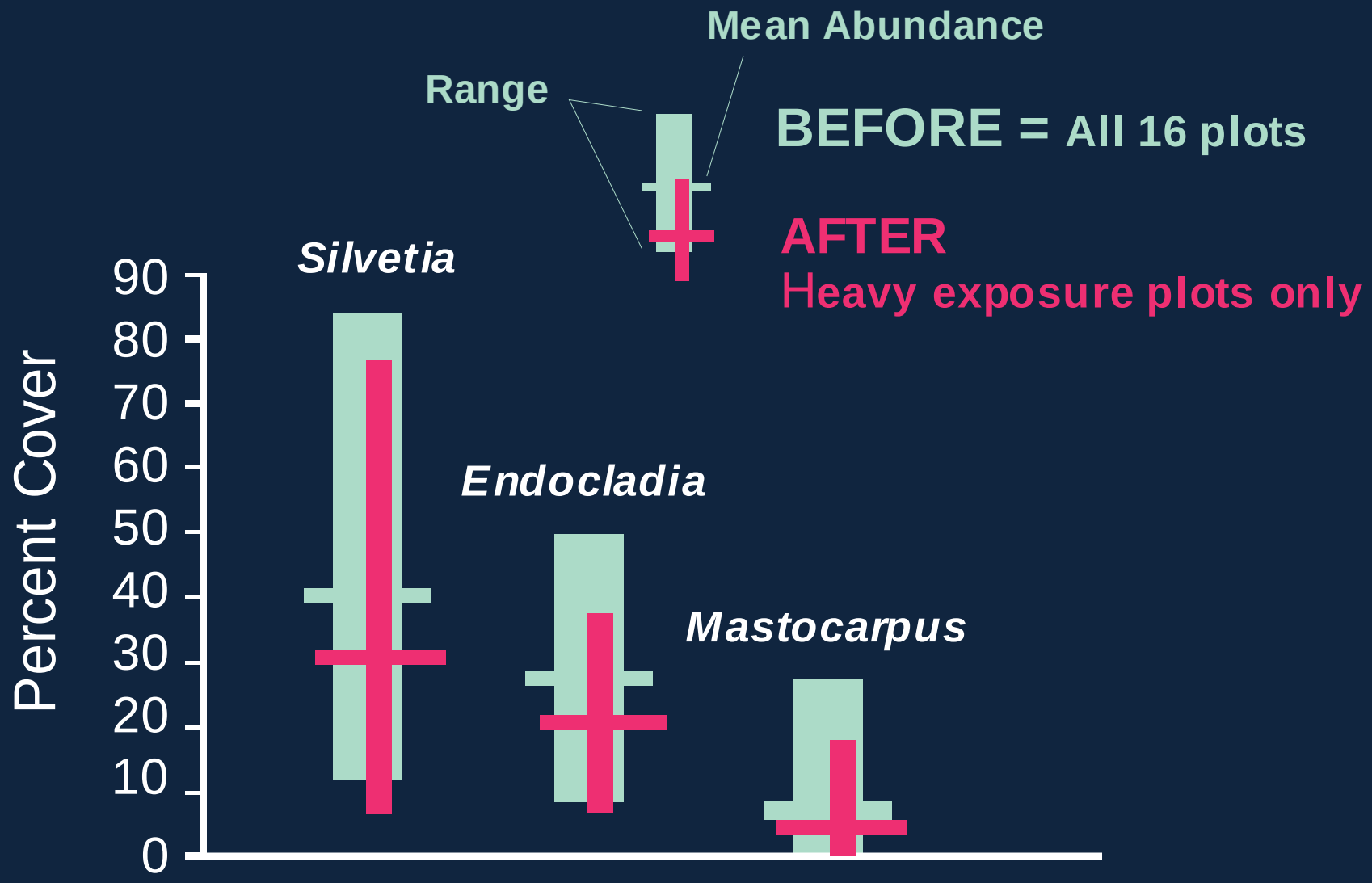
Statistical Analysis

	Treatment Probabilities		
Taxon	**Low**	**Medium**	**Heavy**
Total Algal Cover	0.1083	0.0501	**0.0000**
Algal Taxa Richness	0.8395	0.6830	0.3936
Rockweeds	0.3933	0.4840	**0.0005**
Silvetia compressa	0.4562	0.5680	~~**0.0128**~~
Endocladia muricata	0.5303	0.0722	**0.0012**
Mastocarpus papillatus	**0.0025**	**0.0023**	**0.0000**
Invertebrate Taxa Richness	0.7337	0.7285	0.1546
Lottidae	0.5517	**0.0082**	0.2475
Cyanoplax	0.9373	0.1526	**0.0498**

Rockweed Change in Heavy Exposure Plots



Declines Were Subtle



Assessment of Foot Traffic Impacts

Excessive visitor traffic can reduce species abundances by trampling

However

- People generally avoid stepping on species whenever possible

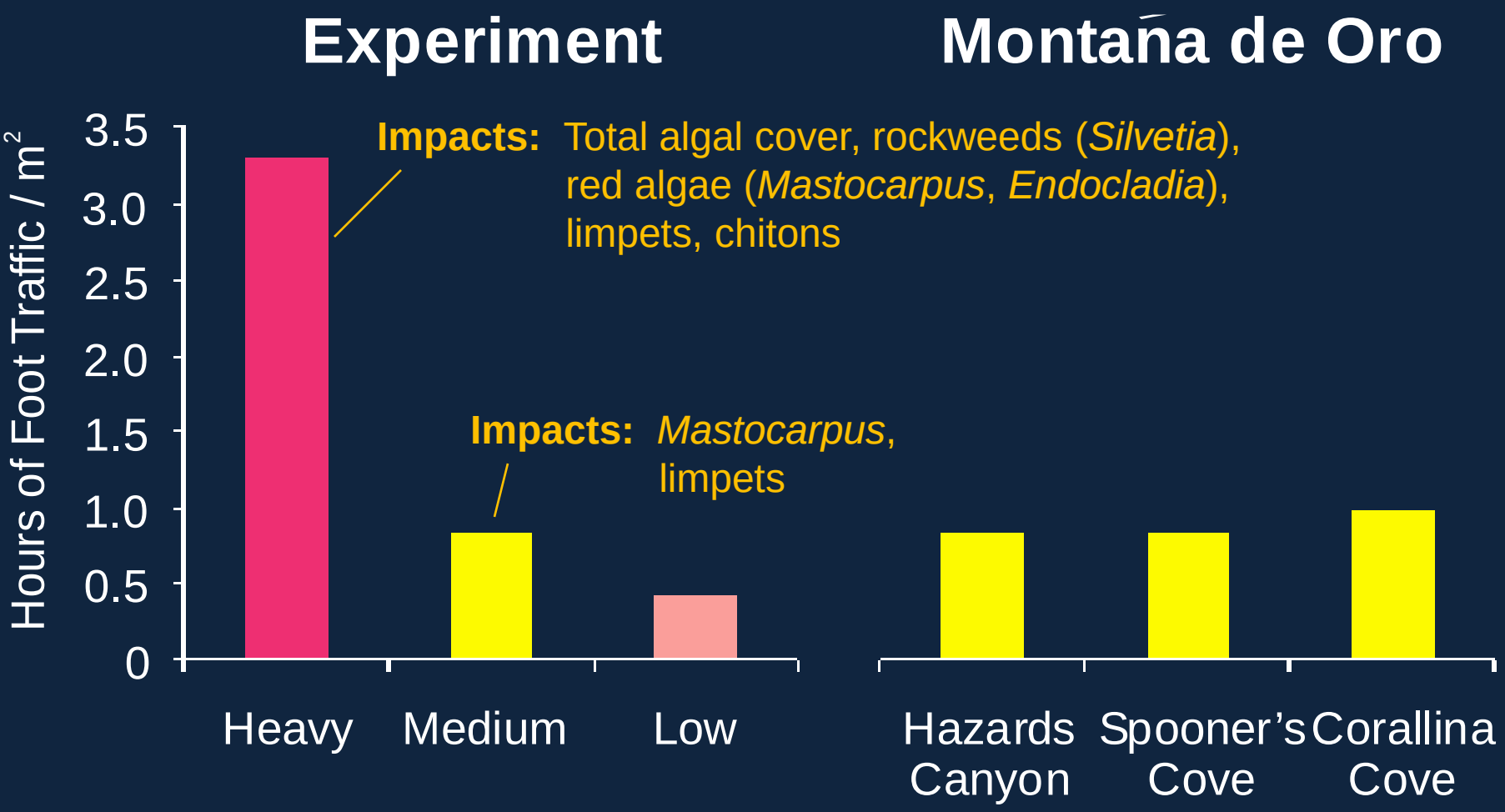
As a result

- An equilibrium may be reached where species can still persist in high abundance around the traffic areas

Also

- Recovery is always occurring in the background
- Trampling probably does not result in local extinctions

Applying Study Findings to the Real World



Next Steps

1) Recovery Monitoring

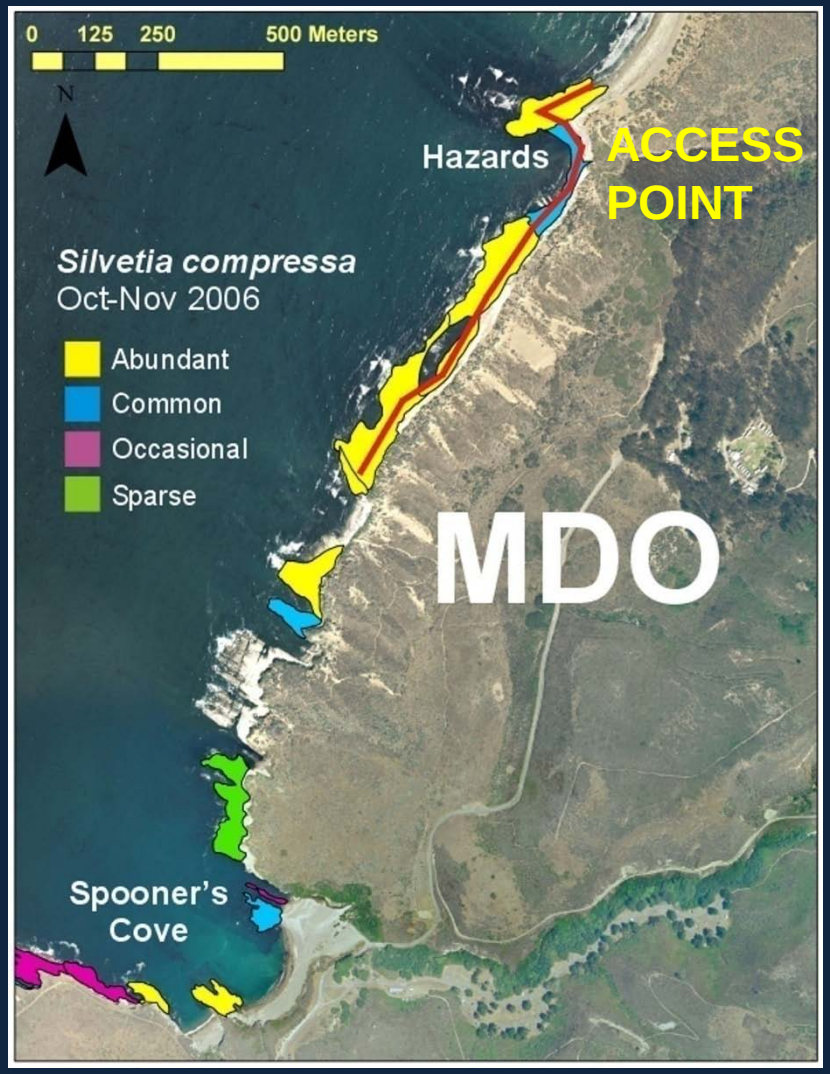
Return to baseline levels would help verify that significant changes were due to trampling

Increases in abundances would also provide estimates of the rates of recovery and community resiliency in the face of visitor traffic

2) Gradient Study

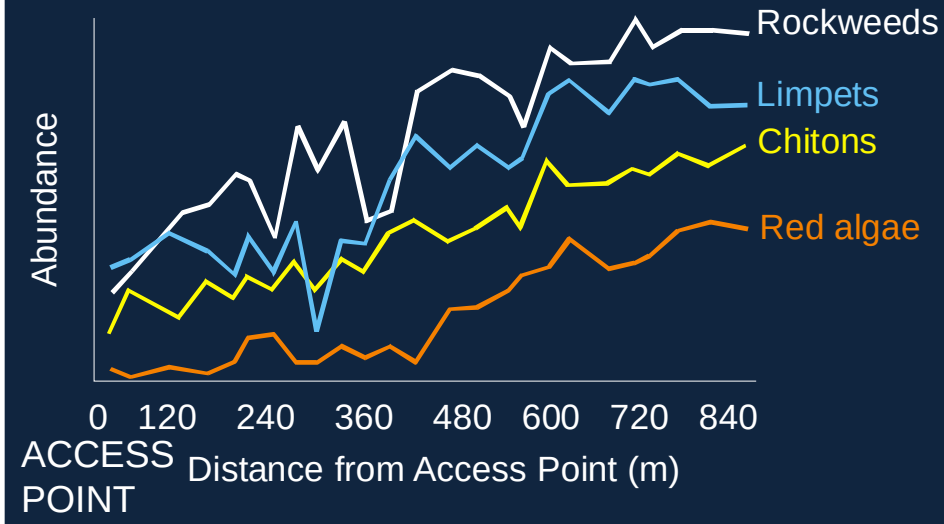
Additional study to assess the effects of long-term / chronic trampling and field confirmation of the experiment findings

Gradient Study



Groups of quadrats sampled every 20 m for select species

Hypothetical data



Management Implications

Short-term impacts from foot traffic may not be large, but, there may be long-term, cumulative effects.

Considerations for Resource Management:

- Visitor attendance record keeping
- Education outreach
- Docents
- Reservation system
- Monitoring

THANK YOU

QUESTIONS ?

Lab Experiment

Purpose

- Determine how much trampling rockweeds can withstand

Methods

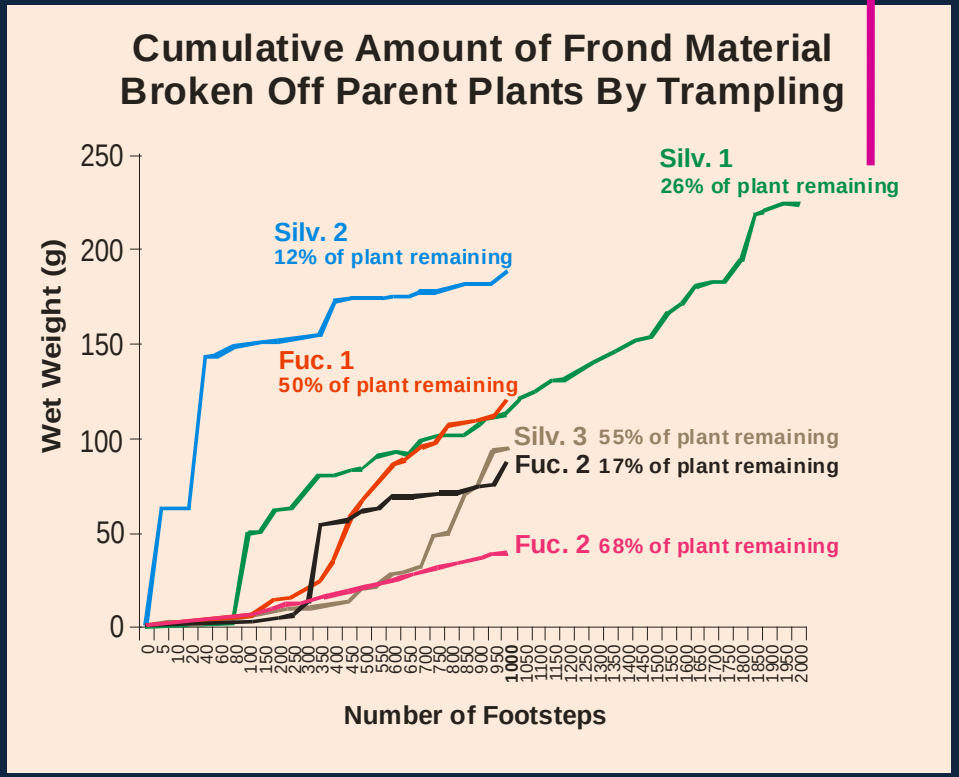
- Collected 3 *Silvetia* and 3 *Fucus* plants, and weighed each plant (wet weight)
- Placed each plant on a flagstone rock and began stepping directly on plants
- Weighed broken off frond material

Findings

- Up to 1,000-2,000 direct footsteps did not fully demolish plants
- Bushy plants are difficult to break apart, due to 'cushioning effect'

Study Limitations

- More breakage might have occurred if the underlying substrate was more rugose
- The study could not account for total plant dislodgement (holdfast breakage), because plants were not attached to the flagstone rock

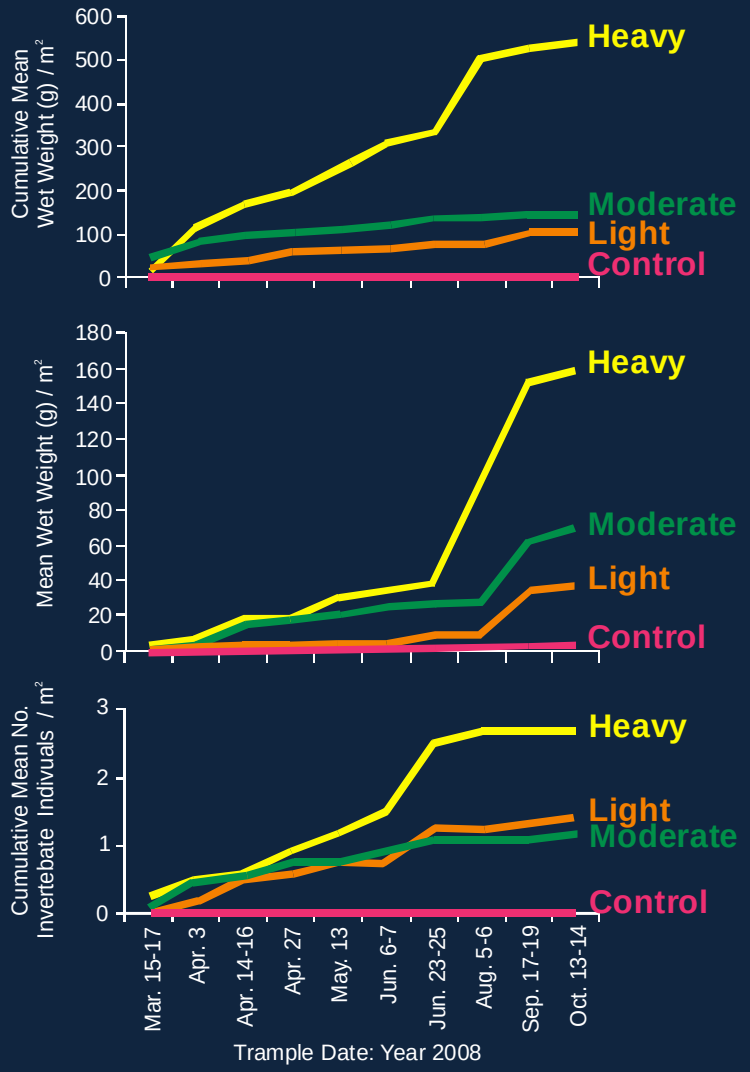


Immediate Damaged to Species (Cumulated Over Time)

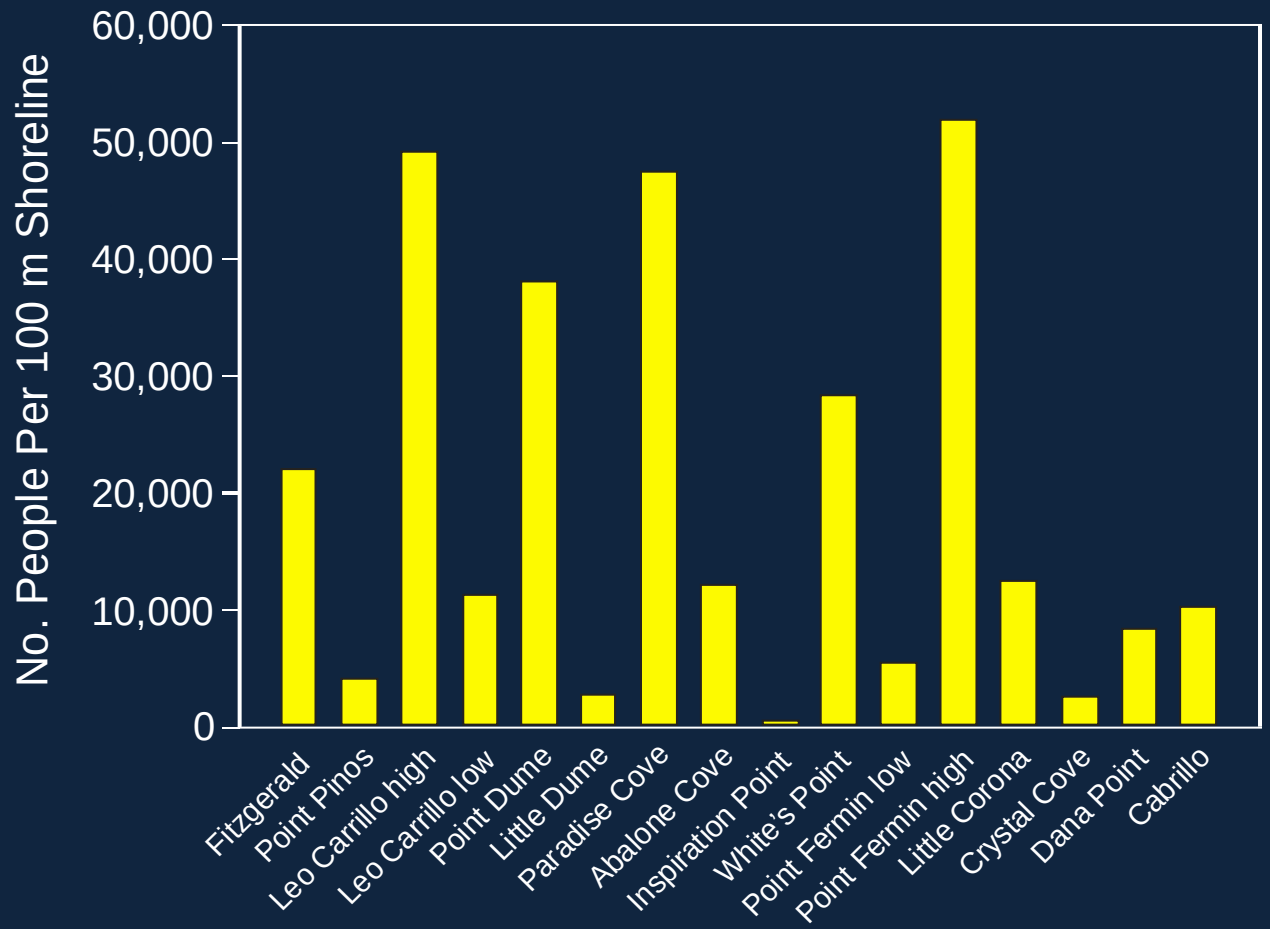
Rockweed Biomass Removed

Understory Biomass Removed

Crushed Invertebrates



Annual Visitation on Rocky Shores
Standardized to 100 m Length of Shore



Data from various sources as summarized
in Tenera (2003) and Ambrose and Smith (2005)

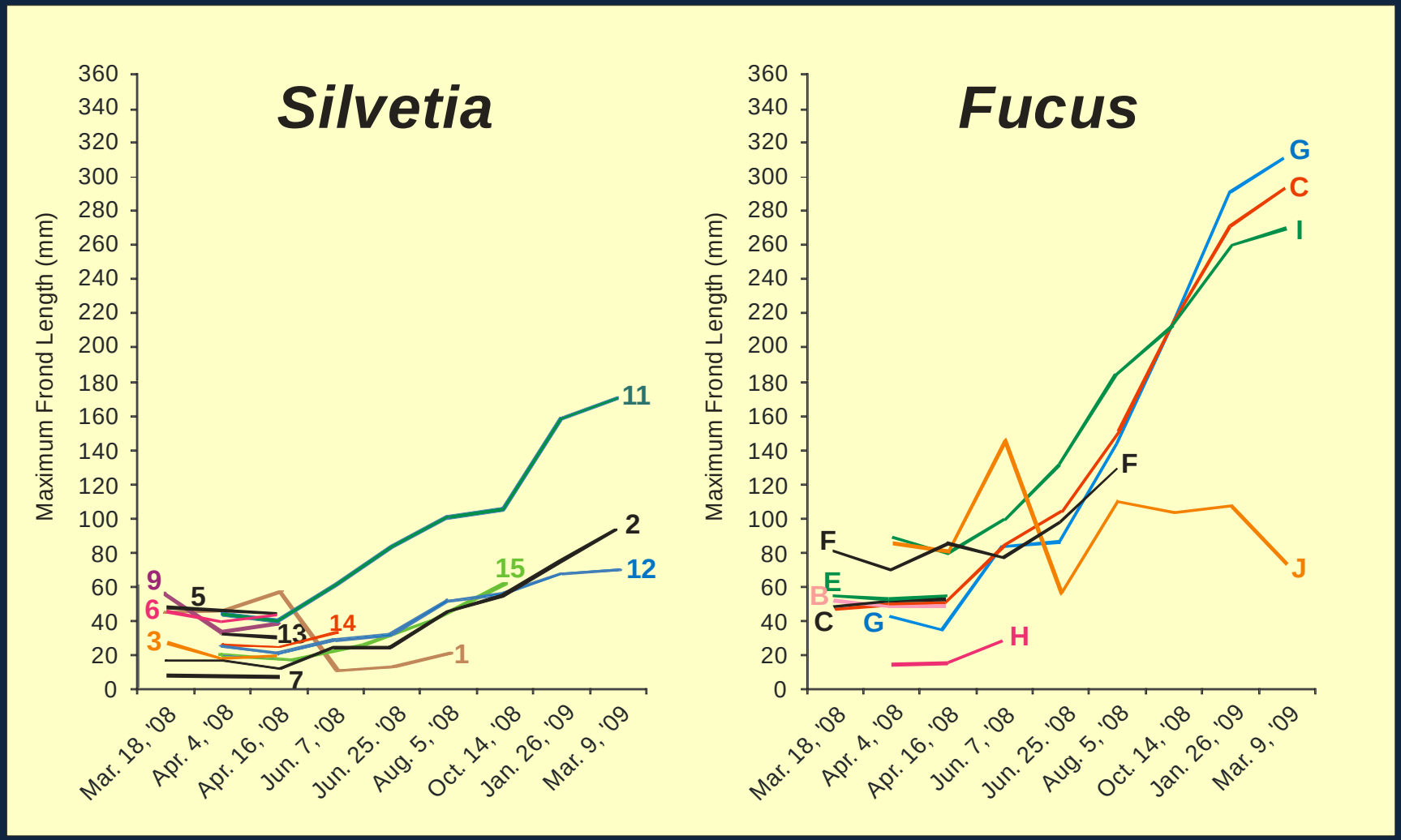
Number of visitors using SLO County shores ??

Recovery Potential - Growth

Silv.- 11

Fucus- G

Rockweed Growth in 12 Months



Recovery - Exxon Valdez Oil Spill