

Why Beaches Matter? Beach Dynamics & Ecology

AdaptLA Webinar Series
Webinar #2 | March 17, 2015

Conference Call-in for Webinar Audio

1-888-387-8686

Passcode: 4898874



Welcome!

- About USC Sea Grant, AdaptLA & the SoCal Coastal Impacts Project, Juliette Hart, USC Sea Grant

Featured Speakers:

- Dr. Reinhard “Ron” Flick, Scripps Institution of Oceanography
- Dr. Karen Martin, Pepperdine University
- Discussion & Questions

USC Sea Grant – The Urban Ocean Program



- Fund research
- Community outreach & education
- Technical assistance to local/regional government

If 10 Million by Sea...

- Climate Change Science & Planning
- Coastal Ecosystem Science
- Coastal Management
- Maritime Affairs

Regional AdaptLA



- Grant led by City of Santa Monica, but includes 11 coastal jurisdictions and L.A. County
- Managed by USC Sea Grant
- Project partners: LARC, Heal the Bay, Santa Monica Bay Restoration Commission



Regional AdaptLA: Project Scope

- “Best of the best” coastal impact models for L.A. region
 - Coastal Storms Modeling System 3.0 (USGS)
 - Impacts to our Beaches (TerraCosta Consulting Group)
 - Shoreline Change (ESA/Revell Coastal)
- Capacity-Building & Stakeholder Engagement
 - Trainings/Workshops
 - Webinar series
 - Public outreach



Southern California Coastal Impacts Project



- Outreach in Southern California coastal communities on CoSMoS and other relevant SLR planning topics
- Focus regions: San Diego, Orange County, L.A. (thru AdaptLA) and Santa Barbara/Ventura
- Stakeholder Engagement and Capacity Building
 - Initial Process Workshops (SB/MT on April 14th)
 - Webinar series through (2015 – Summer 2016)
 - Technical Outreach Workshop (Summer 2016)

The Iconic Coast of Los Angeles



- ❑ Challenges
- ❑ Coastal Setting
- ❑ Sea Level
- ❑ The Future?

LA Region Beach Webinar
17 March 2015

Reinhard E. Flick, Ph.D.
Coastal Oceanographer
Scripps Institution of Oceanography

Rising to California's Coastal Challenges

❖ Finding & maintaining balance...

- ❑ Commercial, institutional, transportation, residential & public infrastructure
- ❑ Retreat & armoring MSLR will require
- ❑ Sand supply, nourishment & retention

■ Getting & keeping enough sand on beaches & dunes...

- ❑ Satisfy recreational & tourist demand
- ❑ Reap economic, habitat & cultural benefits
- ❑ Provide some coastal protection

❖ Preserving natural features, resources, & habitat in urban settings

- ❑ Wetlands, open space & clean water
- ❑ Beach & coastal scenery
- ❑ Living resources - Fish, abalone, lobster & tide pools
- ❑ “Surf habitat” - Waves

Geological Setting and Tectonics

Short 24-my Tectonic History
Young & Steep Coastal Setting

Tectonic uplift
Sea level rise & fall



California Coastal Records Project 2005

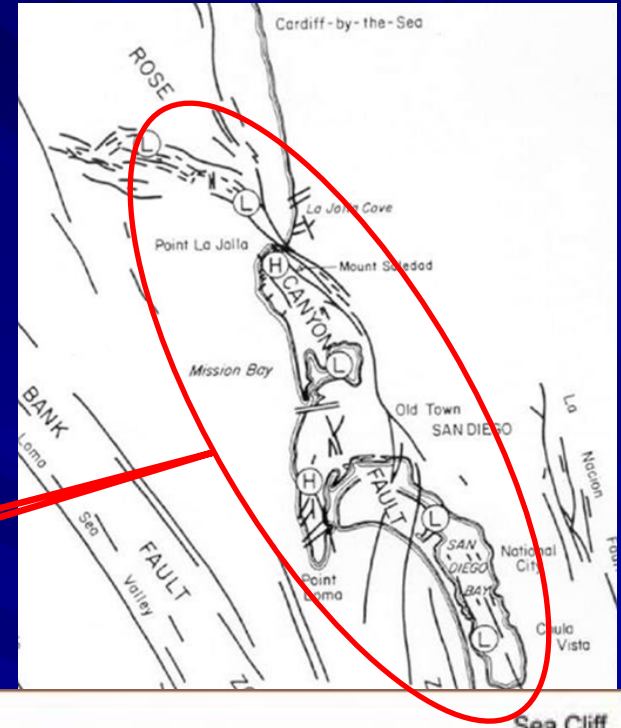
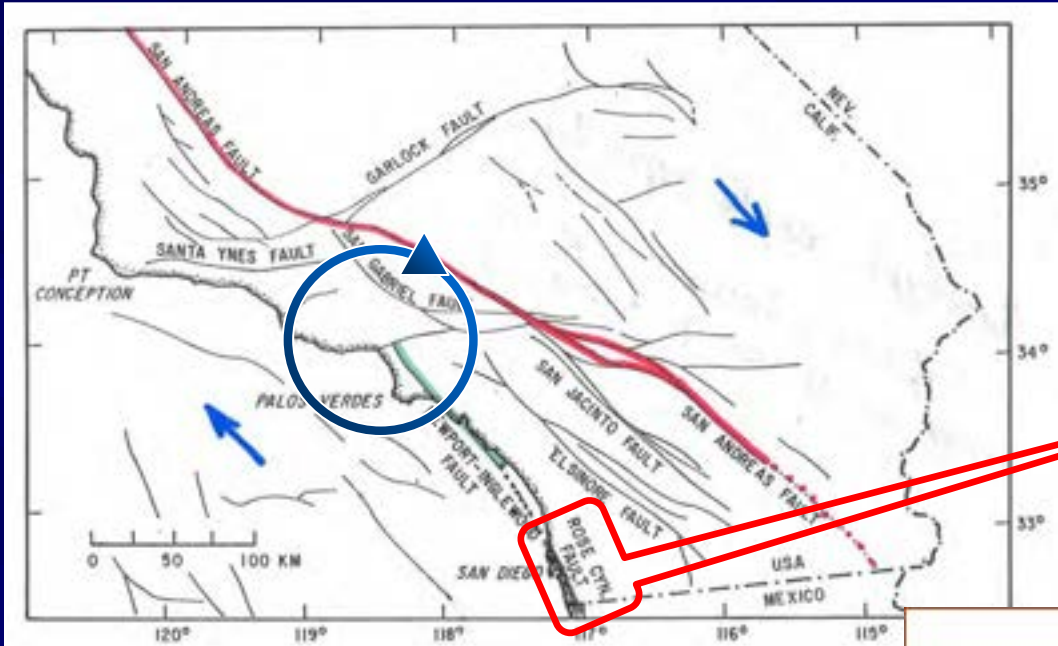
Active Volcanoes, Plate Tectonics, and the "Ring of Fire"



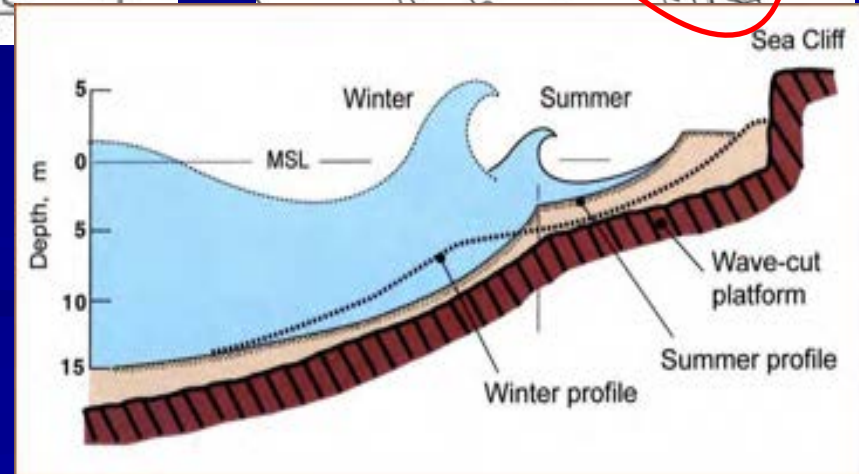
Inman and Nordstrom, 1973. Tectonic classification of coasts, *Jour. Geology* 79(1)

High, Steep, Stable, Eroding & Sand Starved

A guide to future evolution



TerraCosta Consulting Group
Photo

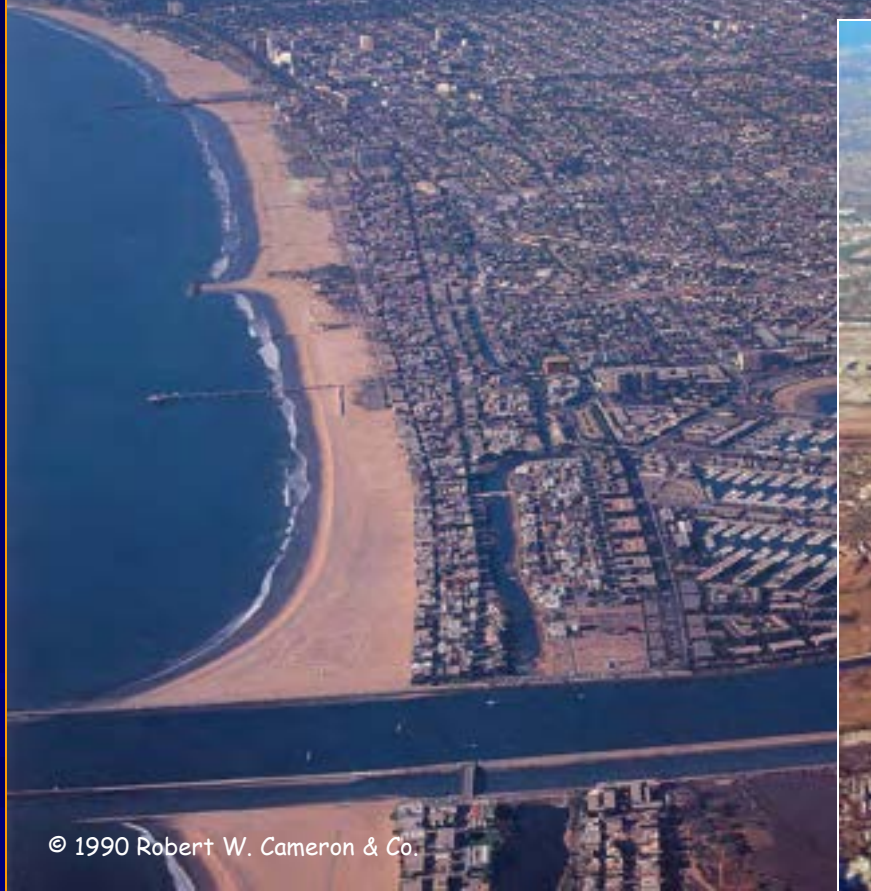


Doug Inman Illustrations

LA Beaches Artificially Wide

Modern Santa Monica Bay Shoreline is Human-Made

23 million m³ sand 1940-1990



© 1990 Robert W. Cameron & Co.

Griggs, Patsch, Savoy, 2005. *Living with the CA Coast*, UC Press
Flick, 1993. *Myth & Reality of Southern California Beaches*, *Shore & Beach* (61)



“I have always had an inordinate fear of sea level.”

Woody Allen

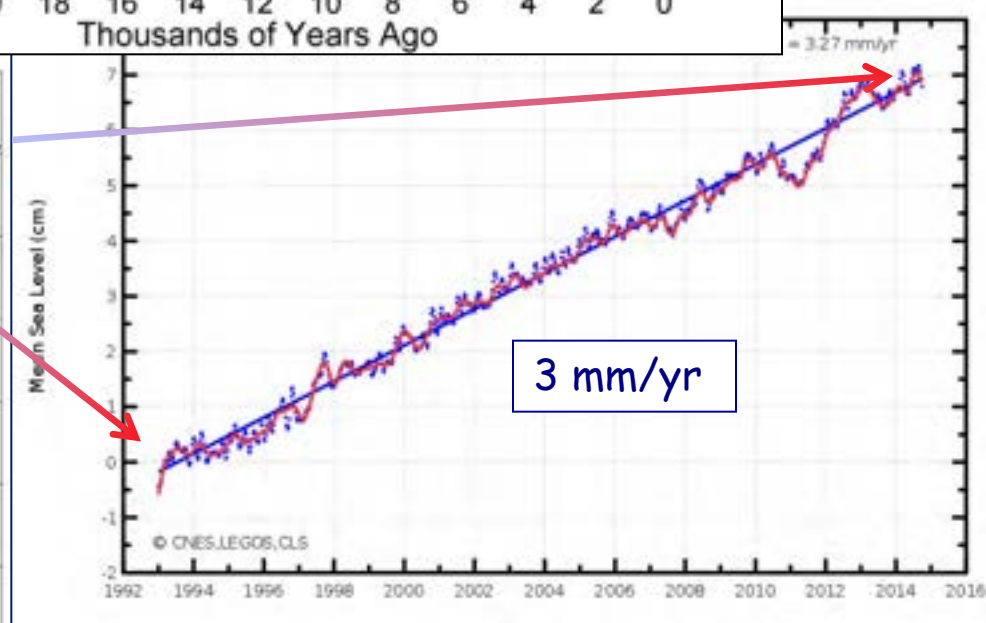
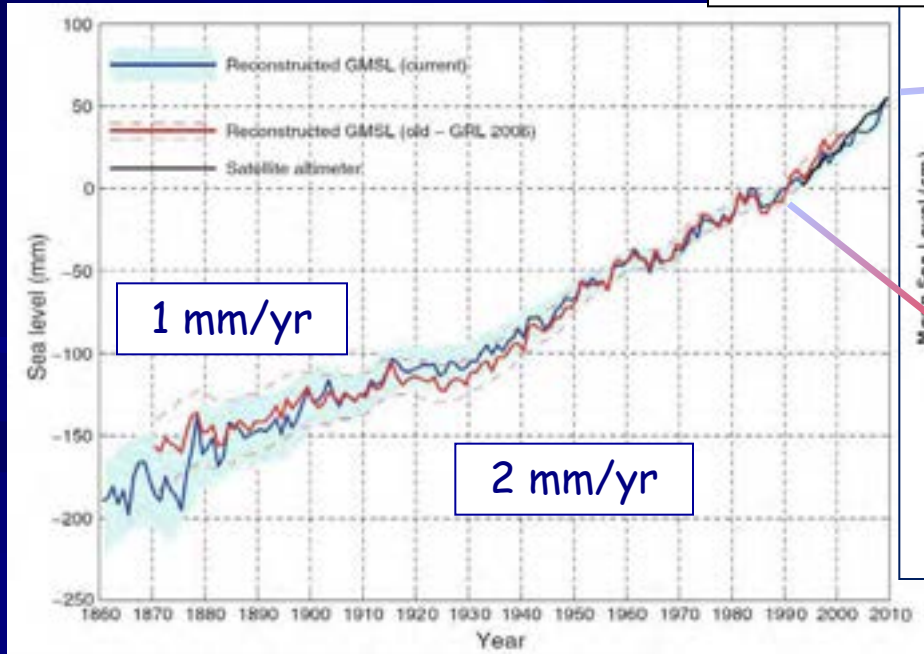
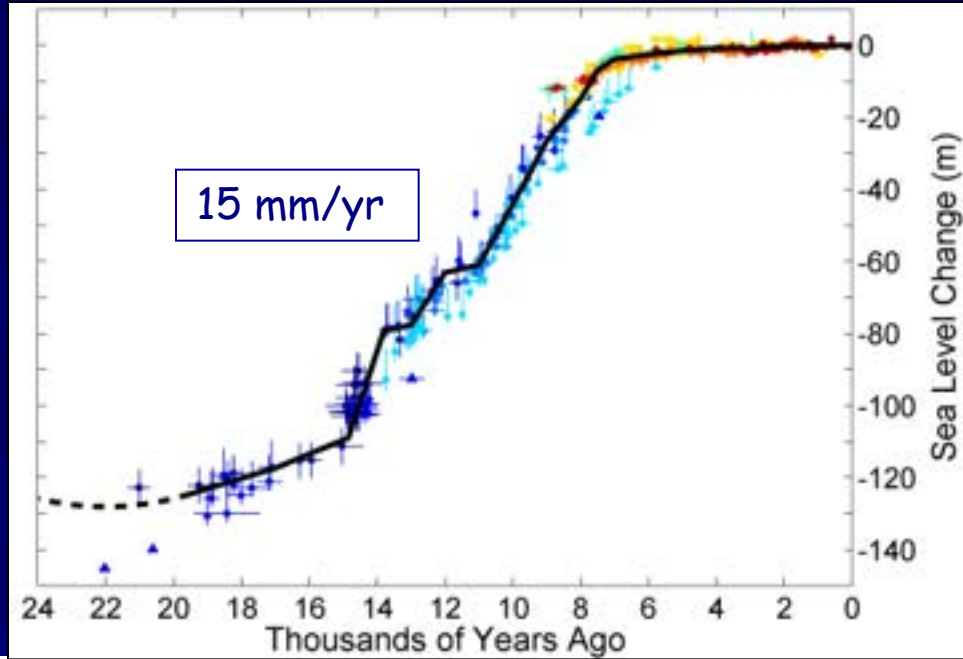
- ❑ Ice Melting - Freezing
 - ❑ Ocean Warming - Cooling
 - ❑ Tides
 - ❑ Wave Runup
 - ❑ Storm Surges
 - ❑ El Niño - La Niña
- “Mean Sea Level” (MSL)
- “Fluctuations”



Global MSLR

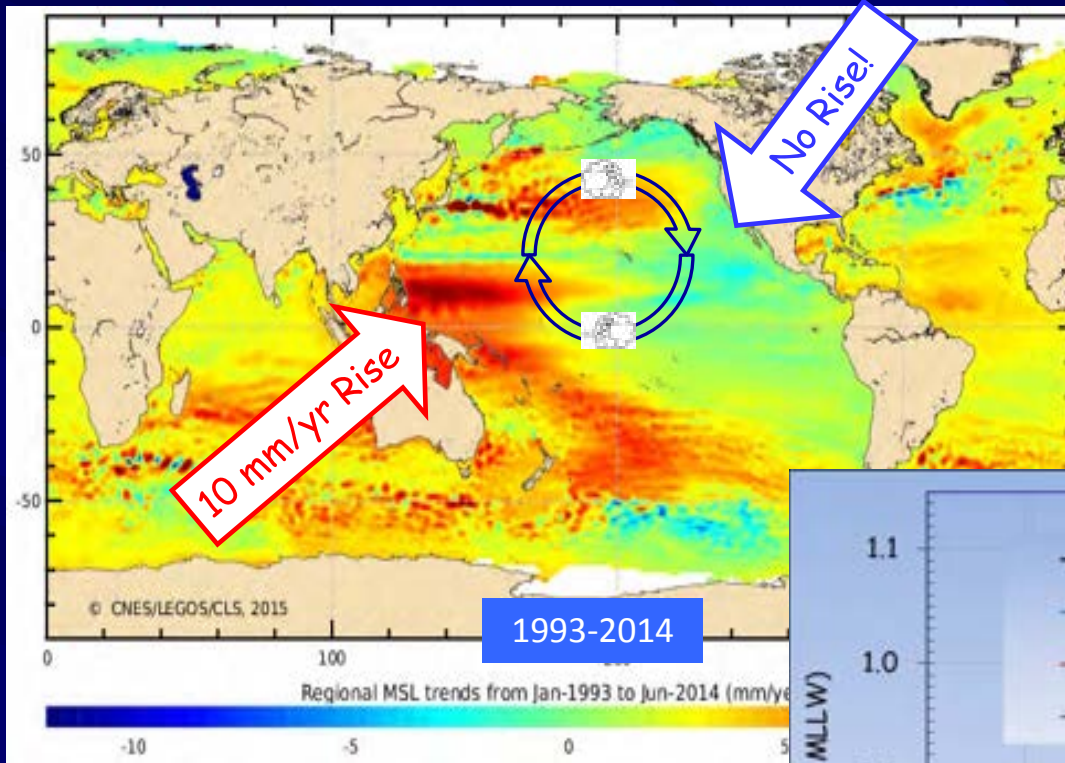
Global Tide Gauges

Church and White, 2011. Sea-Level Rise from the Late 19th to the Early 21st Century, *Surv. Geophys.*

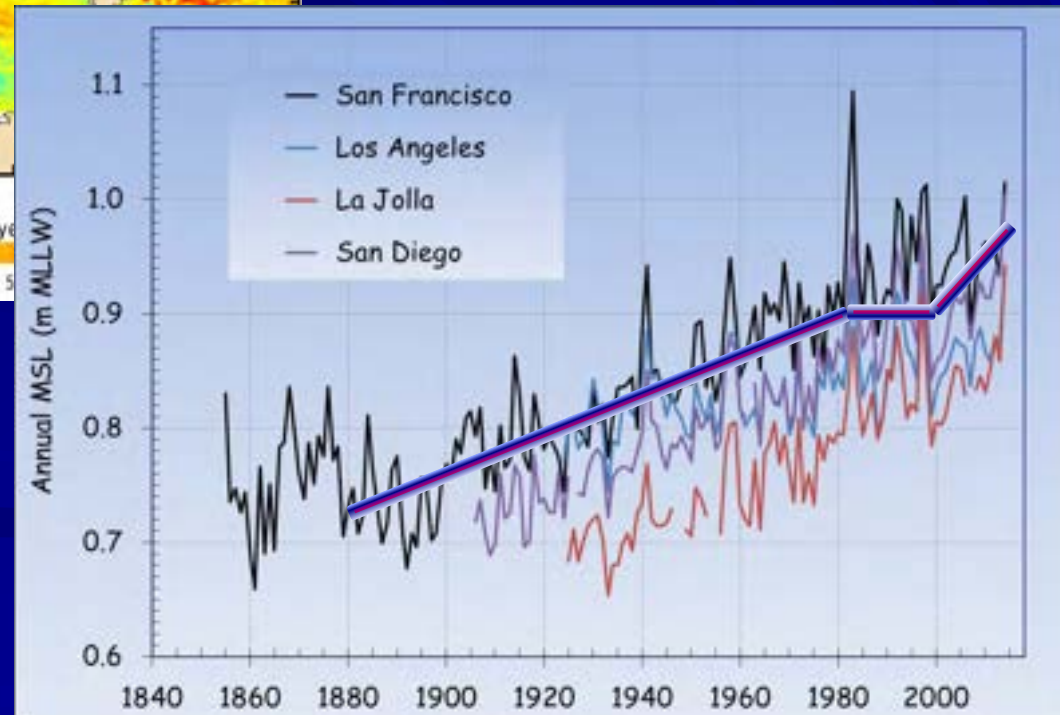


Satellite Altimetry 1992-
<http://www.aviso.altimetry.fr>

MSLR Not Evenly Distributed



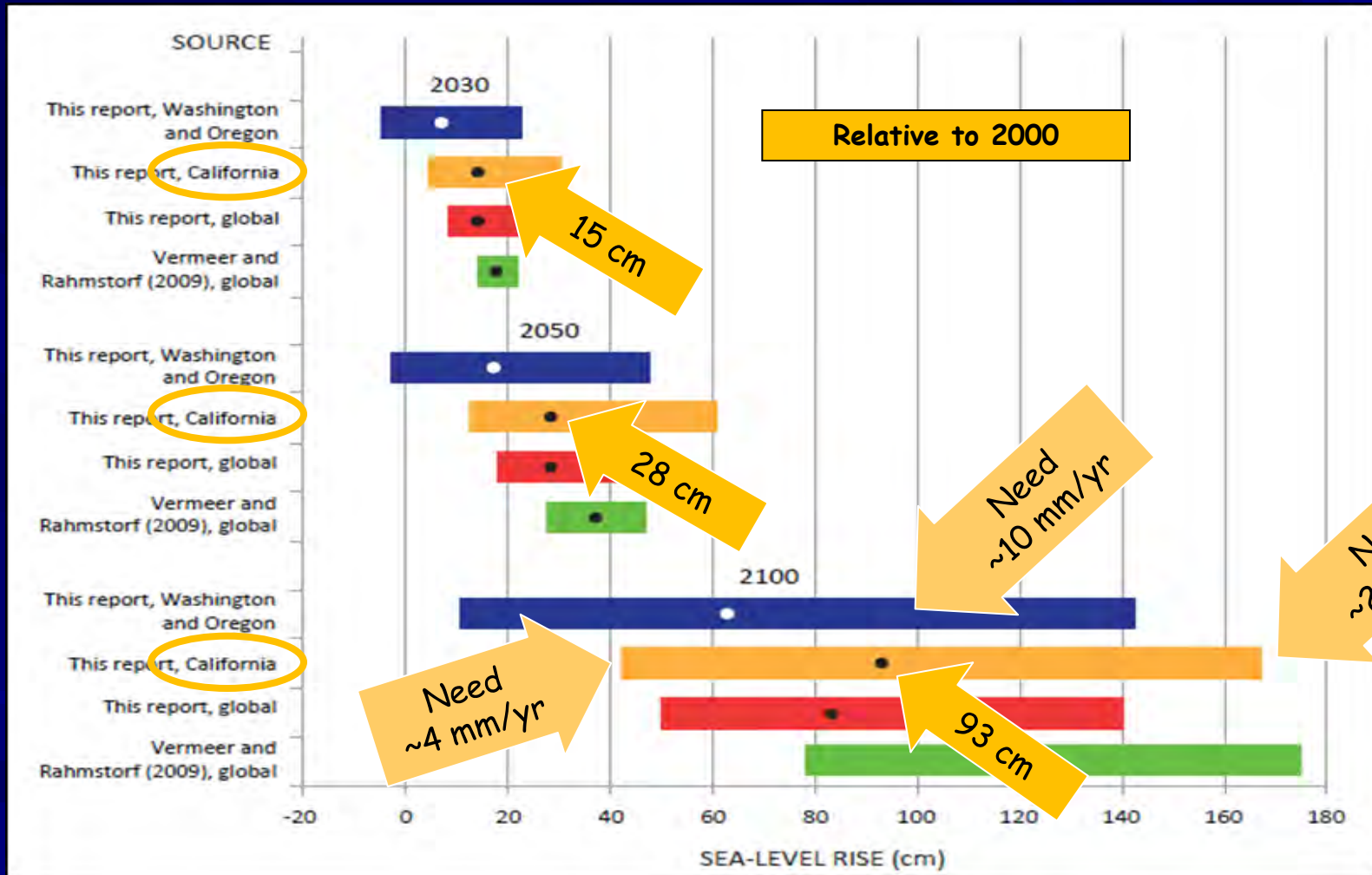
Evidence for Acceleration?



<http://www.aviso.oceanobs.com/>

Bromirski, Miller, Flick & Auad, 2011. Dynamical suppression of sea level rise along the Pacific coast of North America: Indications for imminent acceleration, *Jour. Geophys. Res.*

State of CA Guidance - "Consider MSLR" Based on NRC (2012)



California Coastal Commission Draft Sea-Level Rise Policy Guidance, Public Review Draft, 14 Oct 2013

"Prediction is very difficult, especially if it's about the future."

Niels Bohr



Naval Amphibious Base Beach Width

MSL = 2000

"Current"



What Niels Bohr Said...



Naval Amphibious Base
Beach Width

MSLR = 0.5 m
(2050)



Sounds Like Yogi Berra...



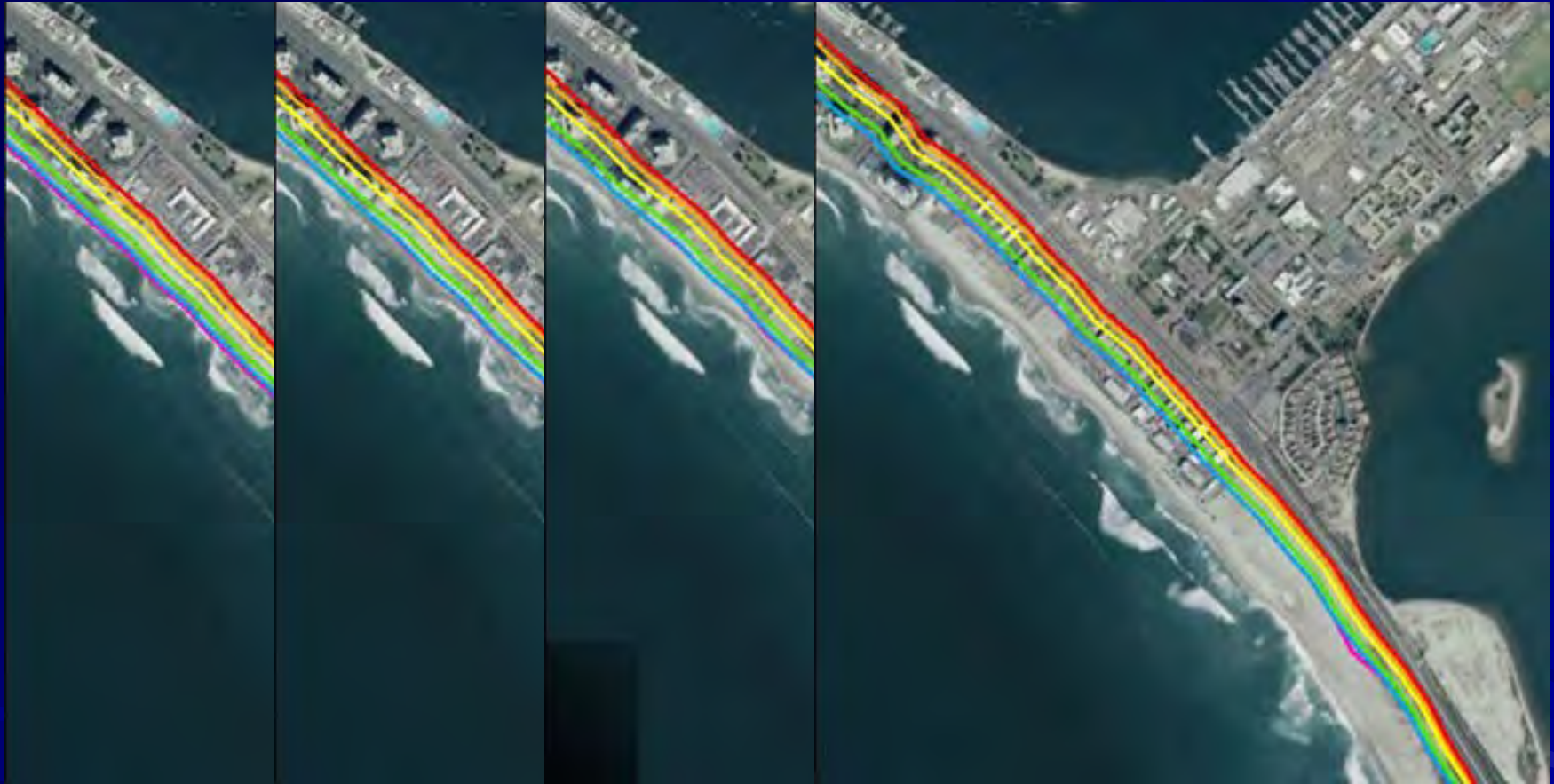
Naval
Amphibious
Base Beach
Width

MSLR = 1.0 m
(2070-2100)



"The Future Will be Difficult"

Ron Flick



Naval Amphibious Base Beach Width

MSLR = 2.0 m
(2100 & beyond)



Beaches are unique ecosystems provide critical habitat for many species



Photos: K. Martin

Beach Ecosystem Functions & Services



Water filtration



Nutrient cycling

Photos: D. Hubbard, J. D

High Biodiversity & Rich Prey Resources for Birds & Fishes

California beaches :
rich in species,
high productivity.

More than 70 species, up to 40+
species/beach

Abundance up to >125,000 individuals
per meter ²

Photos: Dave Hubbard and Jenny Dugan



Alloniscus perconvexus



Megalorchestia californiana



Donax bean clams may be very abundant at some times of year.



Photo: Dave Hubbard

California Beaches are heavily used by shorebirds for feeding, resting, and nesting.

Many migratory species appear along the Pacific Flyway.

Shorebirds appear in greater numbers on beaches with seaweed wrack, correlated with prey diversity and abundance.

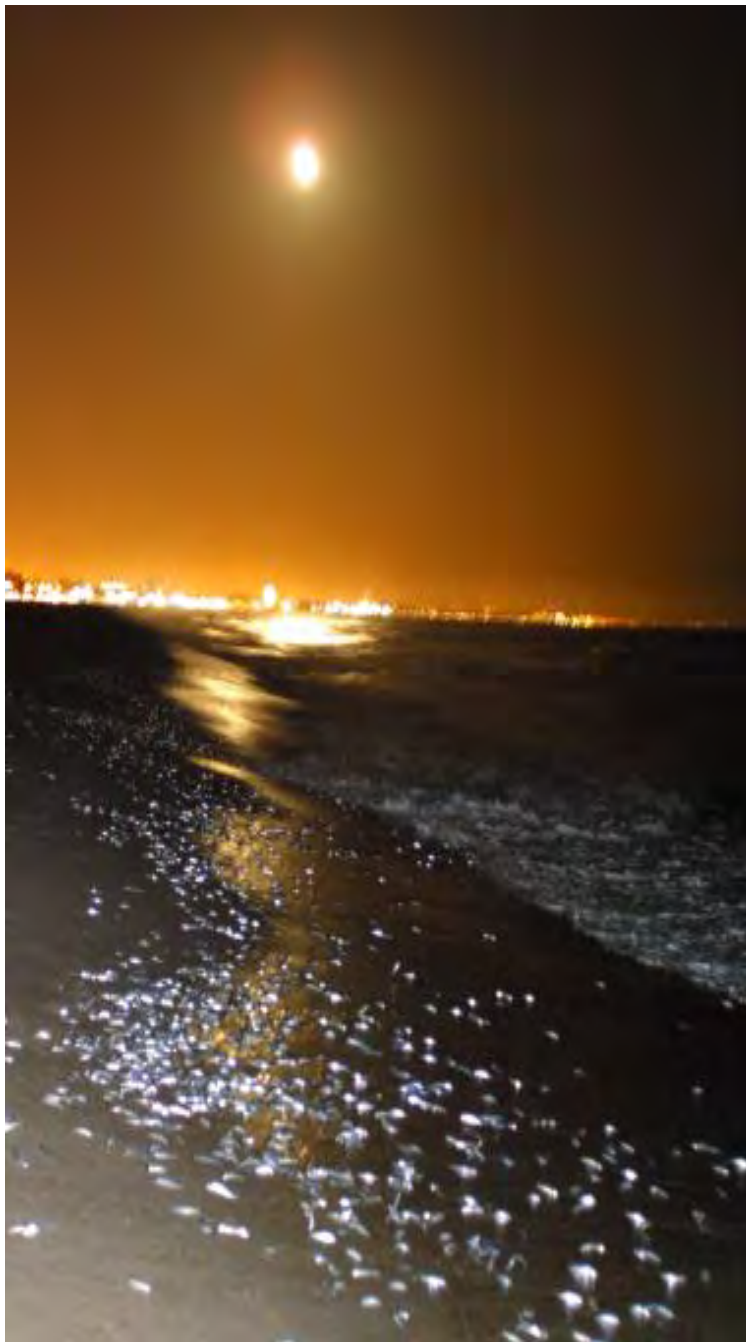


Photo: El Matador Beach, K. Martin

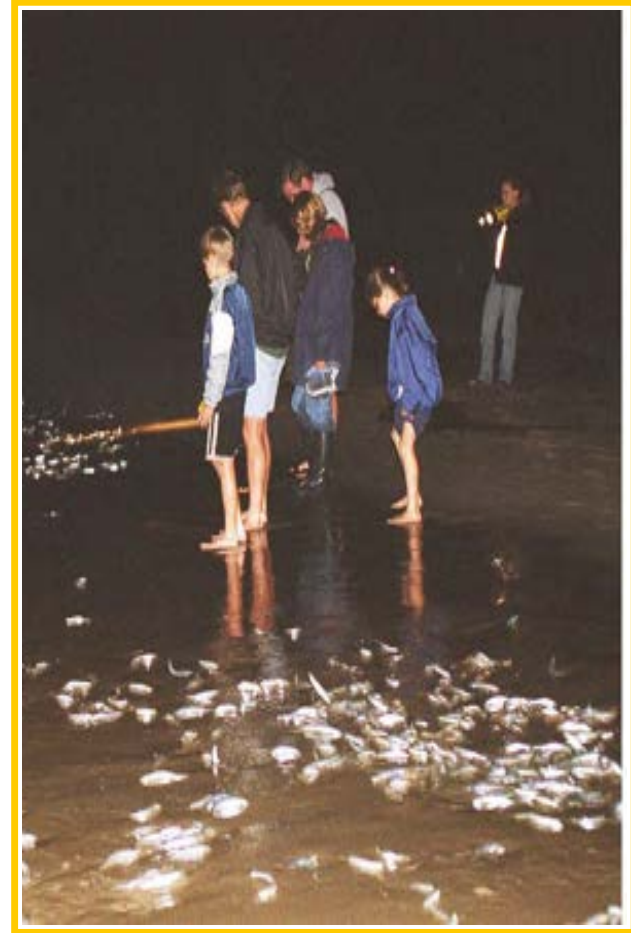
Beaches are nursery areas for birds, mammals, fish, and other animals.



Photos:
Bill Beebe,
K. Martin



California Grunion:
a unique endemic
fish, the original
California surfers



Photos by Bill Hootkins, Jennifer Harr

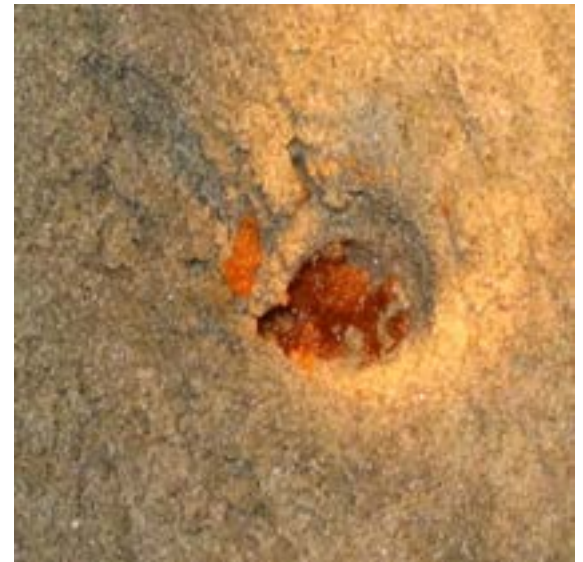
Predation on eggs can be very intense.
Grunion eggs may be important for migrating
birds on the Pacific Flyway.



Seven species of birds
eating eggs.
Photo by Lester Thompson



Photos: K. Martin,
Carlos Carreon





S. Davi

California Grunion runs are preyed upon from land and sea.



K. Hoang



E. Jones



P. Heistand

Beach Recreational Fisheries put pressure on limited resources :



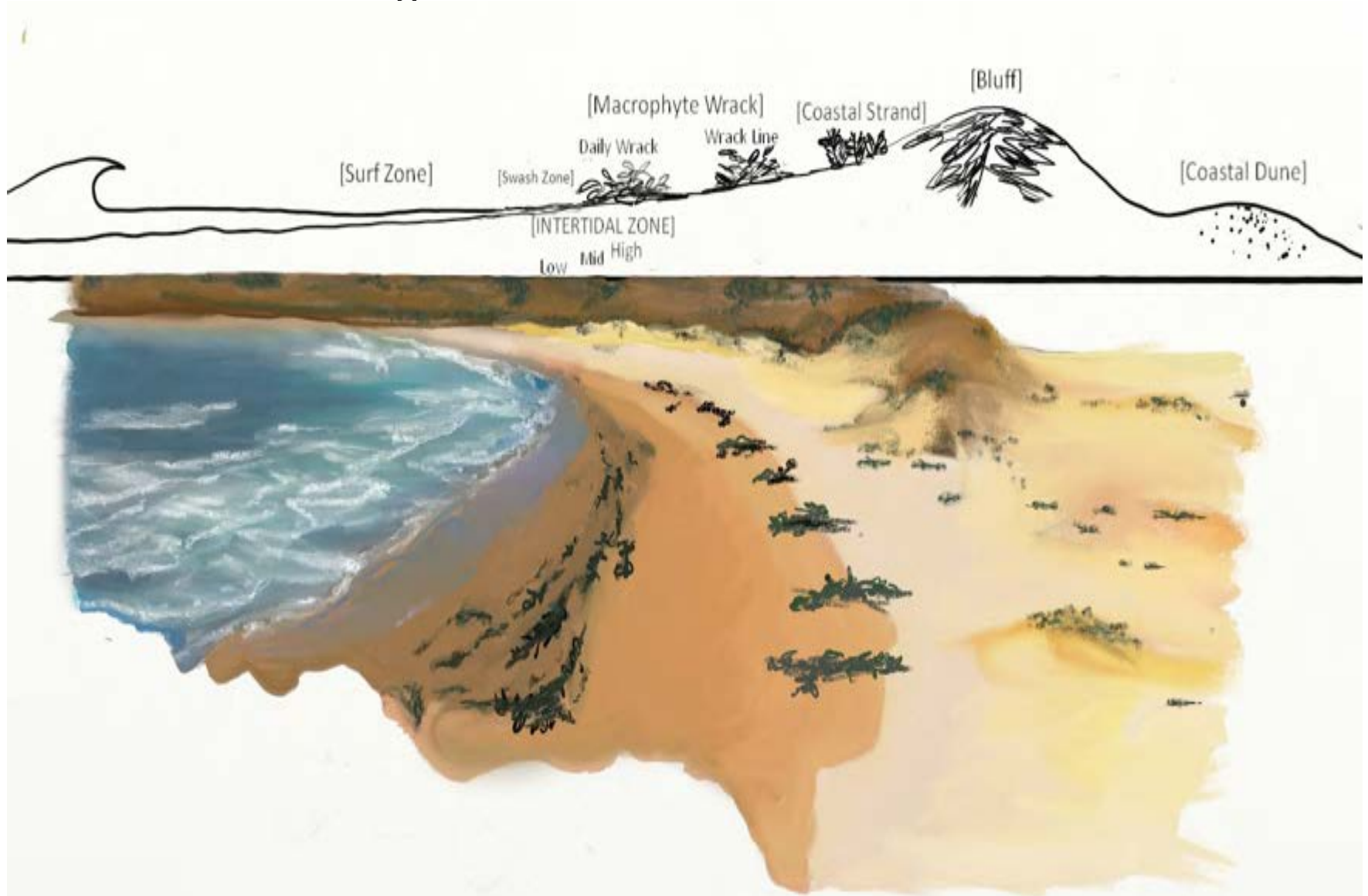
Pismo
Clams



Grunion.org
J. Flannery

California Grunion

Beaches show vertical zonation like other coastal ecosystems, according to the tides.
Artwork: Brie English



Vertical zones on beaches

- Are not fixed in one place
- Animals may migrate up and down the beach with tides
- Burrows are not permanent



Brown Pelicans at Will Rogers State Beach, Photo:

Dynamic distributions



Beachhoppers (*Megalorchestia* spp.) move up with rising tide

Photo:
D. Hubbard

Humans can also be very abundant on beaches.



Photo: D. Reed



**Some urban
beaches use
mechanized
beach
maintenance,
raking up kelp,
debris, and some
sand for removal.**

Concern over the effects of grooming on grunion eggs led to controversy, and subsequent changes in policy to protect the nesting sites.

Photos: K. Martin



Beach Driving can impact ecology



Photos: D. Reed, K. Martin



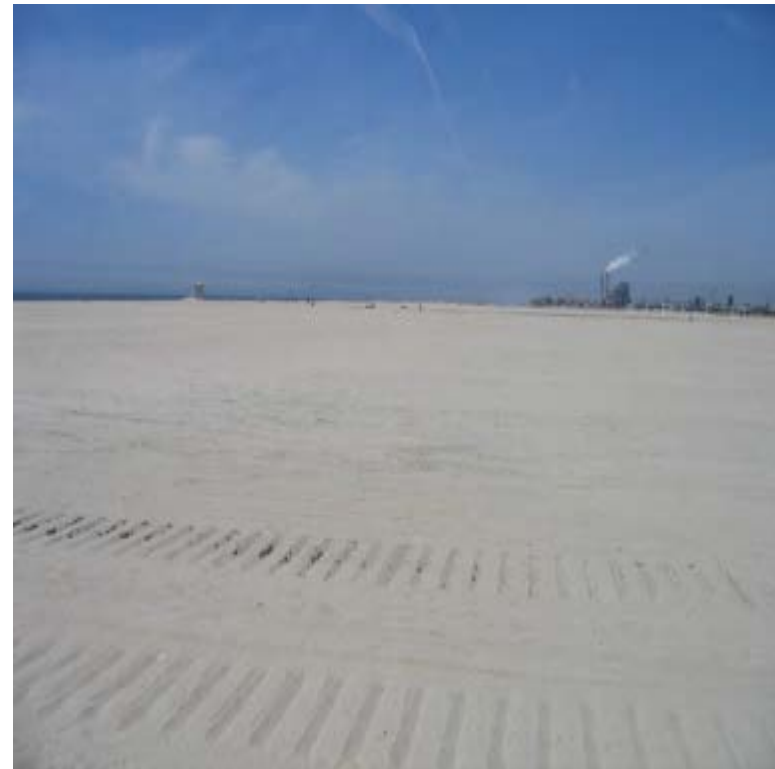
**Western
Snowy
Plovers
resting
in tire
tracks**

**(over 2
dozen)**

Photo: K. Martin

Least tern enclosure, native beach primros

Huntington Beach



Photos:
K. Martin
A. Staines



Coastal Squeeze, Malibu, CA



Coastal armoring, beach erosion, and sea level rise

Over 1/3 of the coastline is armored in So Cal.

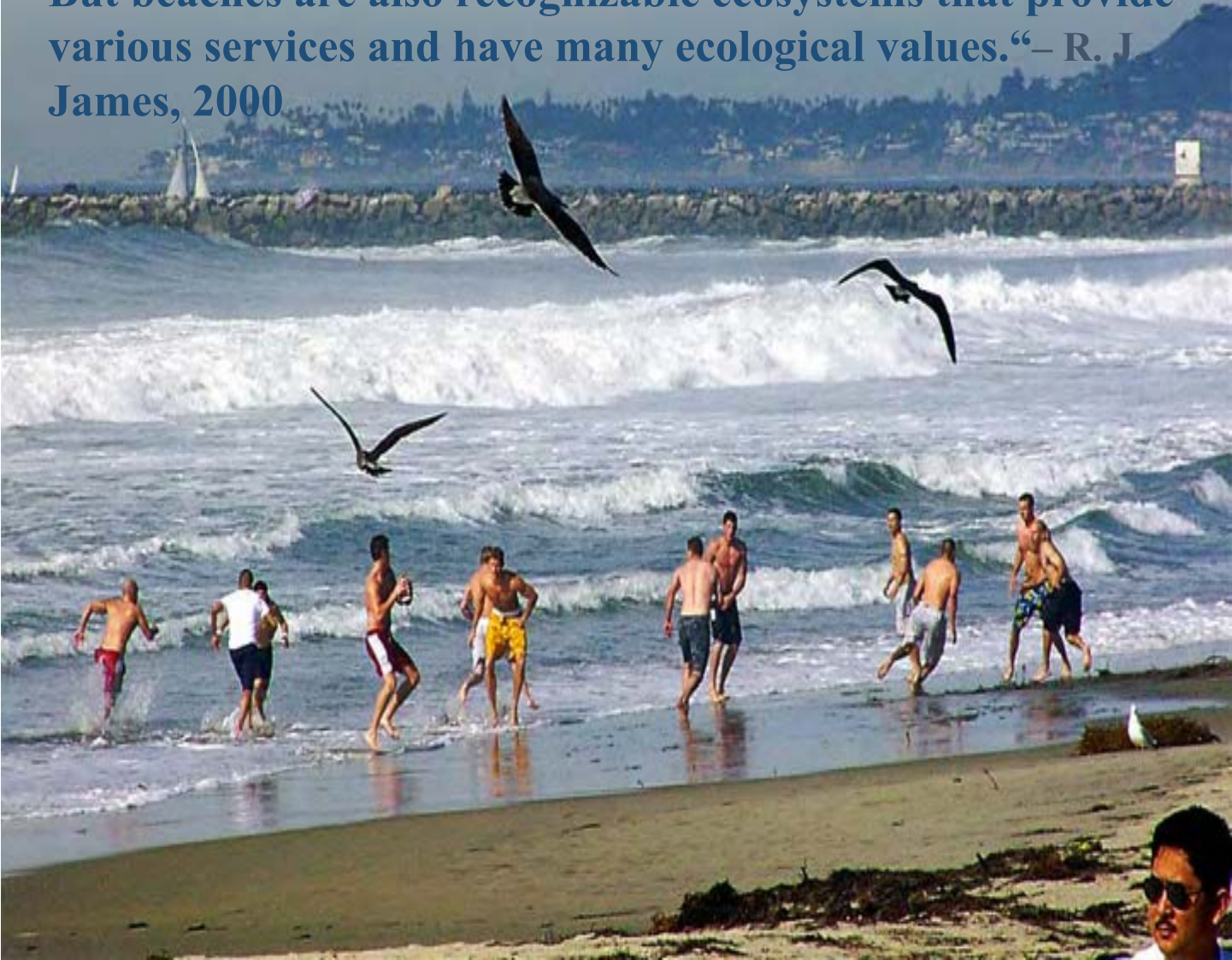
Photo: Kenneth & Gabrielle Adelson, CaliforniaCoastline.org,
used by permission



Photo:
K. Martin

"Beaches are typically viewed in physical and cultural terms, as natural places of sun, sea, surf and sand that support various hedonistic socio-cultural activities.

But beaches are also recognizable ecosystems that provide various services and have many ecological values."– R. J. James, 2000



Adaptation Strategies - Oh Boy!

- ❖ Do Nothing
- ❖ Restore Beaches
- ❖ Restore Dunes
- ❖ Floodproof
- ❖ Elevate
- ❖ Armor
- ❖ Retreat

LA City Coastal Options



Big tourism & recreation \$\$
Monitor, measure, project
Anticipate sand shortages
Nourish beach eventually
MDR harbor adaptation
Eventual retreat?

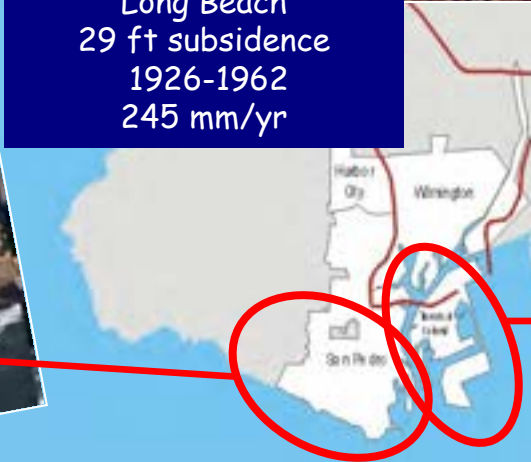
Most critical infrastructure area
Armoring bigger & higher
Road repair & re-alignment
Beach monitoring & nourishment

Long Beach
29 ft subsidence
1926-1962
245 mm/yr

Port & harbor facility
engineering
Anticipate & budget
Refit & raise as needed



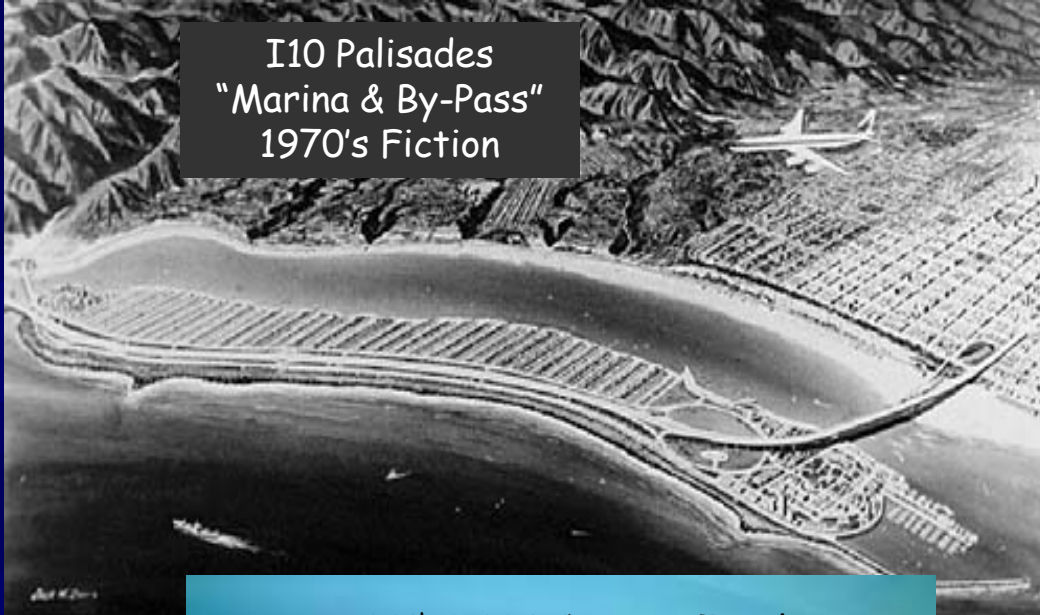
Stabilization or retreat



“Truth is stranger than fiction, but it is because Fiction is obliged to stick to possibilities; Truth isn't.”

Mark Twain

I10 Palisades
“Marina & By-Pass”
1970's Fiction



101 Seacliff
Interchange & Fill
1970's Fact



20th & 21st Century Truths
#Dubai



#Chicago



Mean Sea Level Rise Will Force Decisions

Begin thinking & planning adaptation - but not (yet) a time for panic

- ❖ Finding & maintaining balance
- ❖ Getting & keeping enough sand on beaches & dunes
- ❖ Preserving natural features, resources & habitat in urban settings

Elwha nearshore 15 February 2015. Photo by Tom Roorda and CWI. All rights reserved.

Another potential solution: Dam removal

- Elwha River fish run restoration
- Eulachon,
- Longfin Smelt,
- Salmon



Some concerns about beach adaptation projects:

- If adaptation includes sand transport projects such as
 - Beach sand replenishment
 - Backpassing, grooming, grading, berm building
- Data gaps include the response of plants and animals to:
 - Quantity of sand moved, footprint of project
 - Frequency of repetition of projects
 - Rate of recovery of different species and ecosystem functions
 - Effects on adjacent habitats

This winter berm is built to protect structures. Sand moved from the lower zones of the beach to the upper beach moves surf zone animals out of their habitat.

Return of the berm sand in spring adds another impact to the ecosystem by burying the animals that colonized the area.



Where feasible, dune restoration provides more permanent protection and greater ecological benefits.

Photo: sanelijo.org/dunes-restoration





Sand fill projects like this harbor dredge sand placement in Oceanside can affect an extensive area of the shoreline.

Recovery may take months or years for some species.



Photos: Oceanside,
K. Martin

Beaches are coastal ecosystems with unique flora and fauna – they are so much more than just sand!



We need to balance human recreation and coastal adaptation with natural resource protection on sandy beaches.

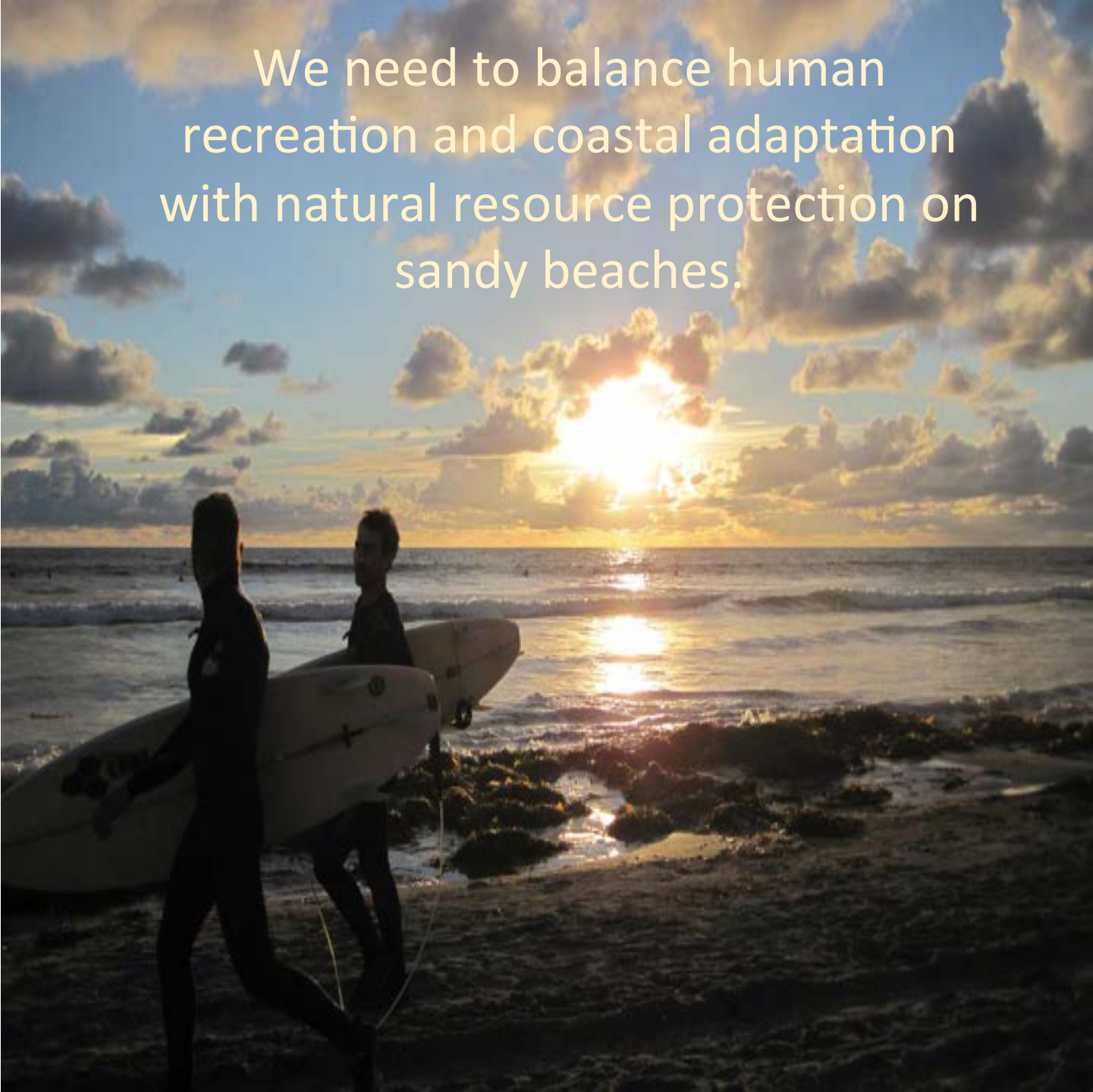


Photo:
K.
Martin

Thank you!

Karen Martin, PhD
Pepperdine University
kmartin@pepperdine.edu

Ron Flick, PhD
Scripps Institution of Oceanography
rflick@ucsd.edu

Juliette Hart, PhD
USC Sea Grant
jahart@usc.edu