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/VT 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?
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

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

- **Eurasian Plate**
- **North American Plate**
- **Cocos Plate**
- **Nazca Plate**
- **South American Plate**
- **African Plate**
- **Antarctic Plate**
- **Indo-Australian Plate**

**Ring of Fire**


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High, Steep, Stable, Eroding & Sand Starved

A guide to future evolution

TerraCosta Consulting Group

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LA Beaches Artificially Wide

Modern Santa Monica Bay Shoreline is Human-Made

23 million m³ sand 1940-1990

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

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

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http://www.aviso.oceanobs.com/
State of CA Guidance - “Consider MSLR”
Based on NRC (2012)

Relative to 2000

- Need ~10 mm/yr
- Need ~20 mm/yr
- Need ~4 mm/yr
- Relative to 2000

- 15 cm
- 28 cm
- 93 cm


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“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

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. Dugan
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
California Grunion runs are preyed upon from land and sea.
Beach Recreational Fisheries put pressure on limited resources:

- California Grunion
- 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:
Beachhoppers (*Megalorchestia* spp.) move up with rising tide
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 exclosure, native beach primrose
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?

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

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

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

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

Mark Twain
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
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: Nick Schooler

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