



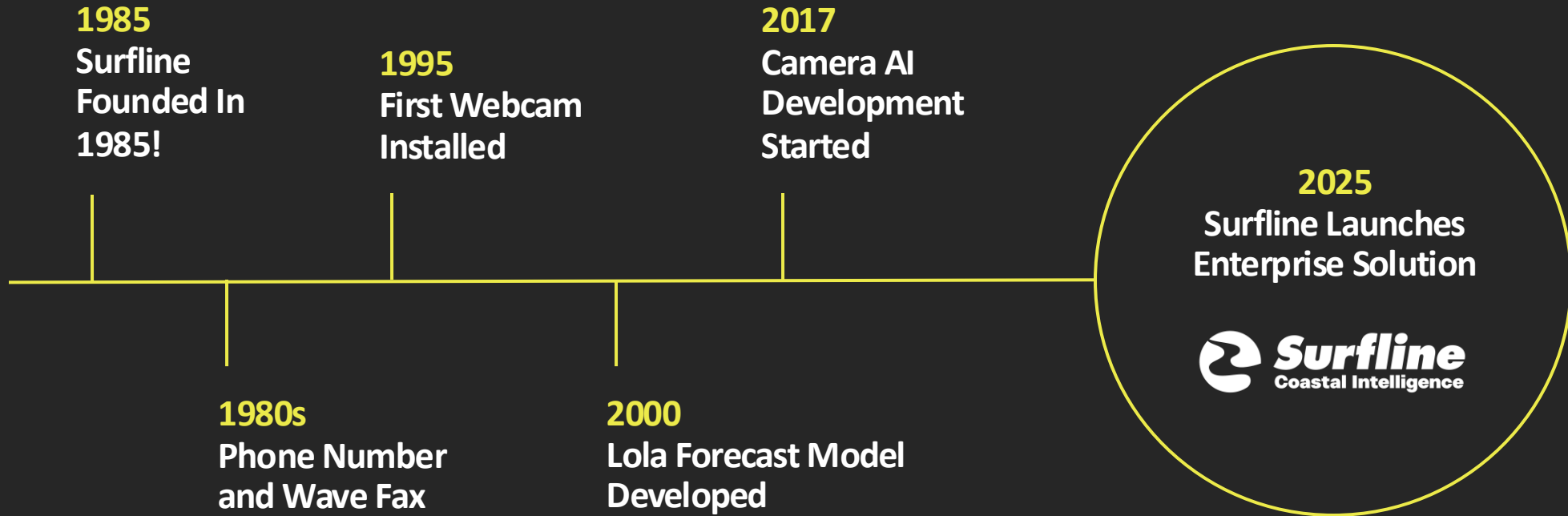
Surfline

Coastal Intelligence

AI-Enabled Coastal Monitoring: Video-Derived Analytics
for Erosion, Flooding, and Beach Management



Surflin's Evolution of Innovation





What is Surfline Coastal Intelligence?

A new way to monitor and analyze your coastline.

Surfline Coastal Intelligence converts camera imagery into structured coastal intelligence - measuring change, movement, and risk in near-real-time.



Erosion & Flooding



Beach Visitation



Coastal Safety



Wave Climatology



Surf Analytics



Vessel Analytics

Attendance

Start Date

2025/07/01

End Date

2025/07/10

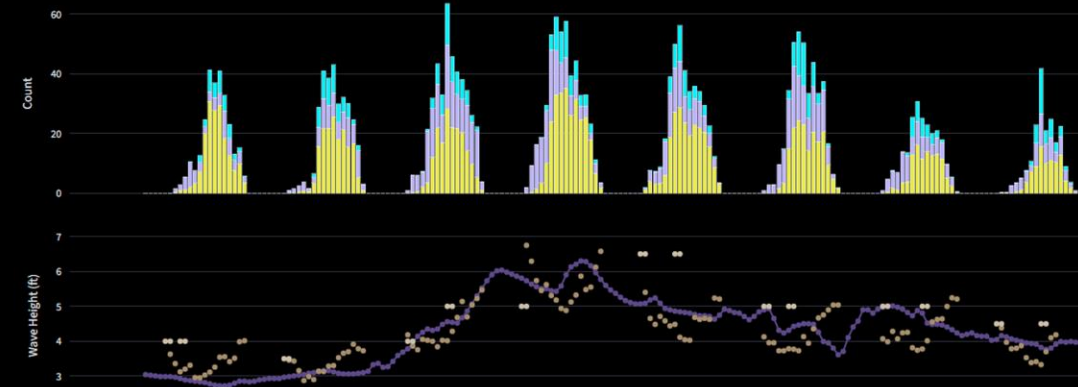
Time Interval

Daily

Count

Ave

Hourly Average Crowd Counts



SCI_e



California Coastal Intelligence – Example Deployments



California Project Examples:

- 01 **San Clemente:**
- Estimating beach visitation and economic impact



- 02 **Oceanside RE: Beach**
- Monitoring shoreline change, surf conditions, and bathymetry



- 03 **Pillar Point Harbor:**
- Monitoring wave & surf conditions



A wide-angle shot of a beach and ocean. A long pier extends from the left side into the water. The sky is blue with some clouds. In the foreground, there's a sandy beach. Overlaid on the image are various camera intelligence elements: a red line across the top, a green line on the right, a blue line with diamond markers across the water, and several small colored squares (orange, green, blue) scattered across the scene. In the bottom left corner, there's a blue circle with the number '0'. In the bottom right corner, there's a blue square with a person's silhouette. On the left side, there's a text overlay: 'Counts - water: 8, shore: 1, total: 9, Frame: 0 ptz: pan: 306.86, tilt: -1.07, zoom: 0.04 Scale Factor: 1.00'. There's also a small text overlay '1.3ft 00:13:11' near the blue line.

What Does Camera Intelligence Look Like?

Counts - water: 8, shore: 1, total: 9,
Frame: 0
ptz: pan: 306.86, tilt: -1.07, zoom: 0.04
Scale Factor: 1.00

The image shows a wide-angle view of a beach and ocean under a blue sky with scattered clouds. A long wooden pier extends from the left side into the sea. In the foreground, there's a sandy beach. Two people are visible: one standing near the water's edge in the lower center, and another sitting on the sand in the lower right corner. The image is overlaid with various colored lines and boxes representing camera intelligence data. A red horizontal line spans the top of the frame. Several orange squares are placed along the horizon line. A green line follows the coastline. A cyan line with diamond markers runs horizontally across the middle. A blue circle contains the text "1.3ft". A red box highlights the person standing near the water. A blue box highlights the person sitting on the sand. A large blue number "0" is in the bottom left corner.

[illegible]

What Does Camera Intelligence Look Like?

Counts - water: 8, shore: 1, total: 9,
Frame: 0
ptz: pan: 306.86, tilt: -1.07, zoom: 0.04
Scale Factor: 1.00

The image shows a wide-angle view of a beach and ocean under a blue sky with scattered clouds. A long wooden pier extends from the left side of the frame into the sea. In the foreground, there's a sandy beach. Two people are visible: one standing near the water's edge in the lower center, and another sitting on the sand in the lower right corner. The image is overlaid with various colored lines and boxes representing computer vision data. A red horizontal line spans the top of the image. Several orange squares are placed along the horizon line. A green line follows the coastline. A cyan line with diamond markers runs horizontally across the middle. A blue circle contains the text "1.3ft". A red box highlights the person standing near the water. A blue box highlights the person sitting on the sand. A large blue number "0" is in the bottom left corner.

[illegible]

What Does Camera Intelligence Look Like?

Counts - water: 8, shore: 1, total: 9,
Frame: 0
ptz: pan: 306.86, tilt: -1.07, zoom: 0.04
Scale Factor: 1.00

The image shows a wide-angle view of a beach and ocean under a blue sky with scattered clouds. A long wooden pier extends from the left side into the sea. In the foreground, there's a sandy beach. Two people are visible: one standing near the water's edge in the lower center, and another sitting on the sand in the lower right corner. The image is overlaid with various colored lines and boxes representing computer vision data. A red horizontal line spans the top of the frame. Several orange squares are placed along the horizon line. A green line follows the coastline. A cyan line with diamond markers runs horizontally across the middle. A blue circle contains the text "1.3ft:00:13:11". A large blue number "0" is in the bottom left corner. Red and blue bounding boxes enclose the two people.

[illegible]



Why Camera Based Monitoring?

Scalable, always on coastal intelligence



One sensor, hundreds of data points

Erosion, bathy, attendance, wave conditions from a single camera feed.



Data 365 days a year

Move beyond seasonal surveys.



Post storm survey response

Rapidly quantify erosion, changes in bathymetry, and crowd displacements within hours.



Monitoring inaccessible coastlines

Get video/ data where it's hard to send humans.



Always on video

Video accompanied with all the data.



SCI_e



Coastal Visitation & Recreation

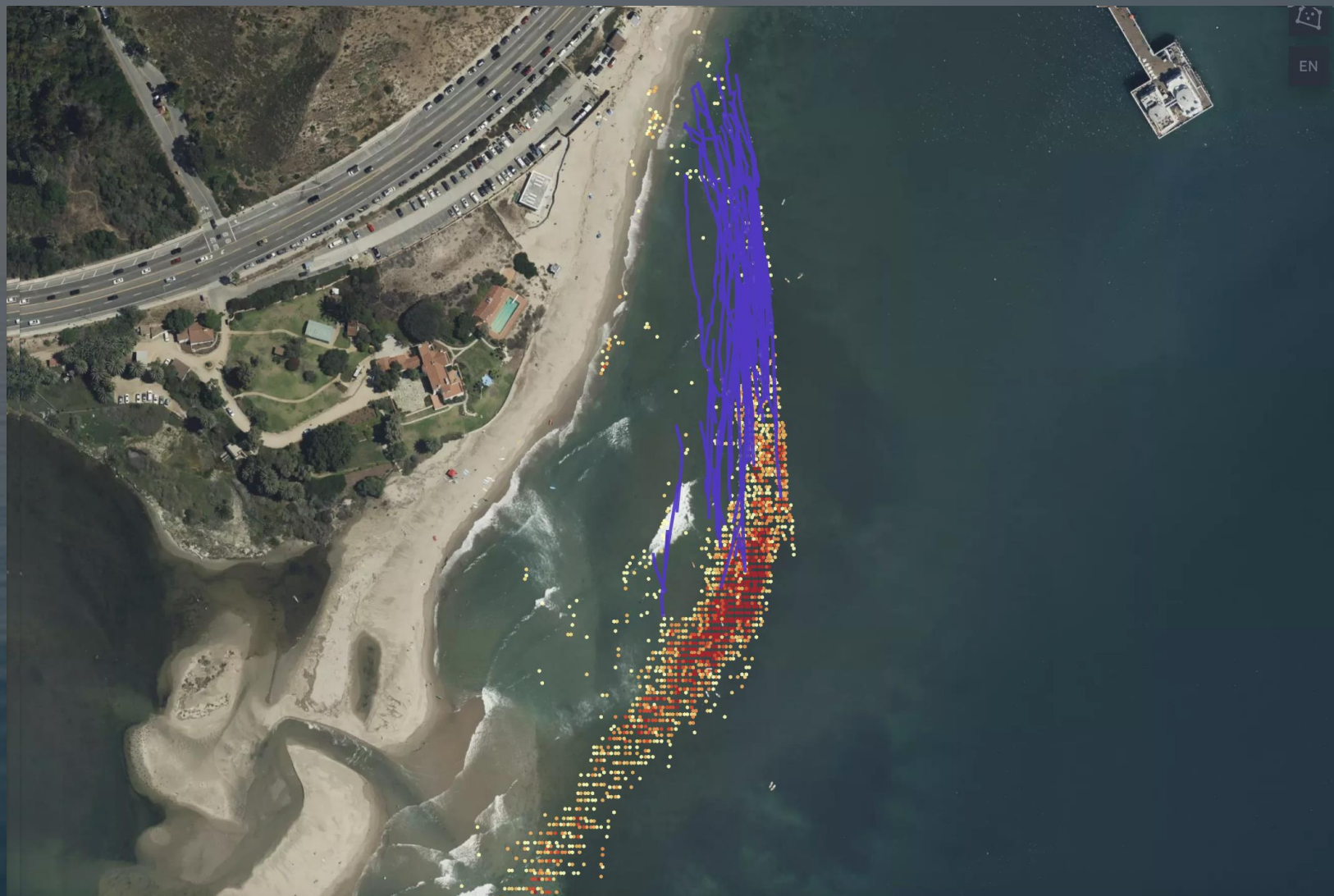
Surflife

Surf Monitoring





Objective Surf Resource Management
Malibu, California

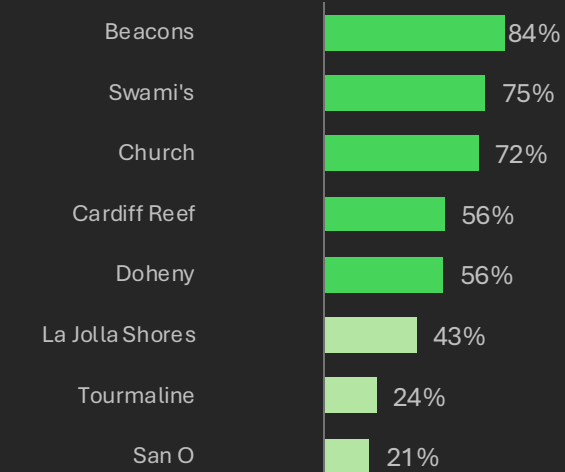




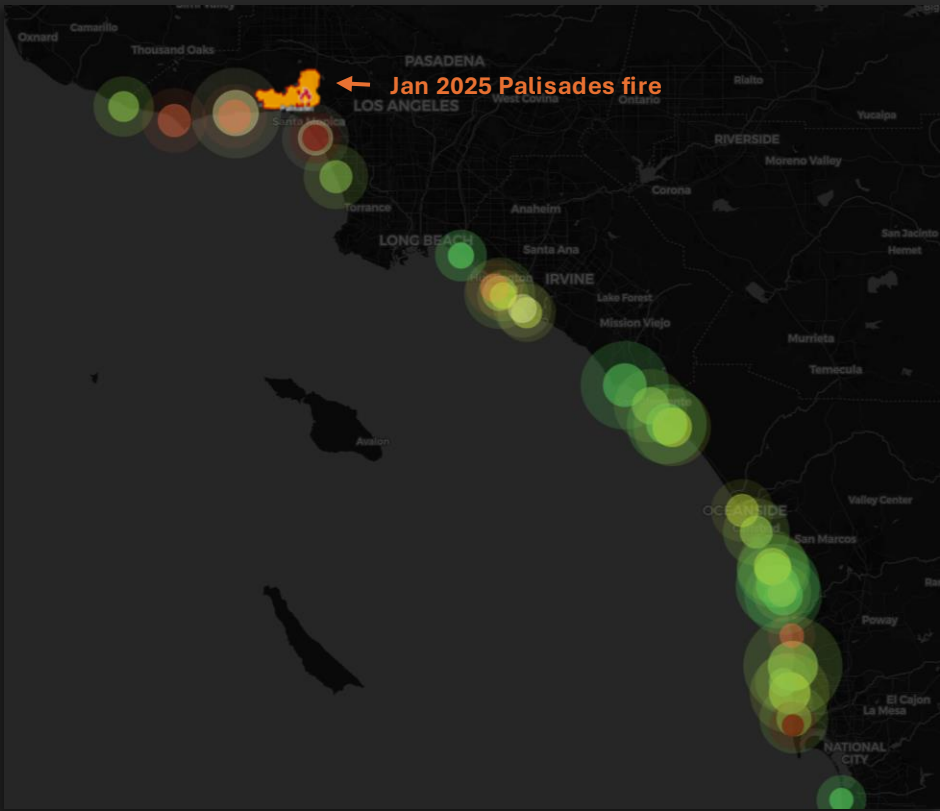
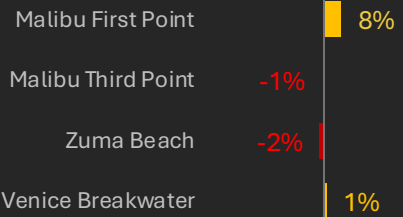
SoCal crowd changes by spot, 2025 vs 2024

Notable SoCal Spots, 2025 vs 2024 Participation

Top Gainers



North LA



While crowds at most SoCal spots increased in 2025, North LA participation was clearly impacted by the devastation and recovery process from the Palisades fire in January.



Counts - water: 2, shore: 28, total: 30,

Frame: 0

ptz: pan: 0.00, tilt: 0.00, zoom: 0.07

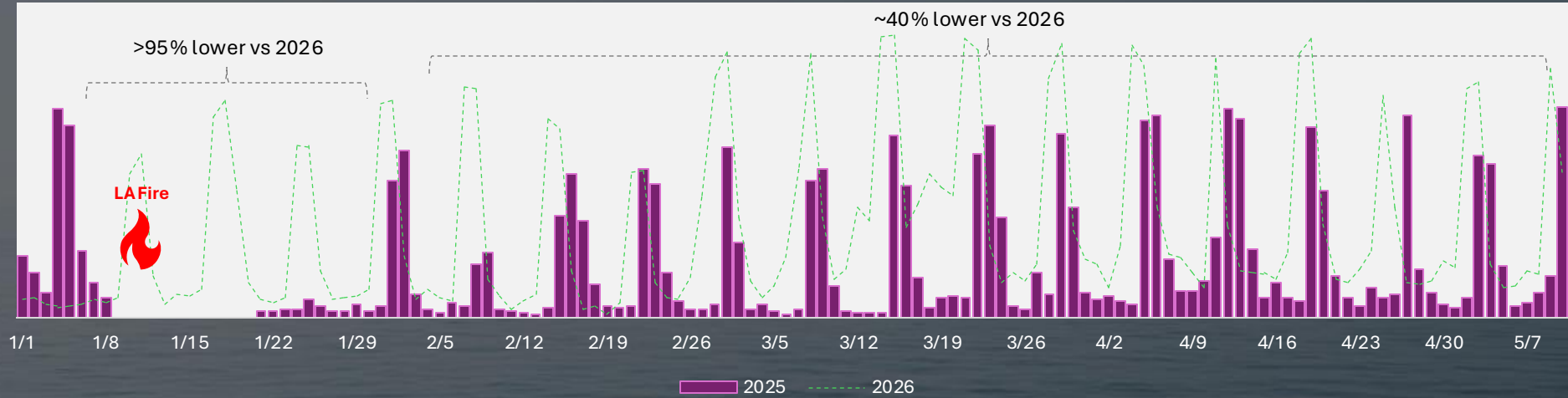
Scale Factor: 0.53



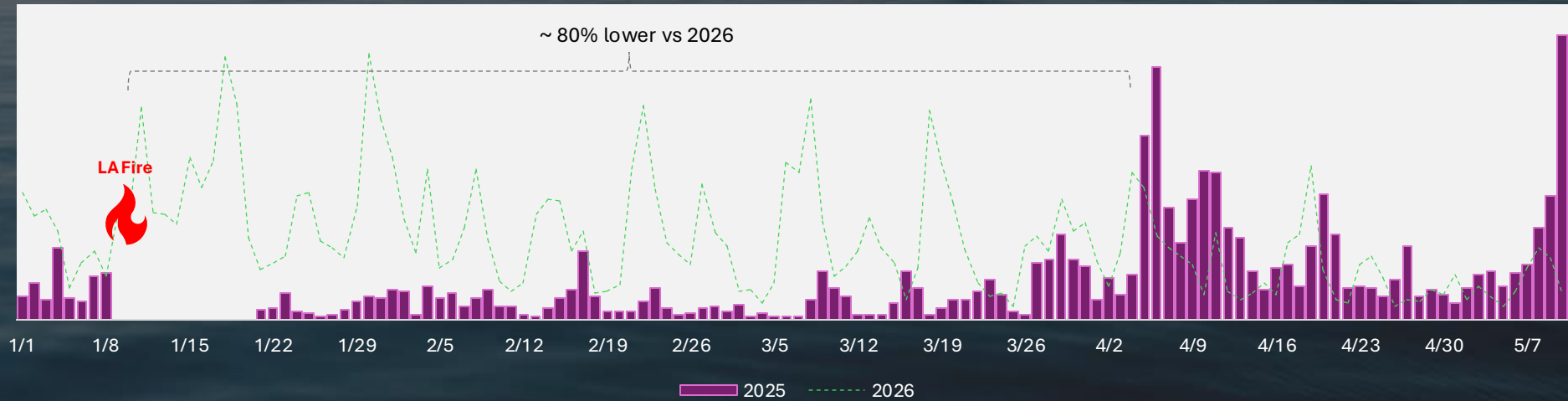


Beach & Water Attendance – Will Rodgers Beach (Santa Monica)

Beach Attendance



Water Attendance





Coastal Resiliency

Surflin

Shoreline Monitoring

Counts - water: 2, shore: 6, total: 8,

Frame: 0

ptz: pan: -189.47, tilt: -0.00, zoom: 0.08

Scale Factor: 1.00

0

A 3D visualization of a shoreline monitoring system. The scene shows a green grassy beach on the left, a blue ocean on the right, and a blue sky with clouds. A yellow line marks the shoreline. Several small blue and red squares are placed along the beach and in the water, representing detected objects. A large blue square highlights a person standing on the beach. In the top left corner, there is a black box with white text displaying monitoring data: "Shoreline Monitoring", "Counts - water: 2, shore: 6, total: 8,", "Frame: 0", "ptz: pan: -189.47, tilt: -0.00, zoom: 0.08", and "Scale Factor: 1.00". A large blue "0" is visible in the bottom left corner.

Shoreline Monitoring

Counts - water: 2, shore: 6, total: 8,

Frame: 0

ptz: pan: -189.47, tilt: -0.00, zoom: 0.08

Scale Factor: 1.00

0

[illegible]

Shoreline Monitoring

Counts - water: 2, shore: 6, total: 8,

Frame: 0

ptz: pan: -189.47, tilt: -0.00, zoom: 0.08

Scale Factor: 1.00

0

Shoreline Monitoring

Counts - water: 2, shore: 6, total: 8,

Frame: 0

ptz: pan: -189.47, tilt: -0.00, zoom: 0.08

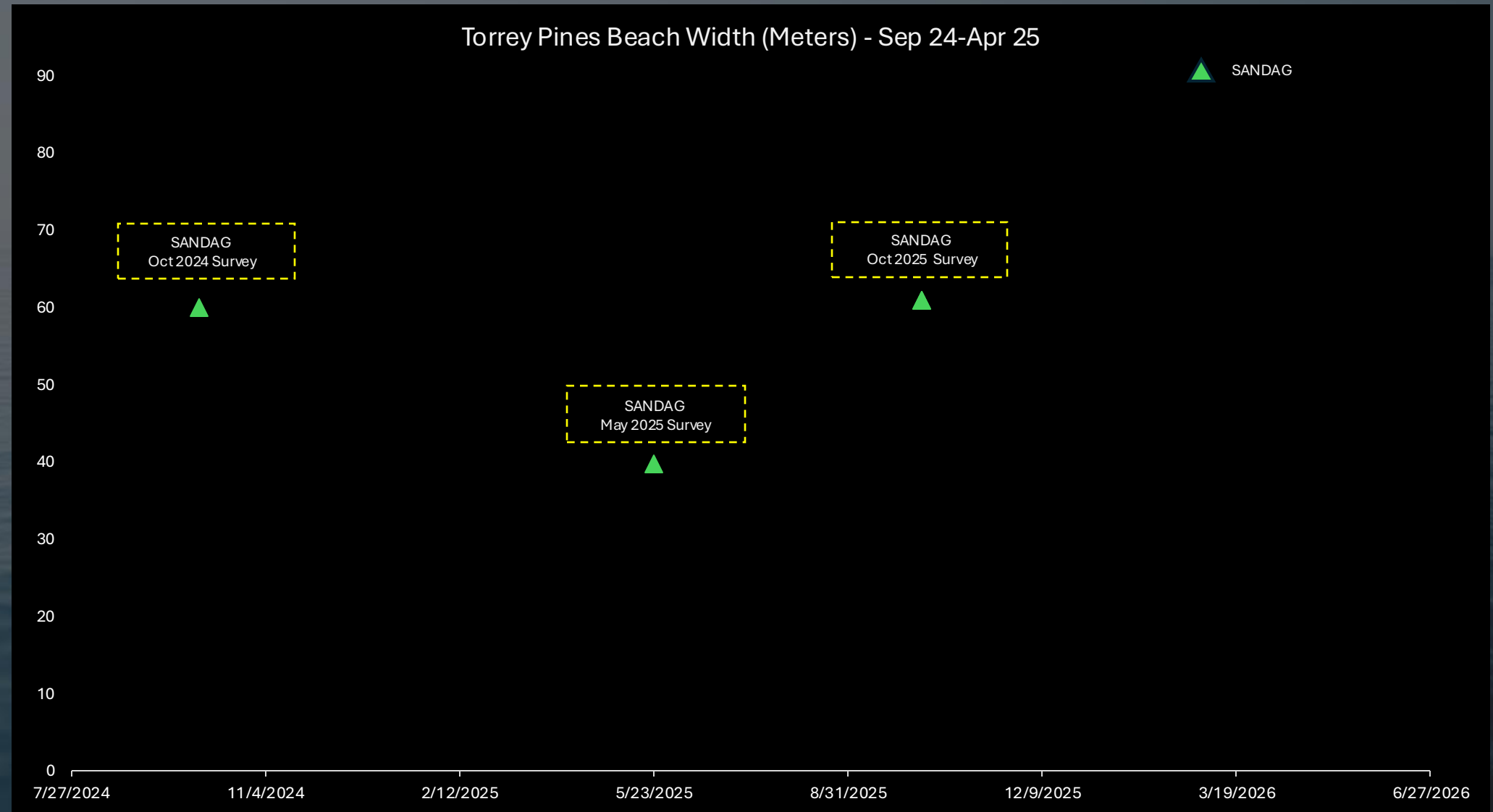
Scale Factor: 1.00

0



SANDAG RTK Surveys – Fall 2024 -> Fall 2025

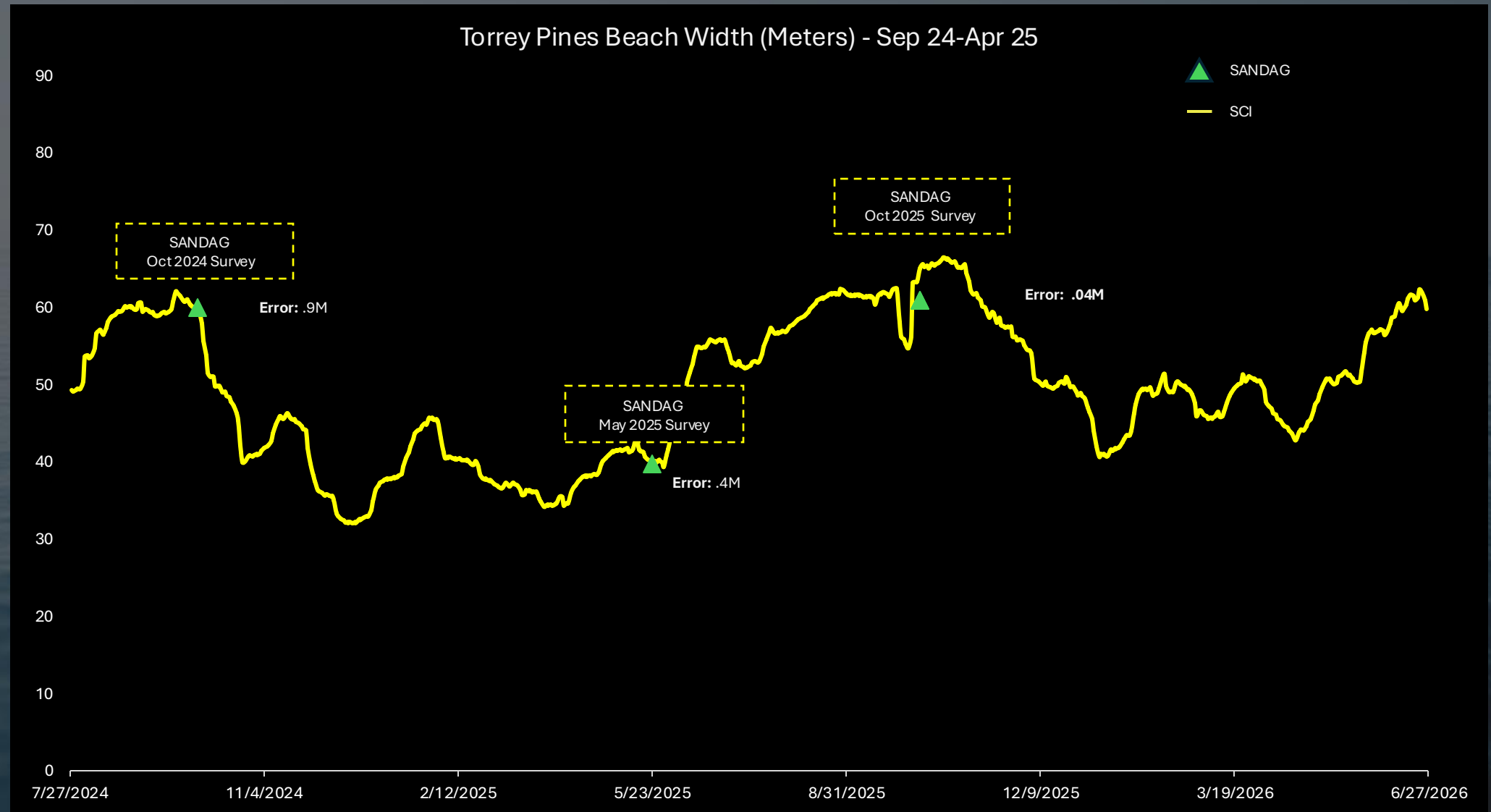
Torrey Pines, San Diego





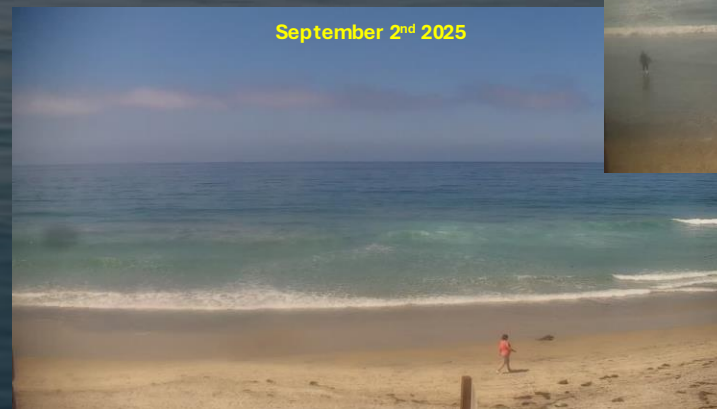
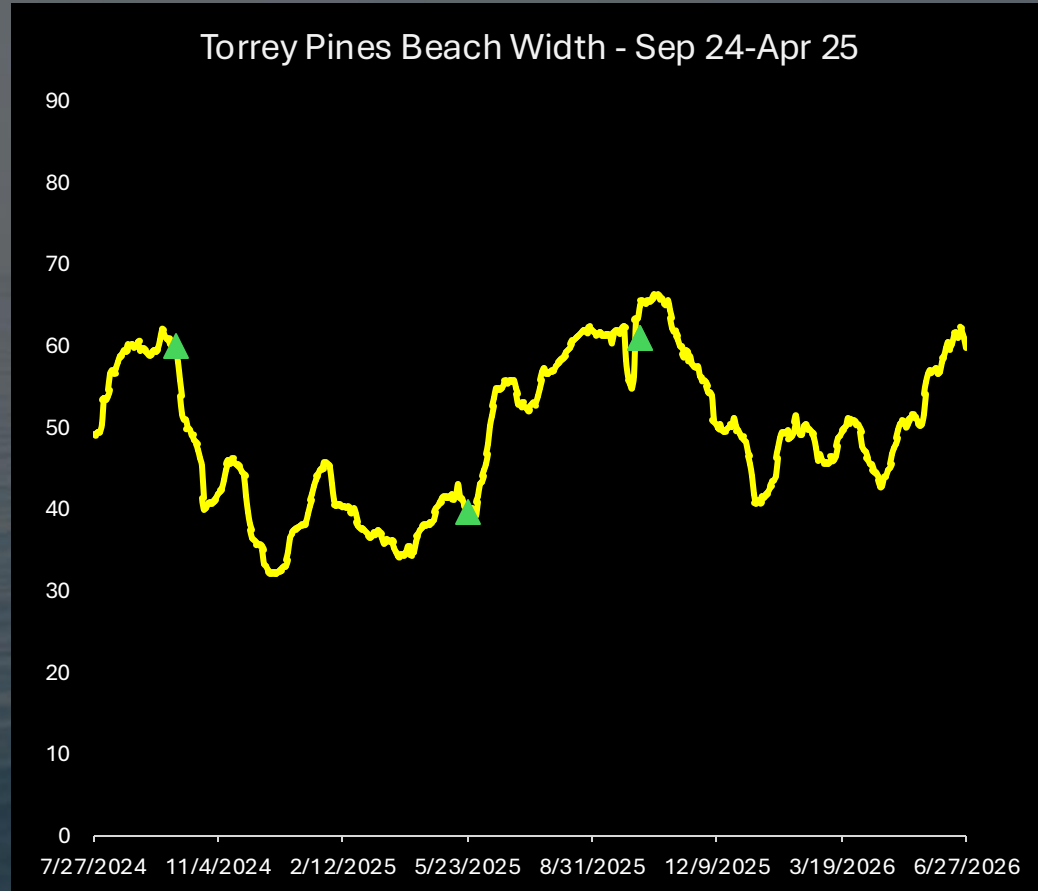
Comparing RTK Surveys to Camera Based Surveys

Torrey Pines, San Diego



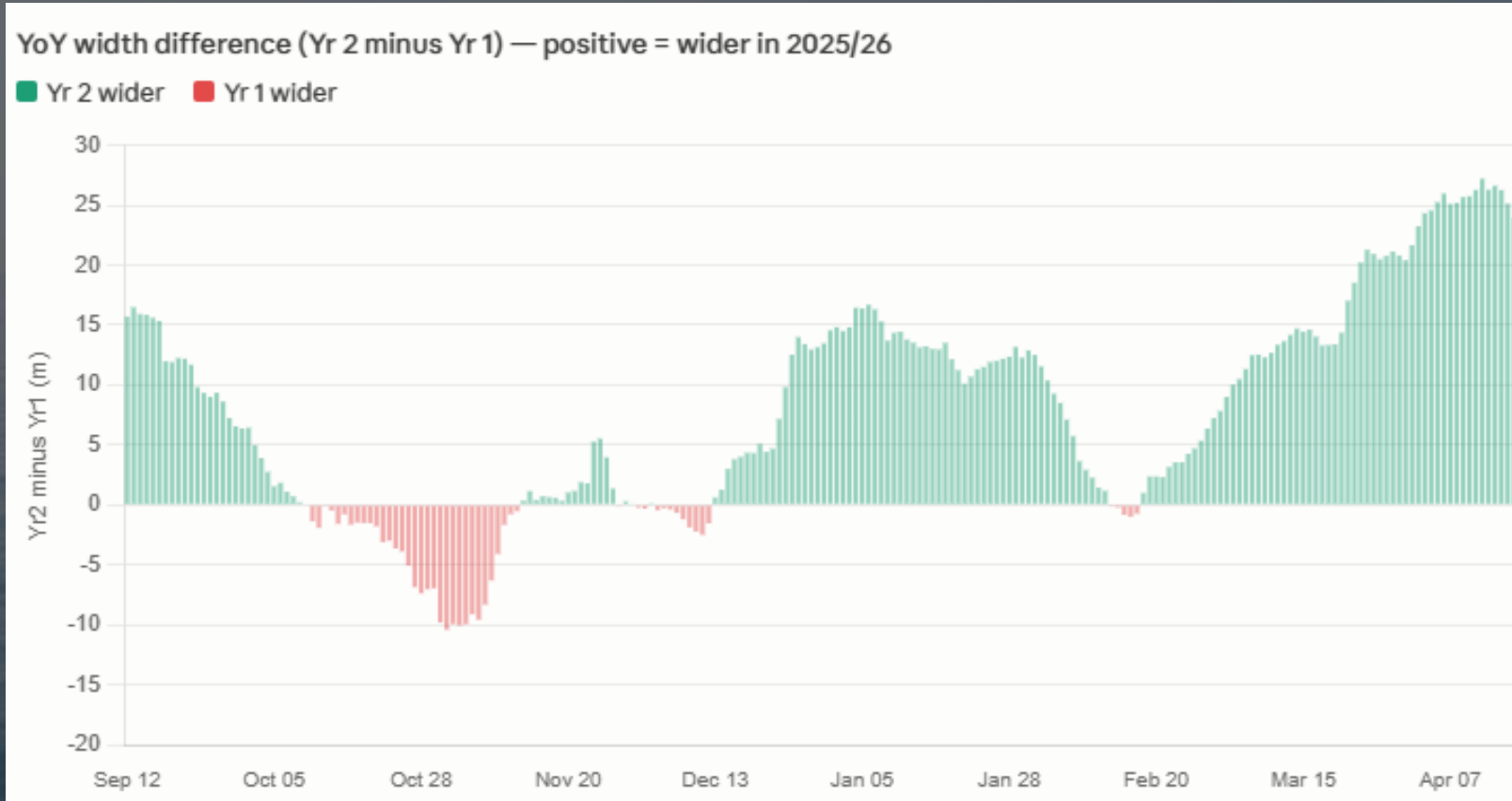


Seasonal Beach Width Photos from the Torrey Pines Camera *Torrey Pines, San Diego*





YoY Beach Width Analysis at Torrey Pines

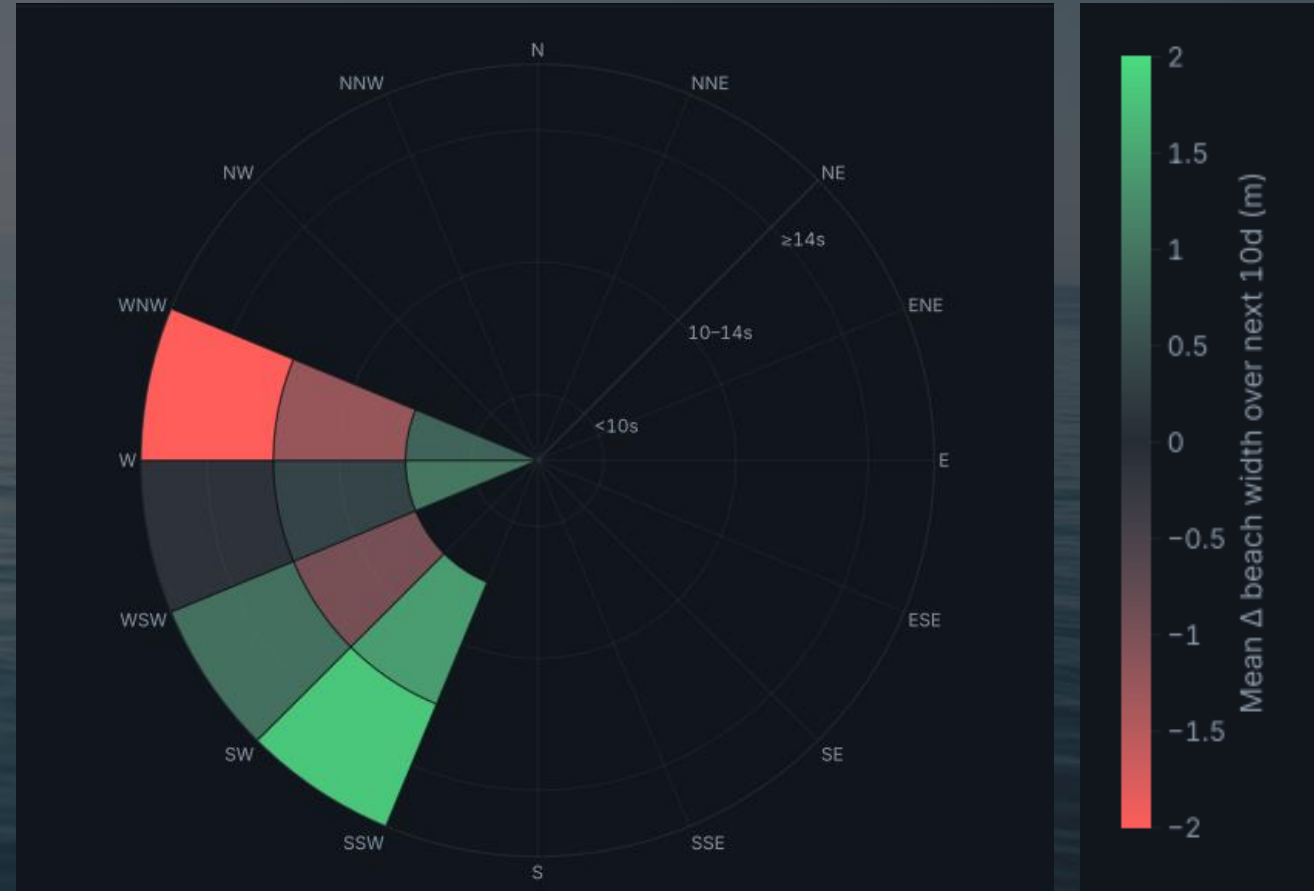
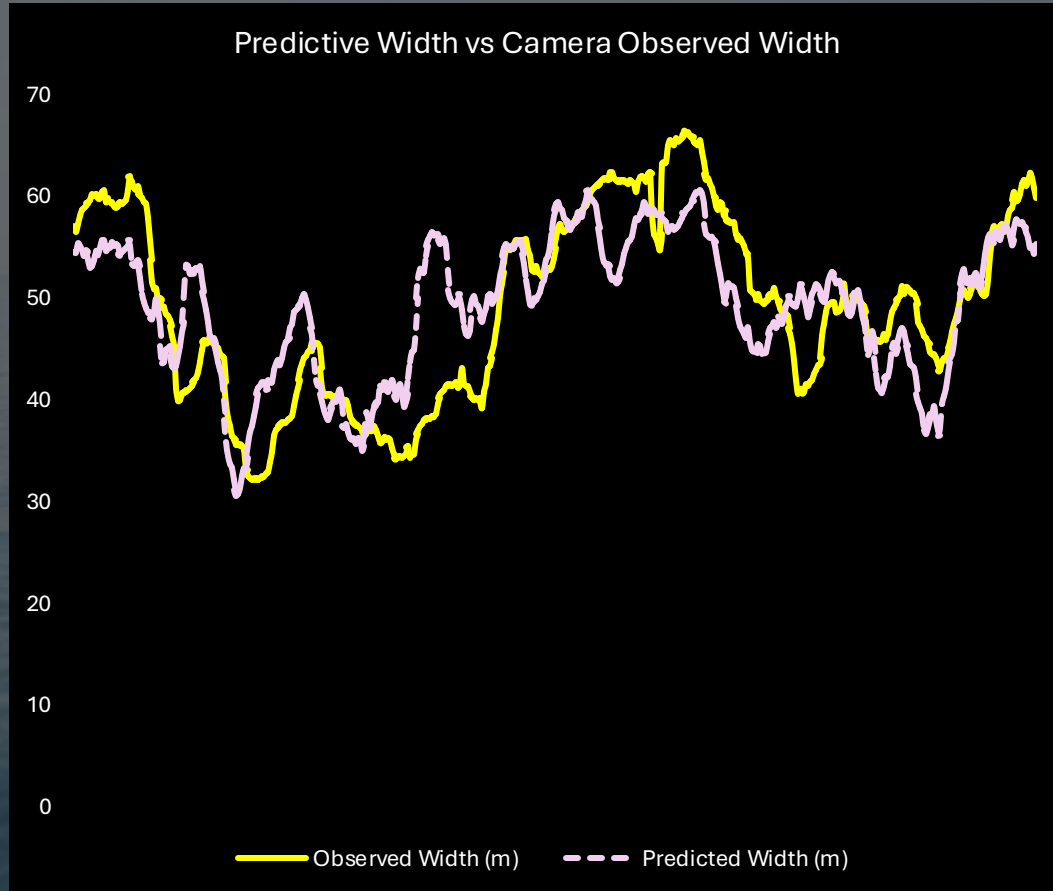


- The beach was significantly wider in 2026 across almost the entire season. The mean width was 52.1m vs 44.2m
- The divergence is almost entirely explained by swell energy, not direction. Mean swell direction was nearly identical between years (253° vs 251°), but Year 2 had 30% lower cumulative swell energy



Predicting Beach Width Change Using Surflin's Lotus Model & SCI Camera Technology

Torrey Pines, San Diego

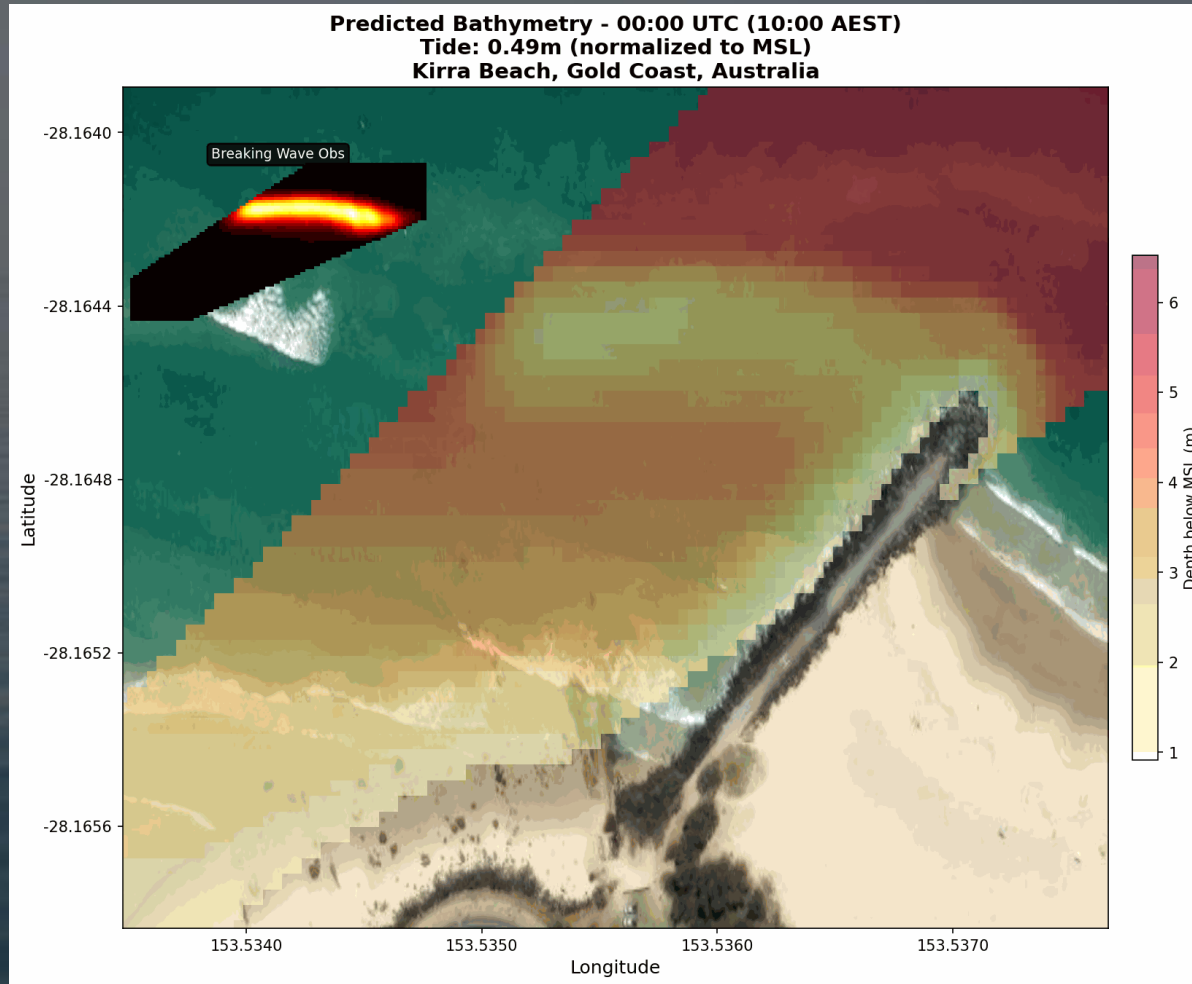




Quantify Wave Overtopping Events *Cardiff, California*



1. Real time notifications of overtopping events.
2. Quantify each overtopping event and predict future occurrences.



01 Requires breaking waves

02 Provides a continuous understanding of how bathymetry is changing over time.

03 xxx



Coastal Resiliency For Ports & Harbors

Surflin



Transforming Cameras into Harbor Safety Intelligence



Identify Hazardous Navigation Conditions



Monitor Vessel Activity in Near-Real-Time



In Depth Boating Analytics and Geospatial Heatmaps



Alert Staff and Boaters of Risk and Incidents

Oceanside Harbor



Oceanside Harbor Cont

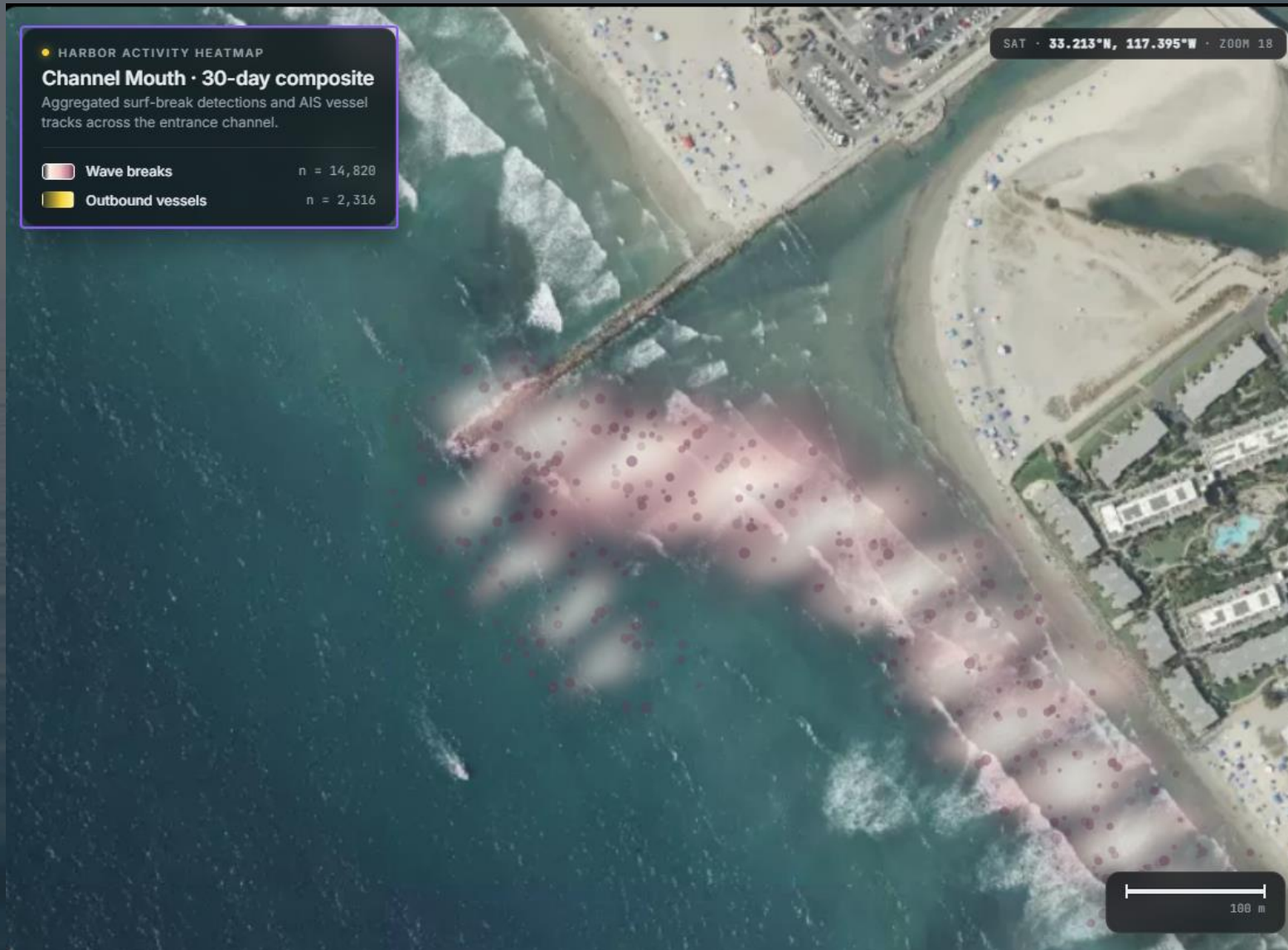


Scale Factor: 1.00

0



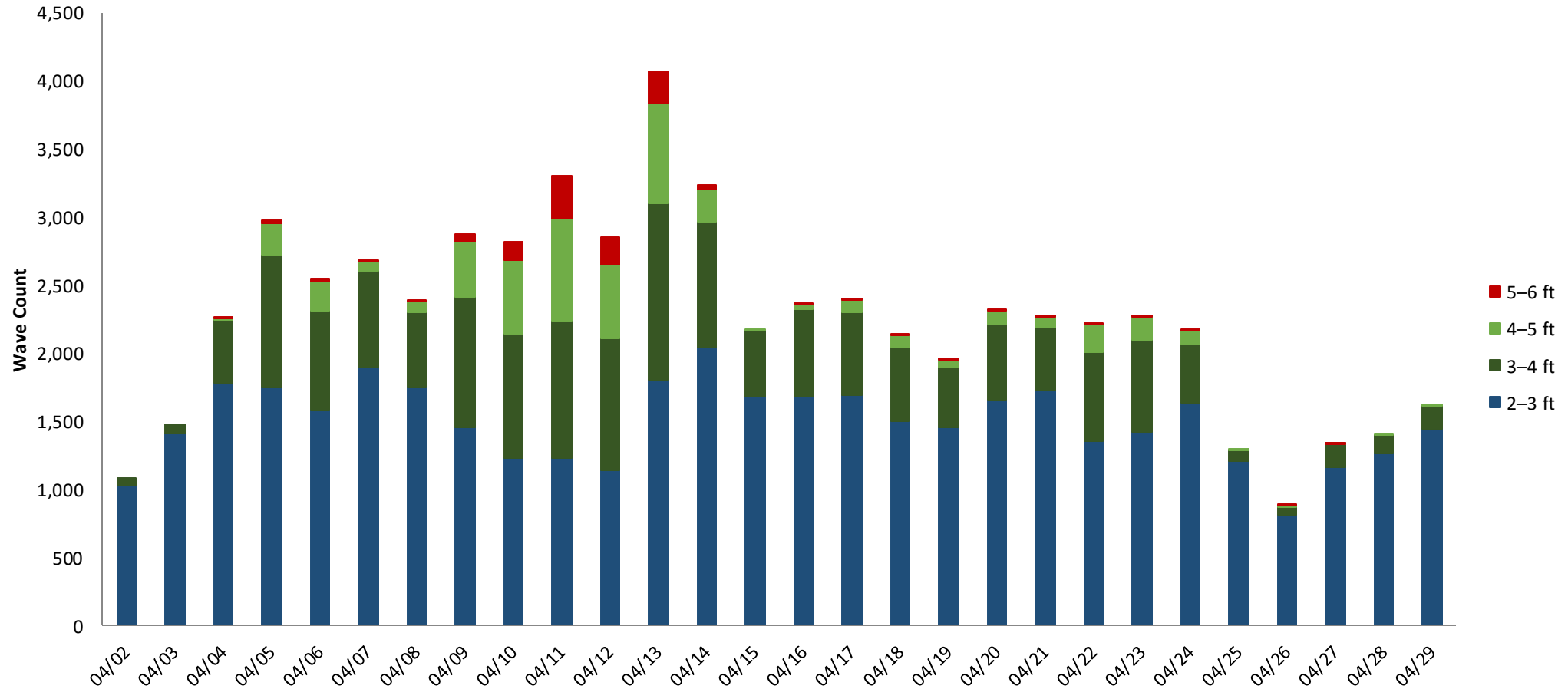
Wave Heatmap – Oceanside Harbor





Count of Breaking Waves in Oceanside Harbor Mouth

Daily Breaking Wave Count by Height Band – April

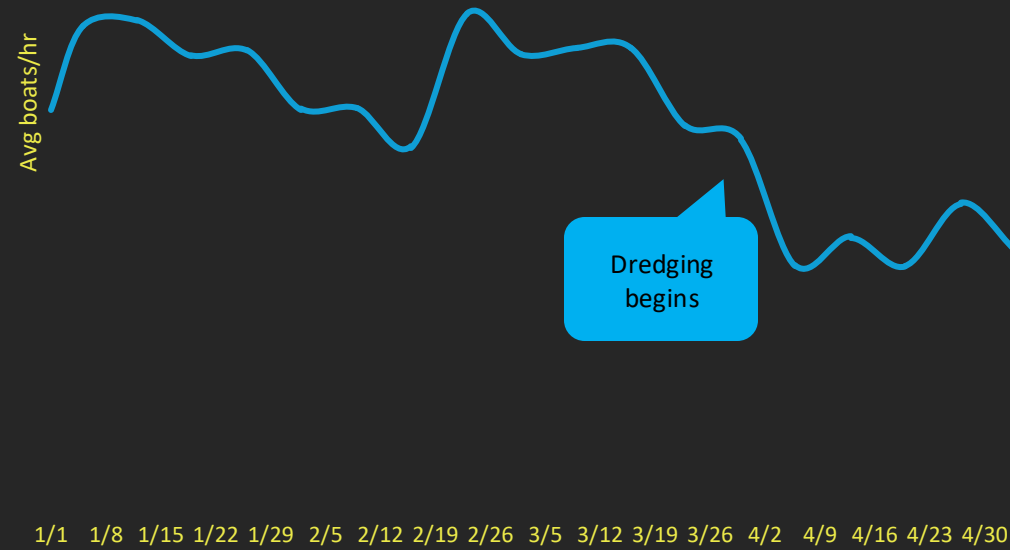




Oceanside Harbor Boat Traffic

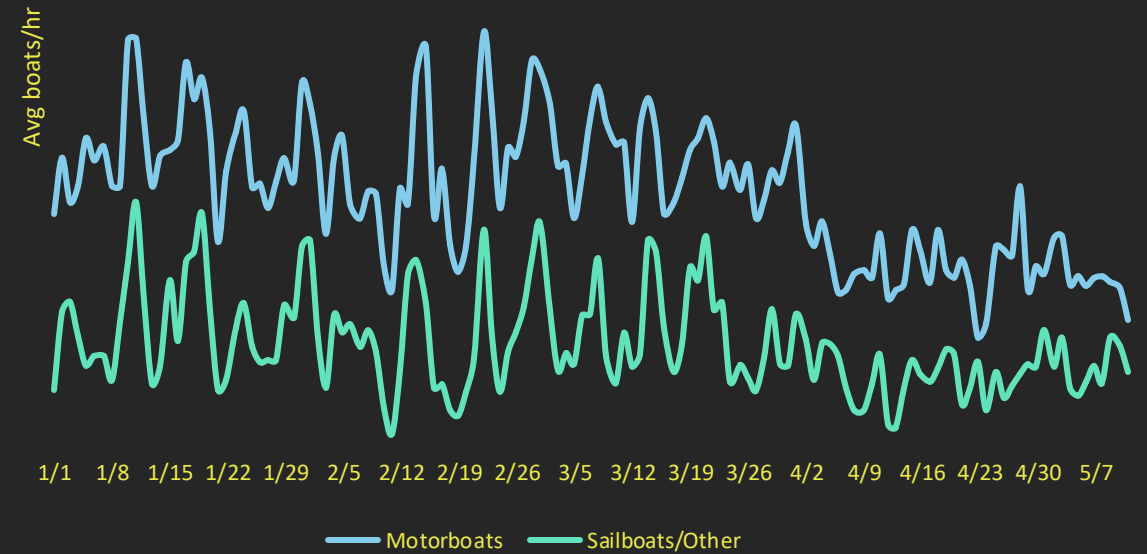
Weekly Boat Totals

Avg boats per hour



Daily Boat Totals

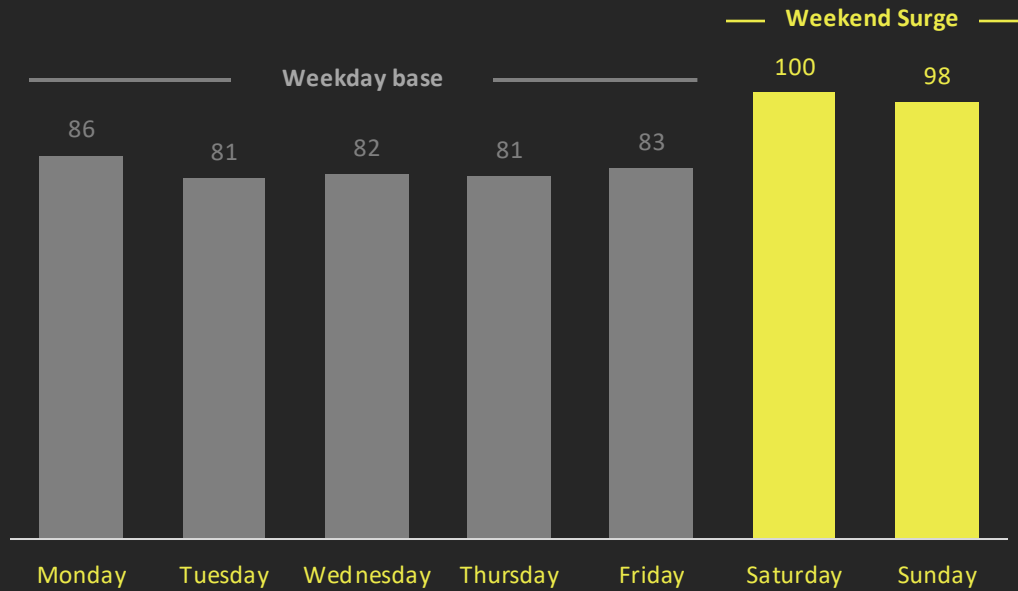
Avg boats per hour



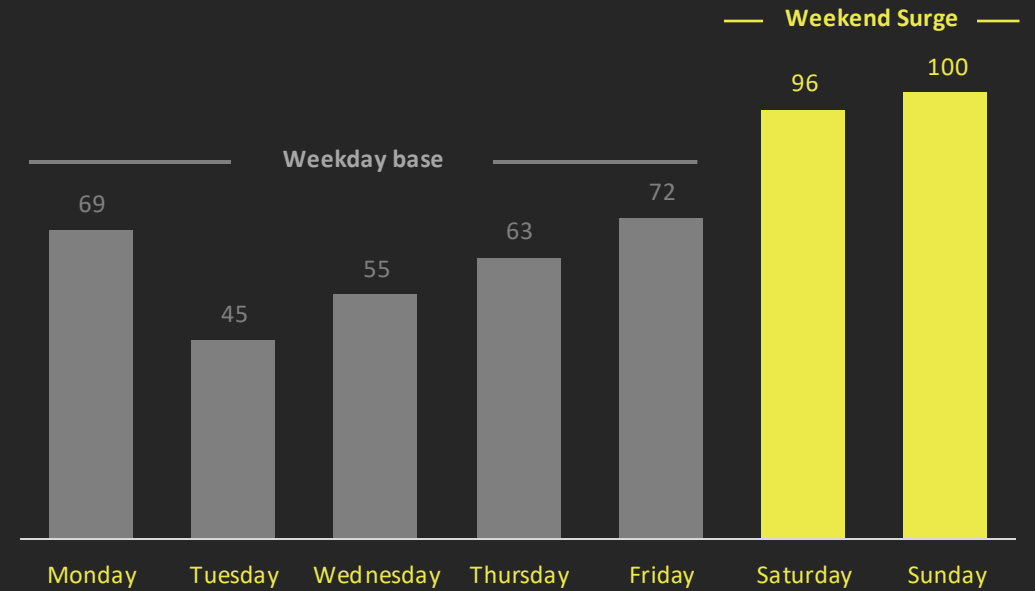


Oceanside Harbor Boat Traffic

Motorboats



Sailboats/Other

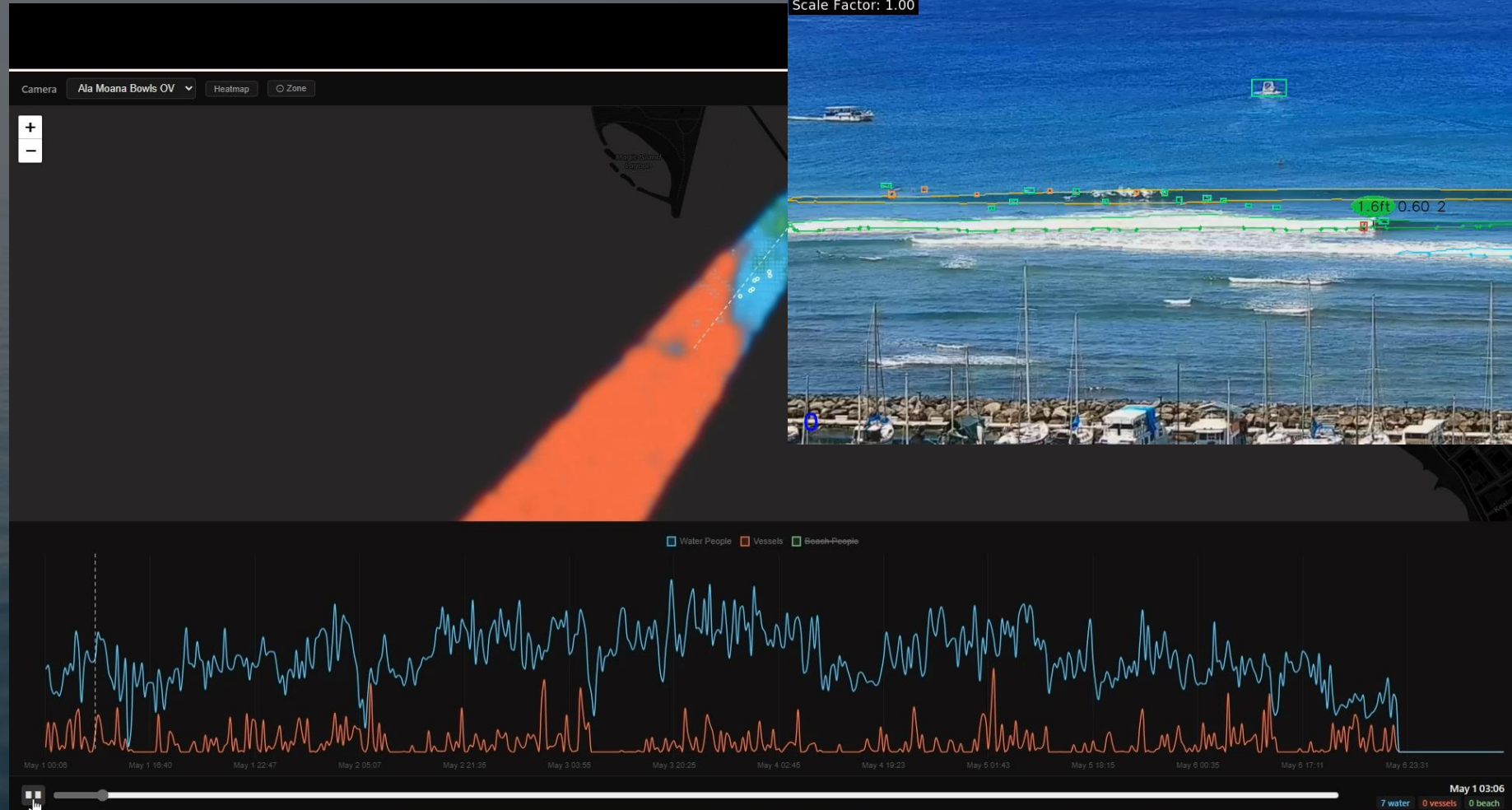


Boat Traffic varies significantly depending on the type of vessel

- Motorboats see more consistent daily traffic – with about 80% of the weekend volume occurring during the week.
- Sailboats and other vessels see more fluctuation between weekends and weekdays



Vessel Monitoring Ala Moana Bowls HI





Paul Ganev
General Manager
pganev@surfline.com



Ben Freeston
Head of Innovation
Ben@surfline.com



Greg Dusek
Science Advisor



Austin Heimark
Commercial Lead
aheimark@surfline.com

Contact Us Here!





Thank You!

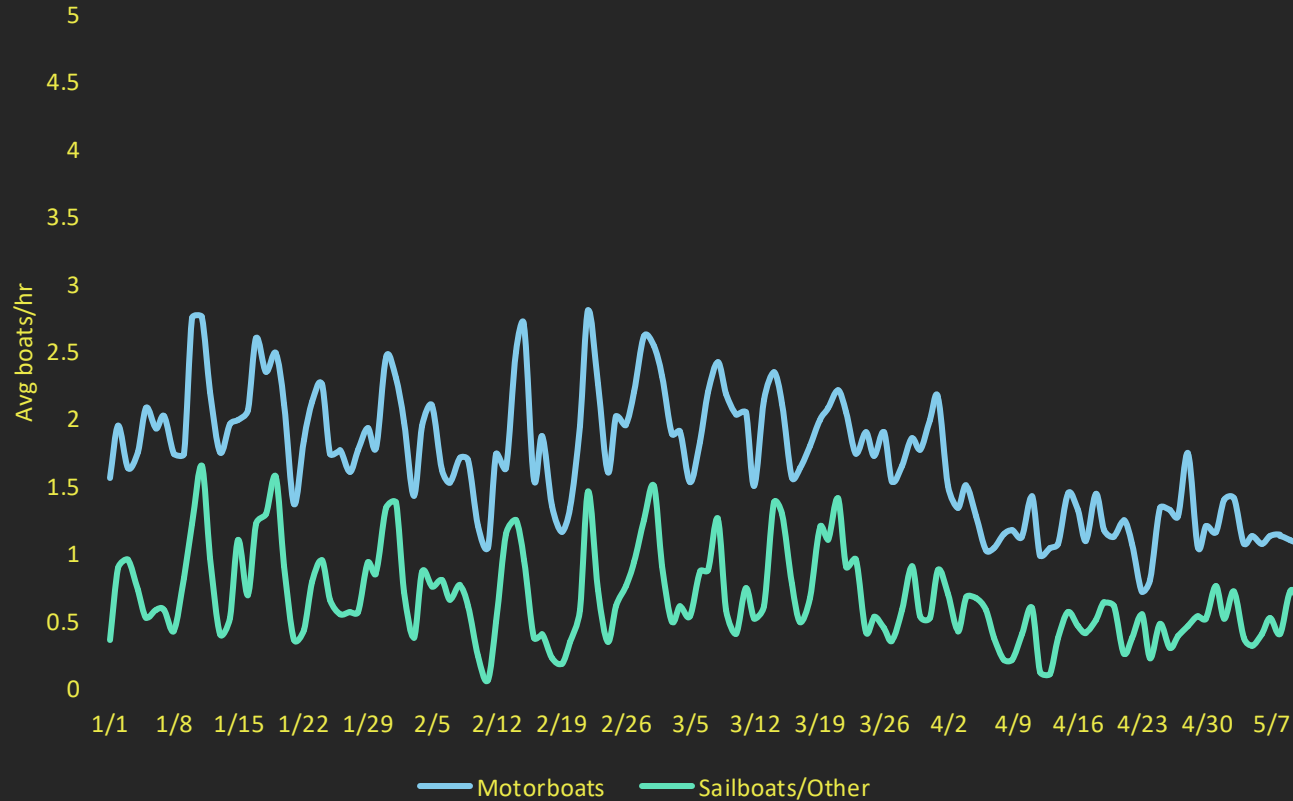
Surfline



Oceanside Harbor Boat Traffic

Daily Boat Totals

Avg boats per hour



Motorboats account for the majority of harbor traffic and the majority of the post-dredging decline.

Daily peaks compressed from ~2.5/hr to ~1.5/hr. Sailboat/other activity declined more modestly, suggesting motorized users are more sensitive to dredging conditions.



Torrey Pines State Park - Site Overview

0011-0014 (CoastSat)

TP - 0520 (SanDag)

SCI.



Torrey Pines State Park – Camera Overview

Counts - water: 3, shore: 1, total: 4,

Frame: 0

ptz: pan: -201.18, tilt: -3.37, zoom: 0.00

Scale Factor: 1.00



Scale Factor: 0.87

21.6ft; 0.00350 11



Comparing Camera Based Surveys to CoastSat

Torrey Pines, San Diego

