Sea Turtle Nesting and Beach Dynamics: A Case Study on Three Southeast Florida Beaches

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Outline

Introduction and overall goals

Study areas

Methods

Results and Discussion

Progressive Findings

Introduction and overall goals

Collect field data to:

1) **Measure post-nourishment profile changes on beaches with different construction and design templates;**

2) **Assess sea turtle nesting patterns on these beaches; and**

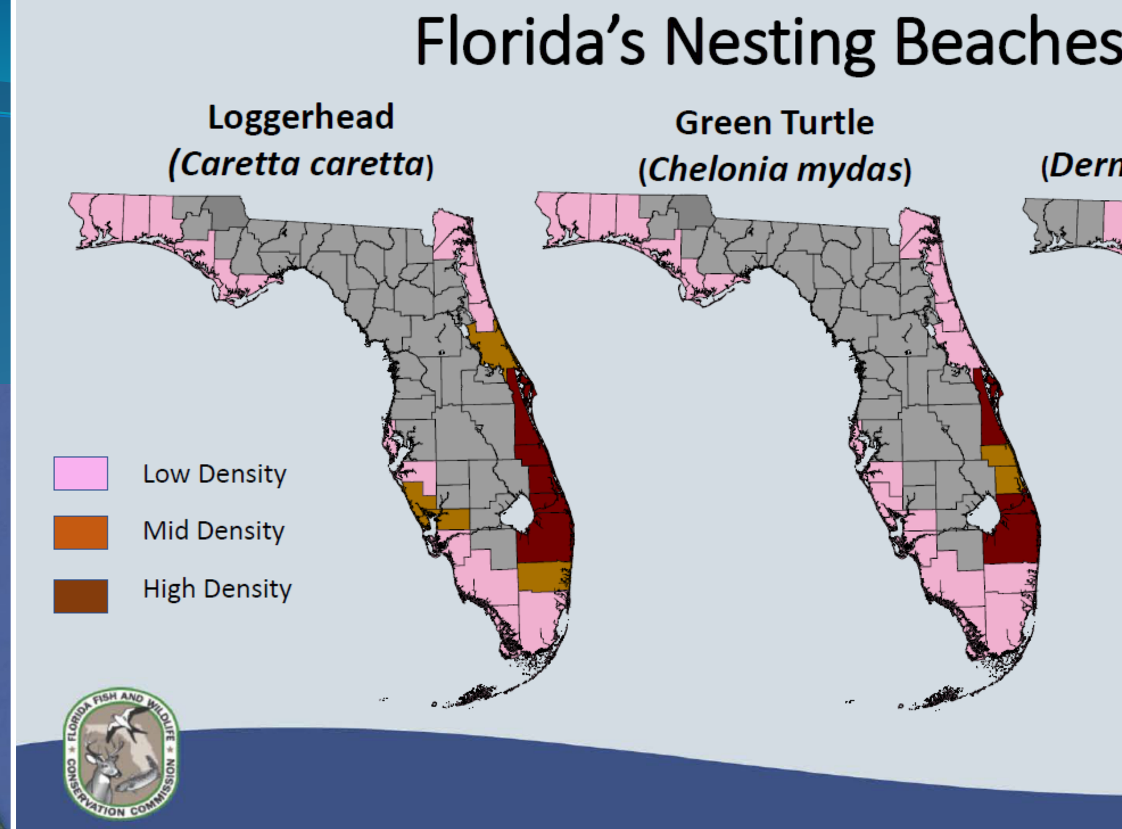
3) **Use results to improve beach-nourishment and construction designs to facilitate successful sea turtle nesting.**

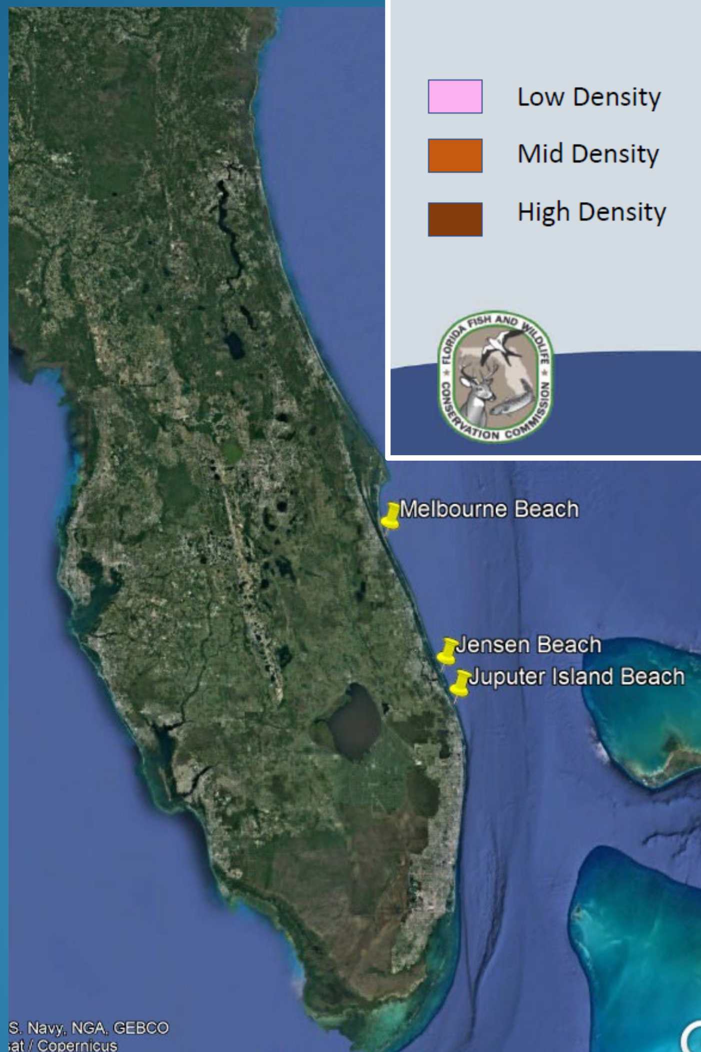
Study areas: 3 high density nesting beaches in Florida

Melbourne Beach

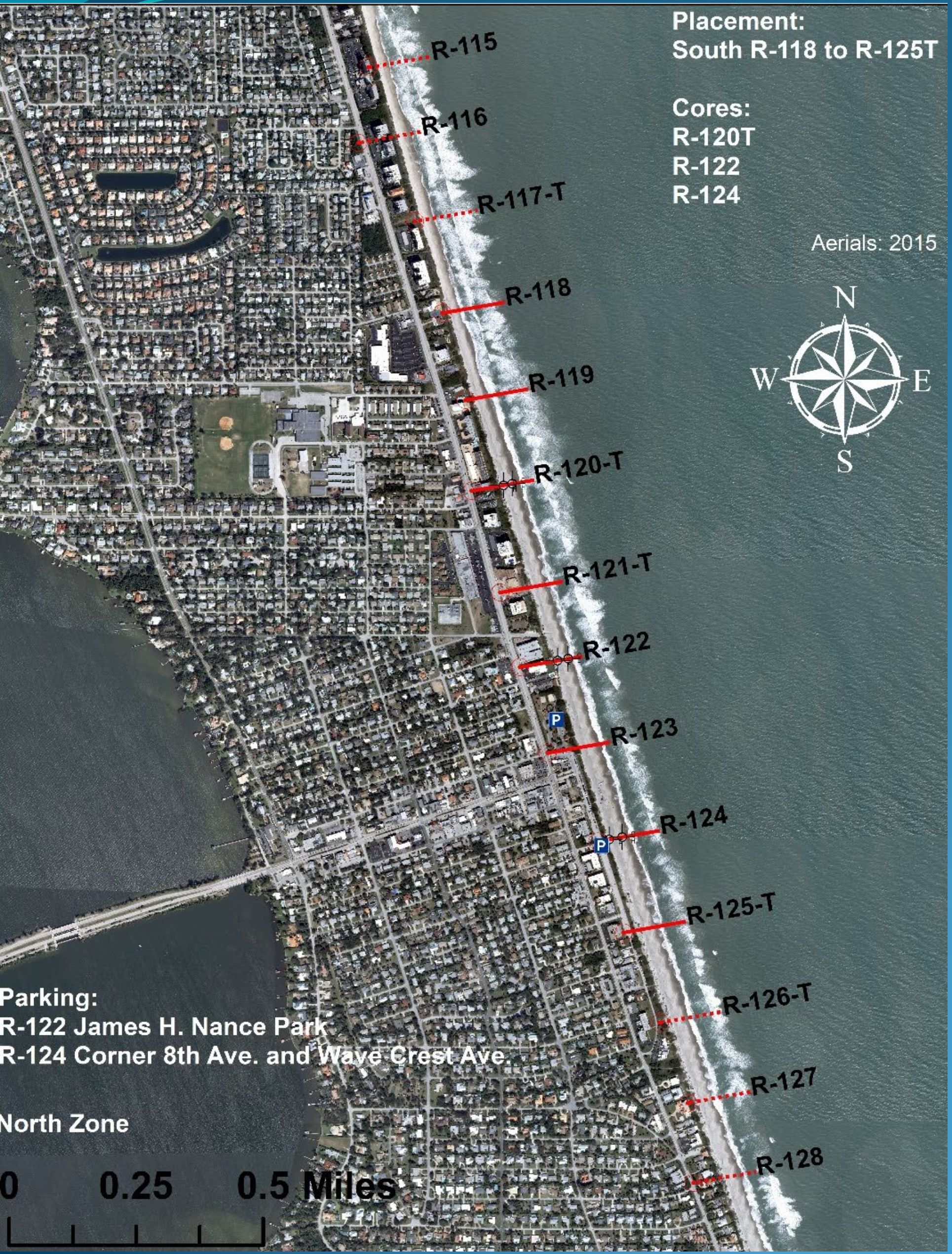
Jensen Beach

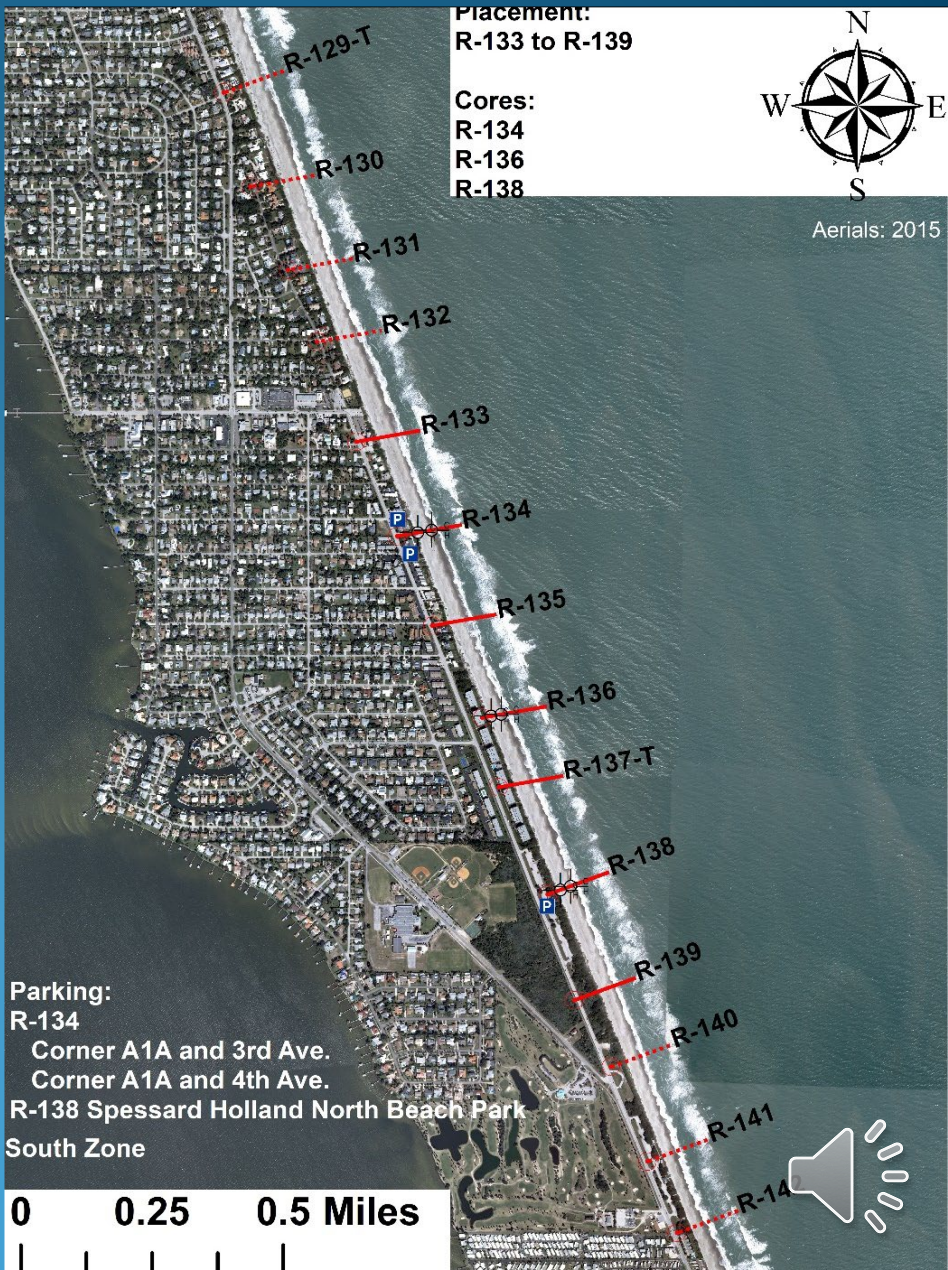
Jupiter Island Beach



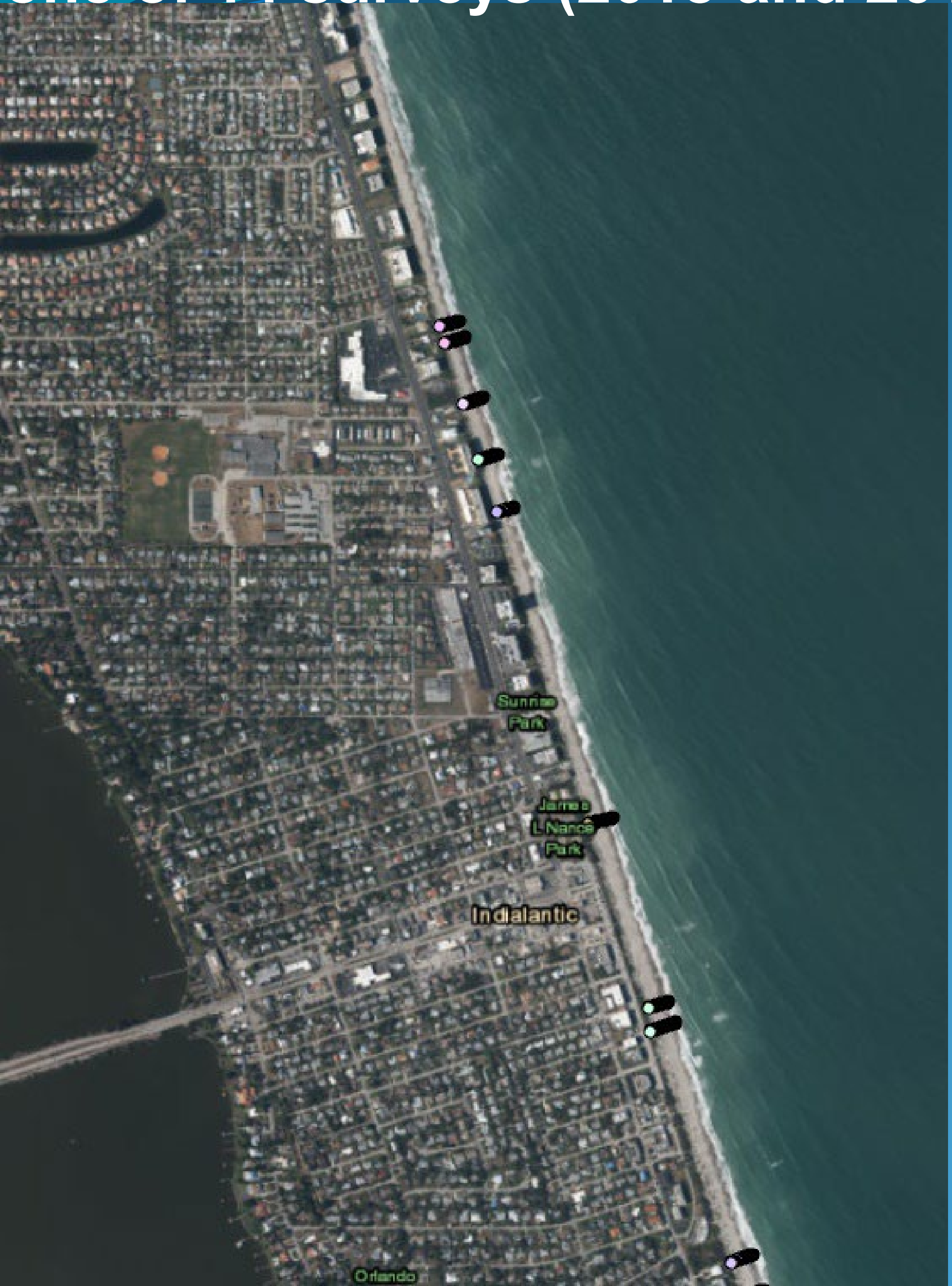


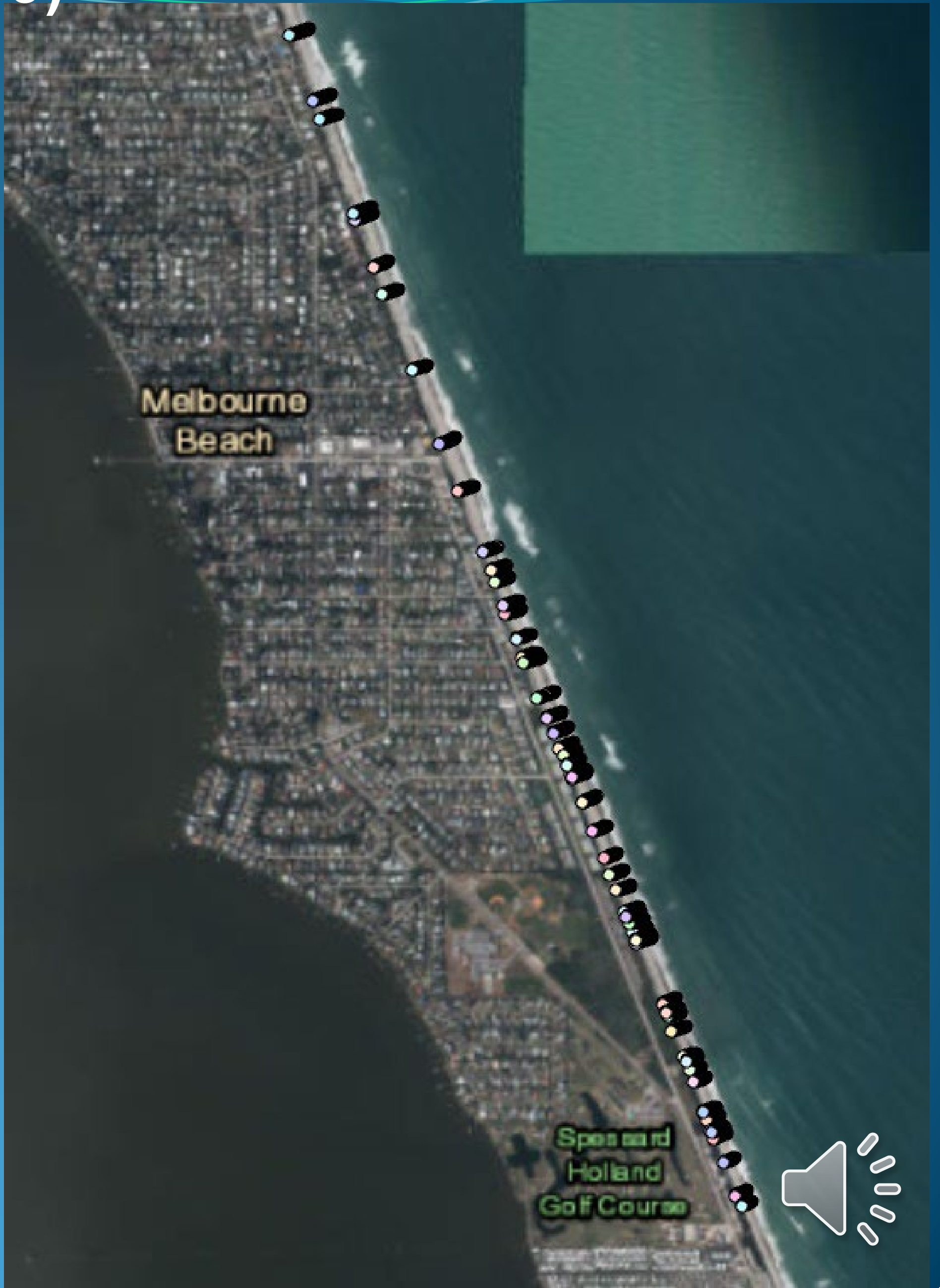
Melbourne Beach: heavily used beach: beach profile locations 16 surveys were conducted since February 2018.





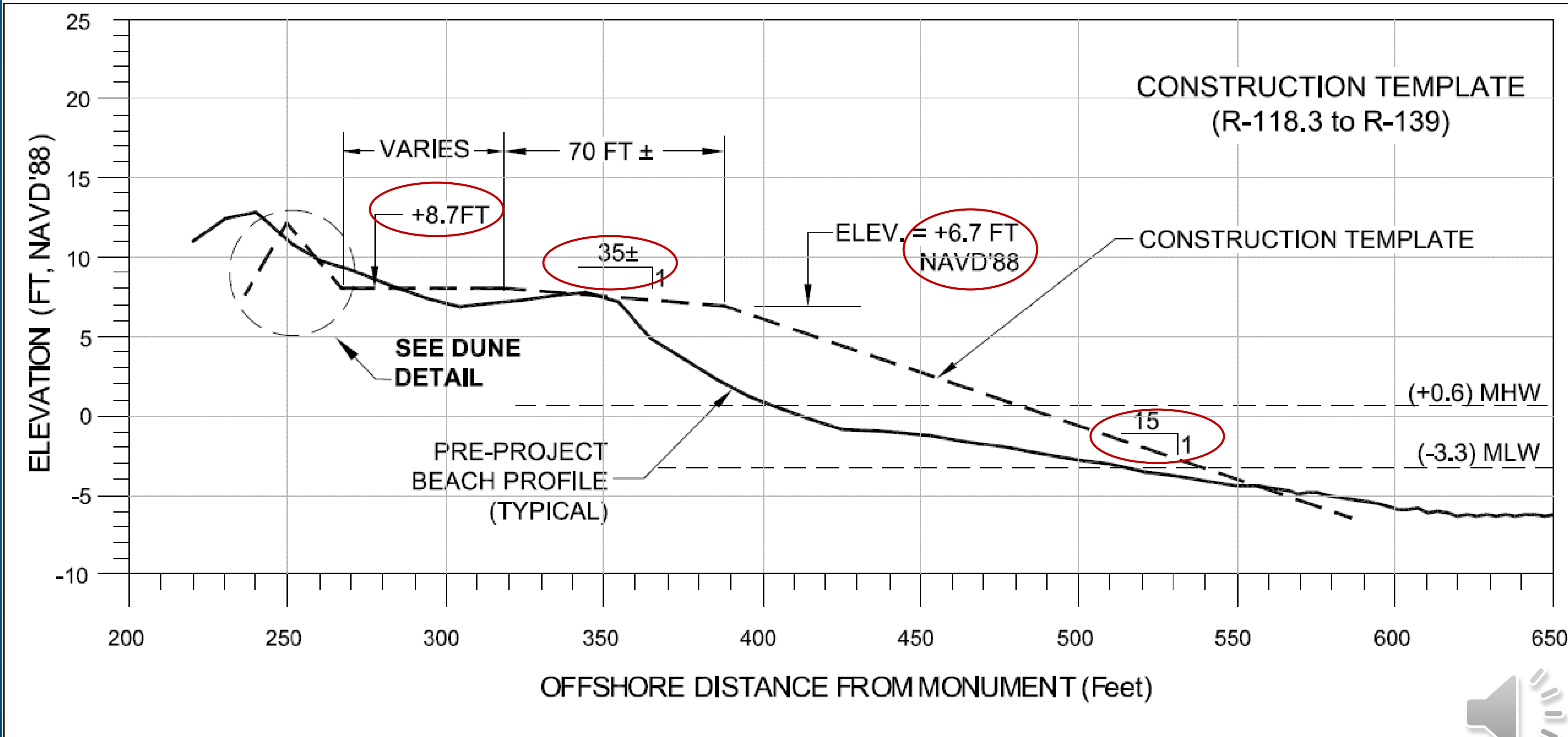
Melbourne Beach: heavily used beach: turtle track locations: one of 14 surveys (2018 and 2019)





Melbourne Beach nourishment design

1) Back beach was designed and graded to 8.7 ft (2.65 m) NAVD88, with a flat slope, with an optional dune.
2) Constructed berm sloped seaward at 1:35 to an elevation of 6.7 ft (2.04 m) NAVD88
3) Foreshore slope = 1:15



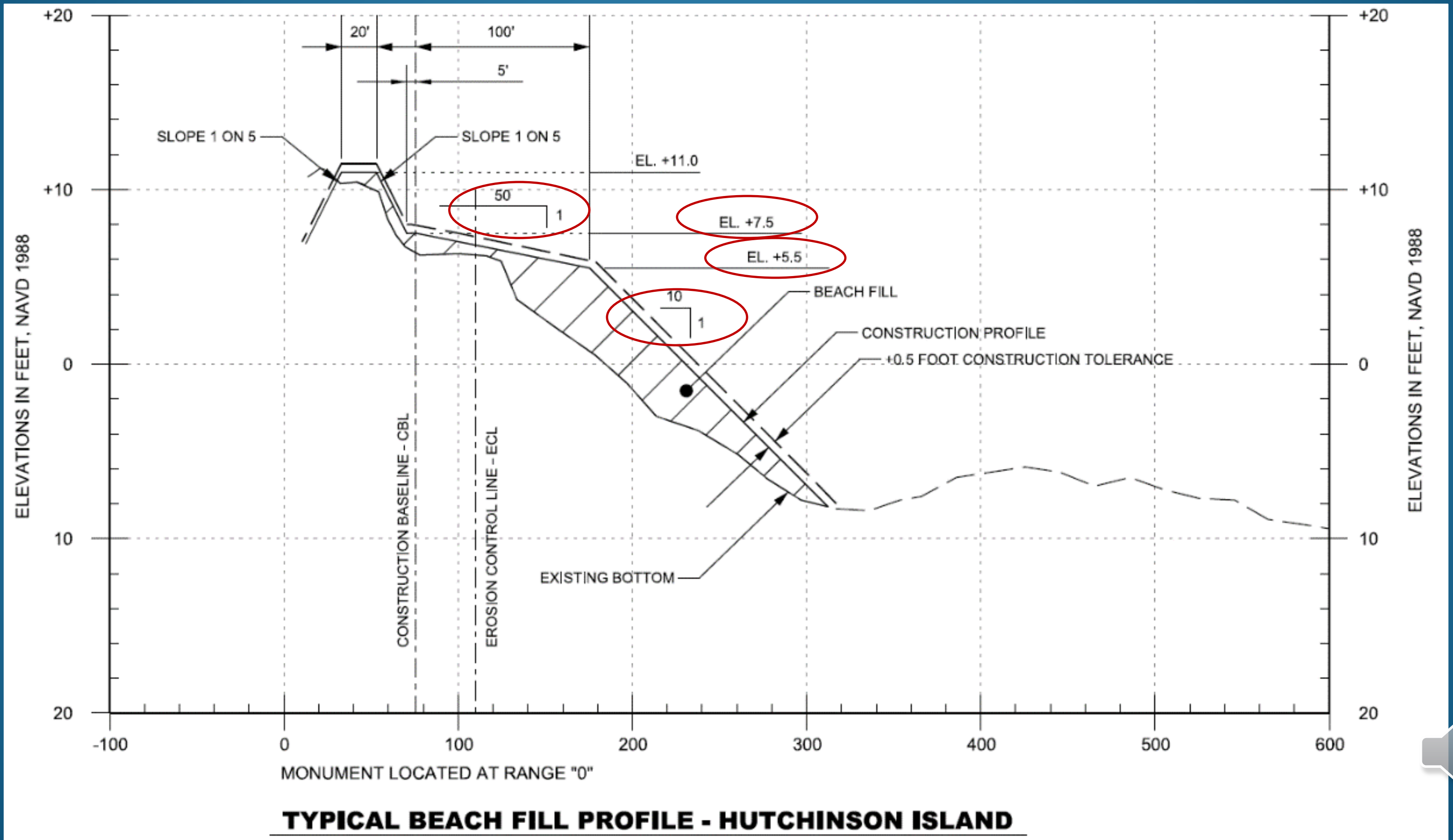
BEACH FILL DETAIL, TYP

Jensen Beach: heavily used public beach: beach profile locations: 10 surveys between 03/2018 and 06/2020

Jensen Beach: heavily used public beach: turtle track locations: one of 9 surveys (2018 and 2019)

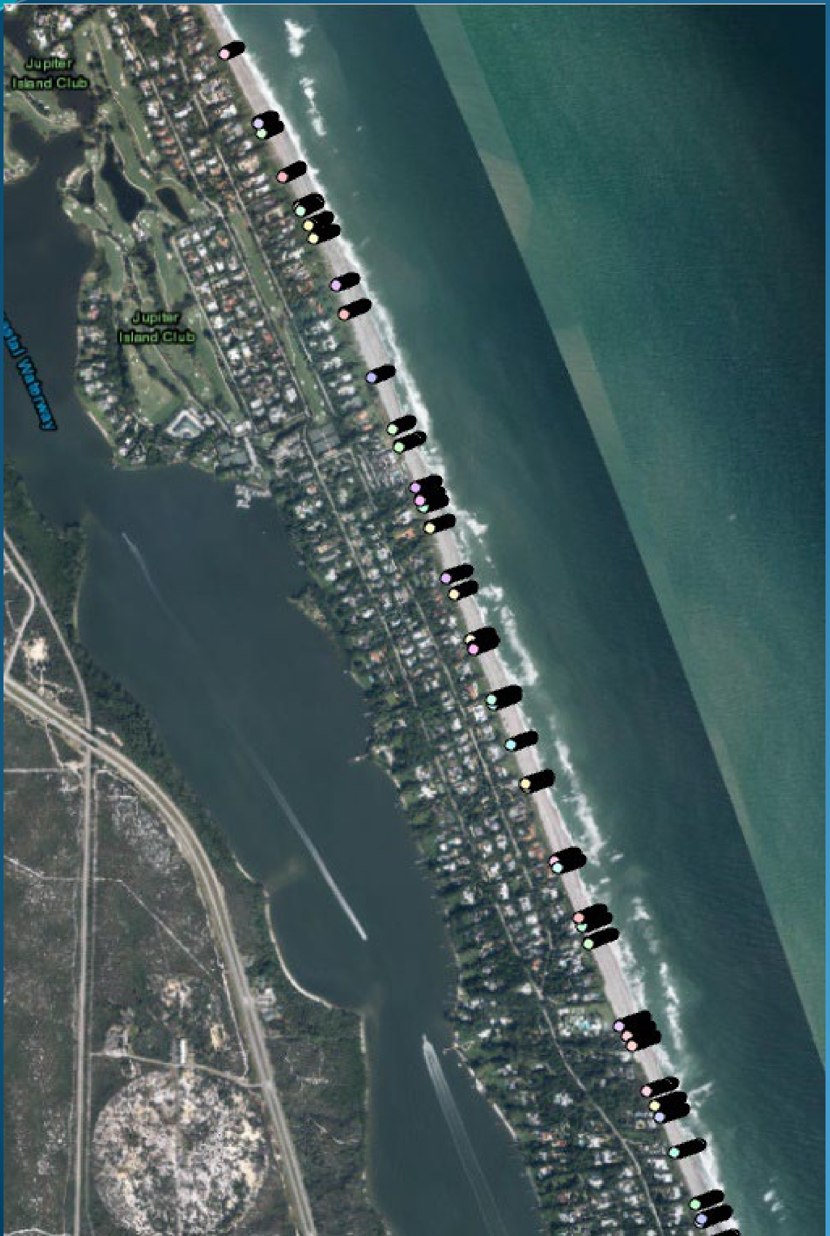
Jensen Beach nourishment design

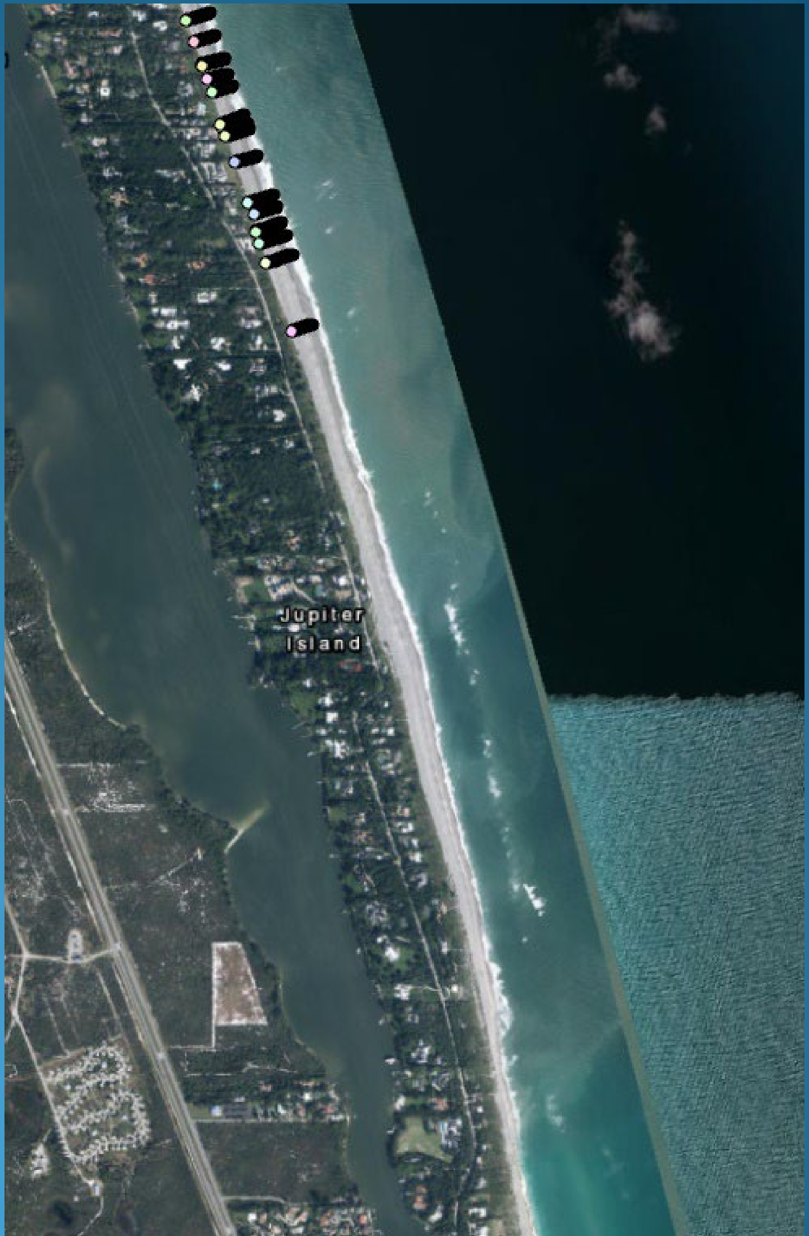
1) Dune was constructed to 11 ft (3.35 m) NAVD88, dune face slope = 1:5.
2) Constructed berm sloped seaward at 1:50, with a landward elevation (i.e., dune toe) of 7.5 ft (2.29 m) NAVD88 and seaward edge at 5.5 ft (1.68 m) NAVD88, constructed berm is typically 100 ft wide.
3) Foreshore slope = 1:10



Jupiter Island Beach: lightly used private beach: beach profile locations: 11 surveys since 12/2018

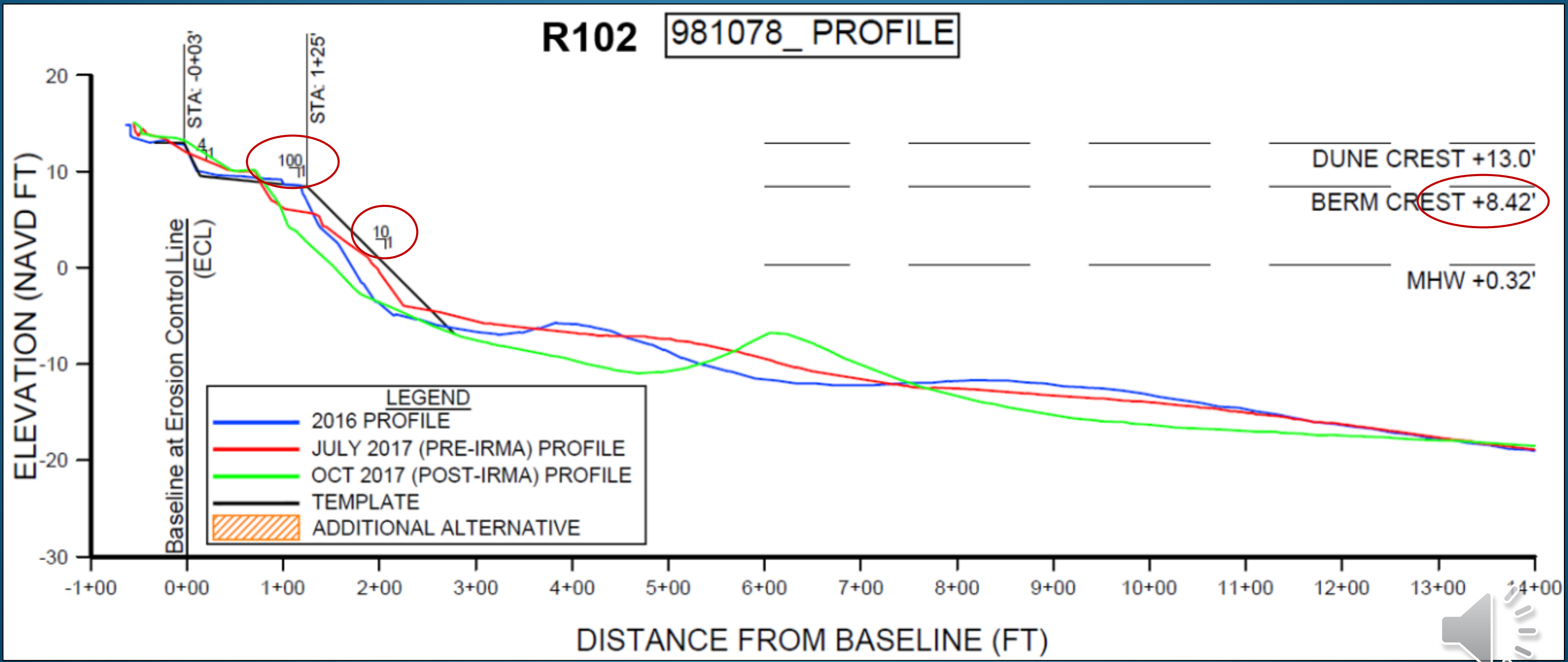
Jupiter Island Beach: lightly used private beach: turtle track locations: one of 8 surveys (2019)





Jupiter Island Beach nourishment design

1) Dune, if not vegetated, was built to mostly 13 ft (3.96 m) NAVD, dune face slope = 1:4.
2) Back beach was graded to 8.42 ft (2.57 m) NAVD88, slope = 1:100.
3) Foreshore slope = 1:10

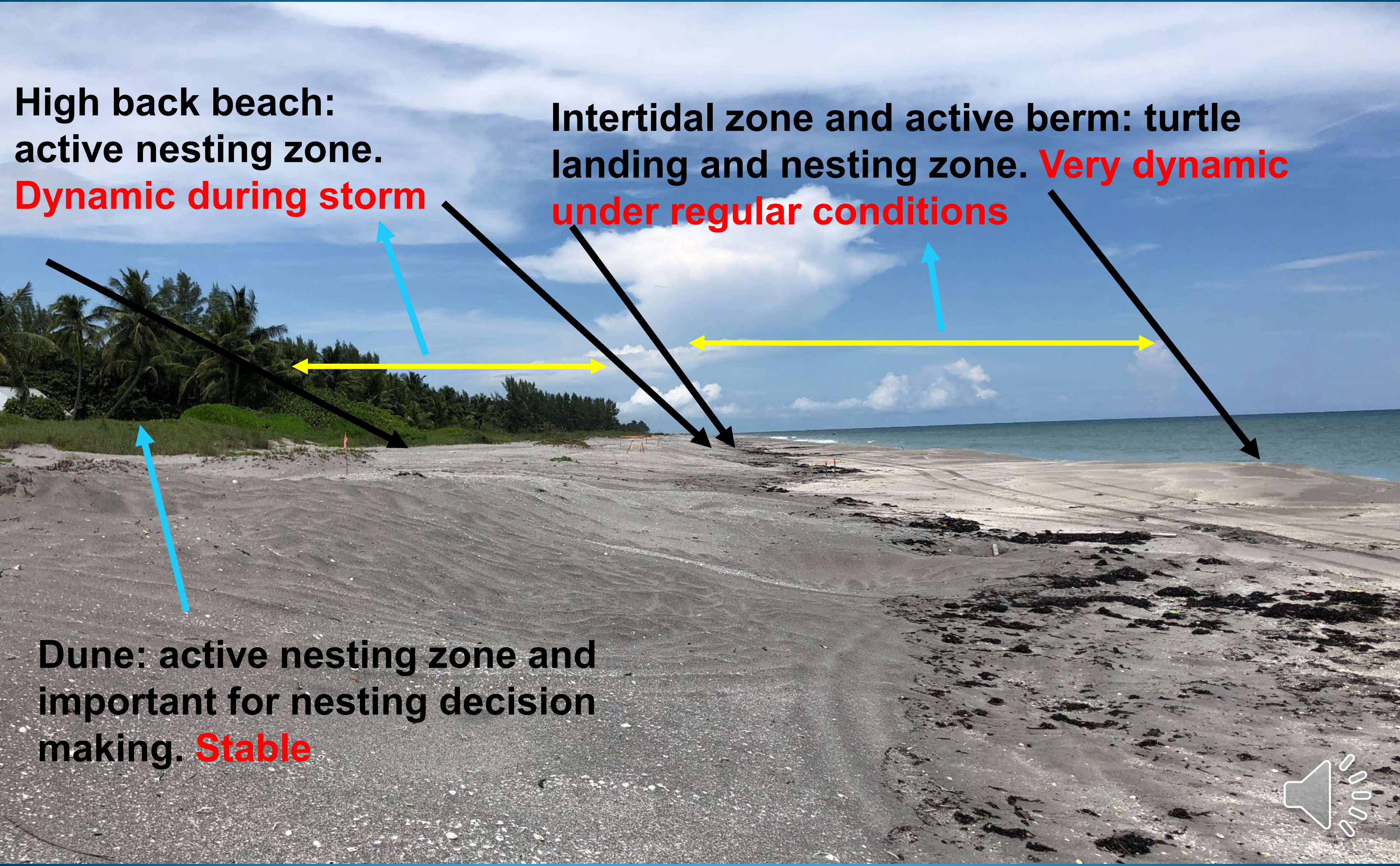


Field data collection

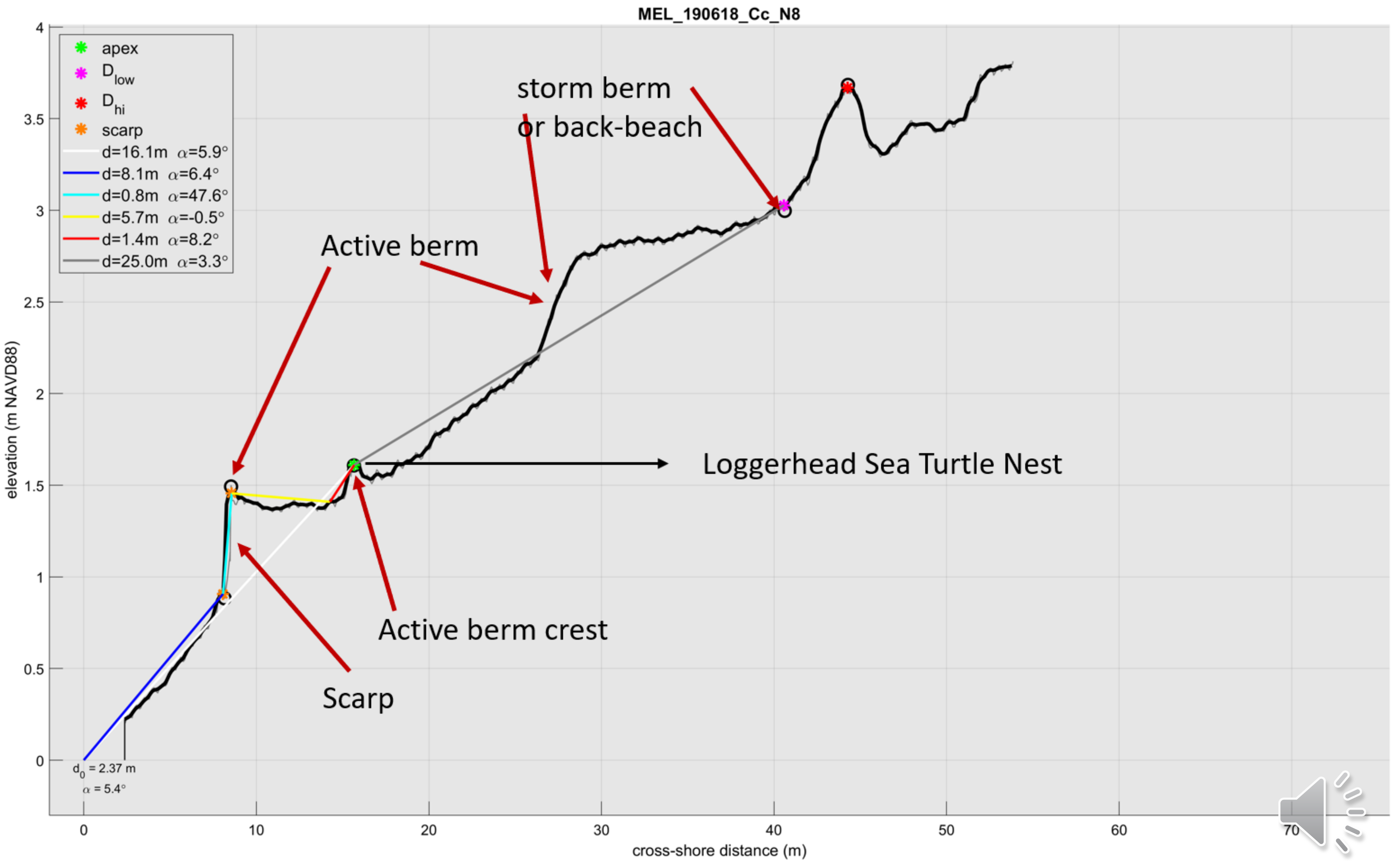
Beach profile survey: RTK GPS

Turtle nest survey: RTK GPS

Defining the nesting section of the beach relating to beach-change dynamics



Defining the nesting section of the beach relating to beach-change dynamics



Beach dynamics that influence turtle nesting: what cause changes at the turtle nesting beach

1) Wave and water-level conditions (not controllable).
2) Beach nourishment and design/construction (controllable).
3) Sediment characteristics (partially controllable).
4) Regional characteristics, e.g., sand supply etc. (mostly not controllable).

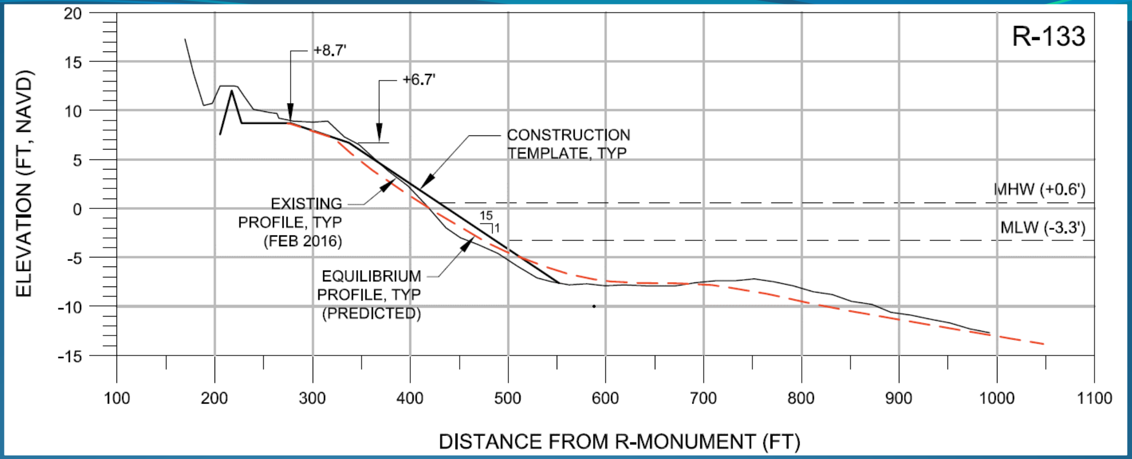
In the following, three beach dynamic factors are discussed, with respect of the above 4 factors:

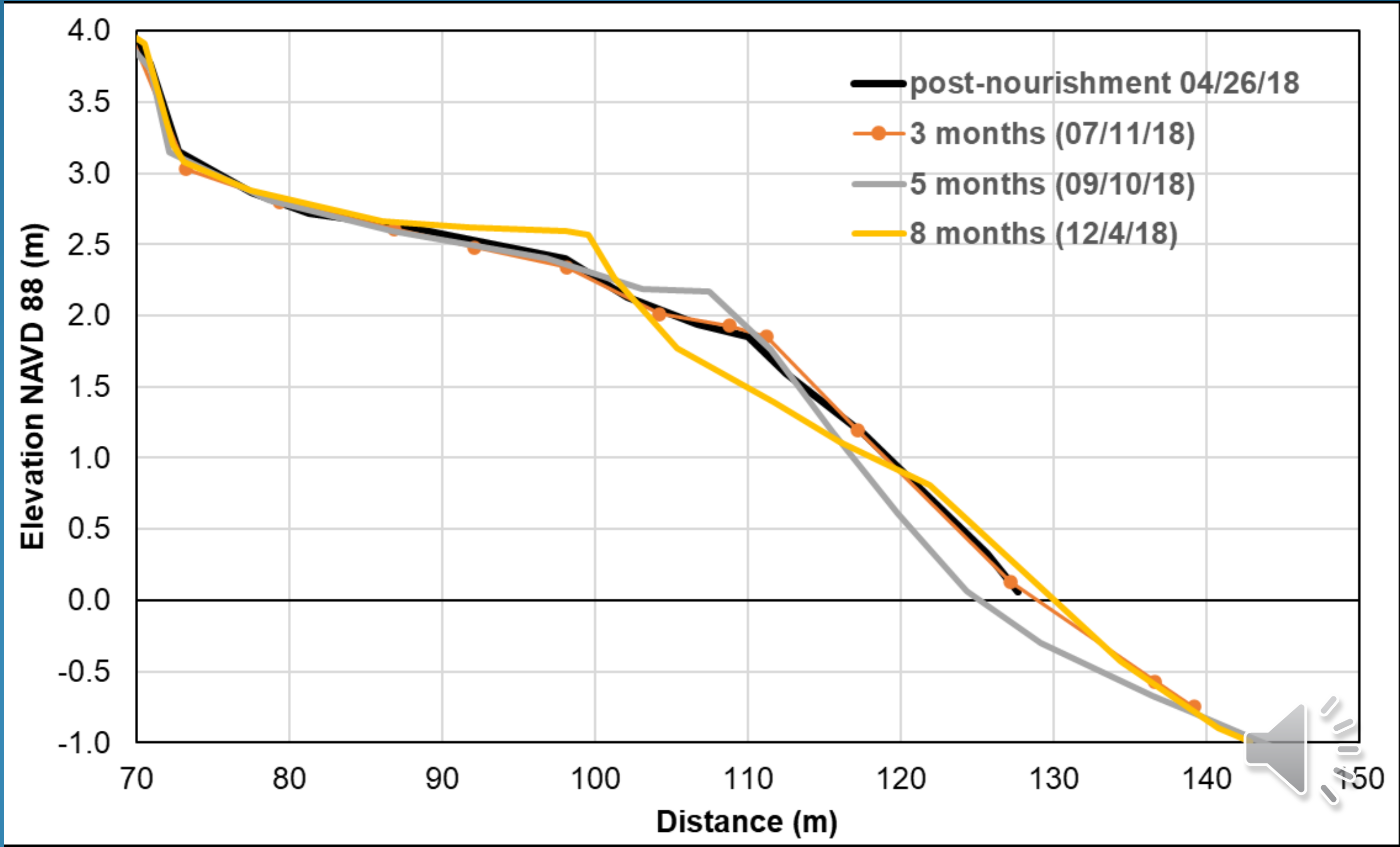
1) characteristics of “turtle nesting” zones:
    1) Active berm
    2) Storm berm/high back beach
    3) Dune
2) Evolution of active berm
3) Formation of beach scarp

Post-nourishment profile adjustment: Melbourne B.

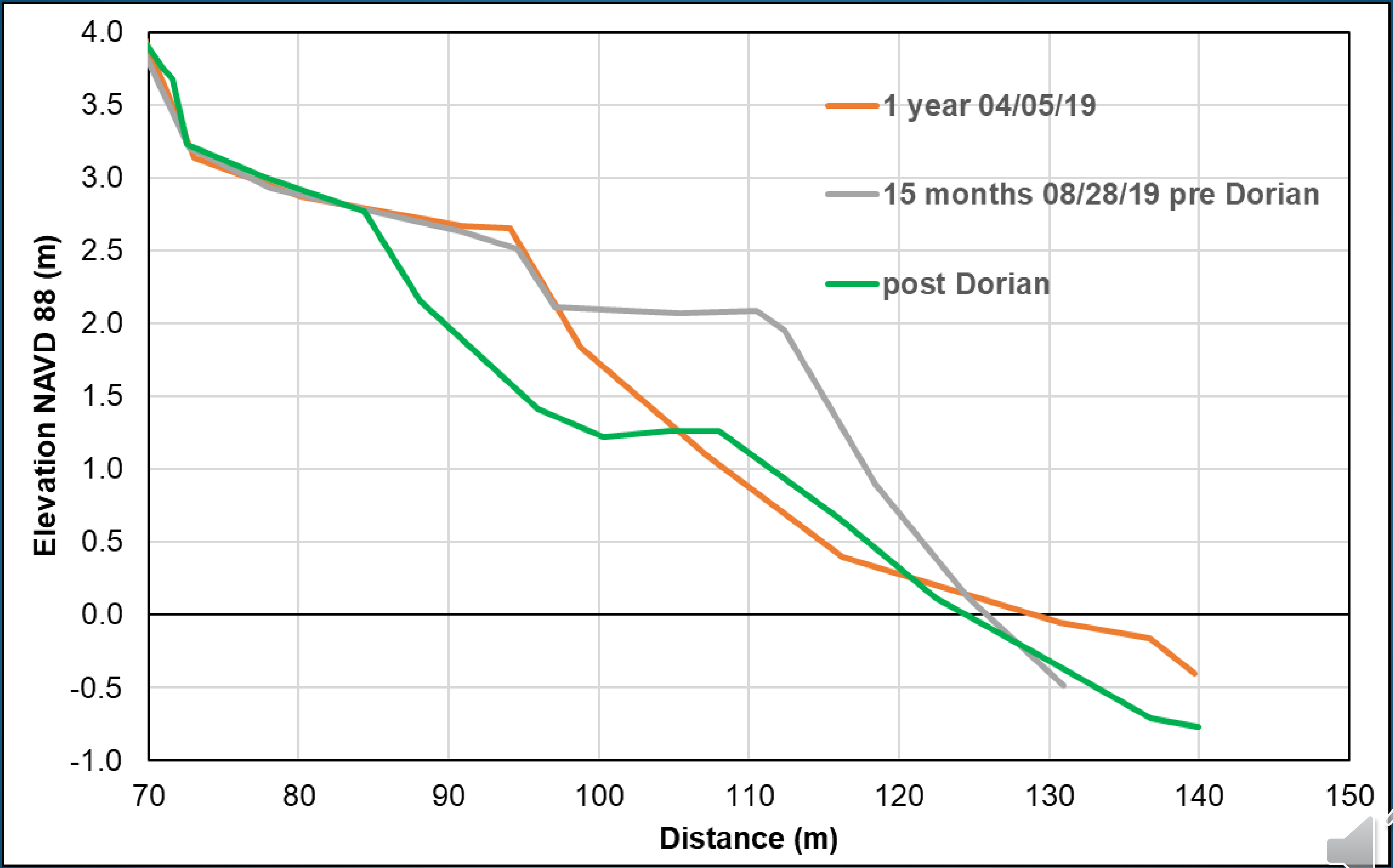
Growth of active berm over the lower constructed berm (1st nesting season)

Considerable longshore variations due to large beach cusps and relatively small fill volume

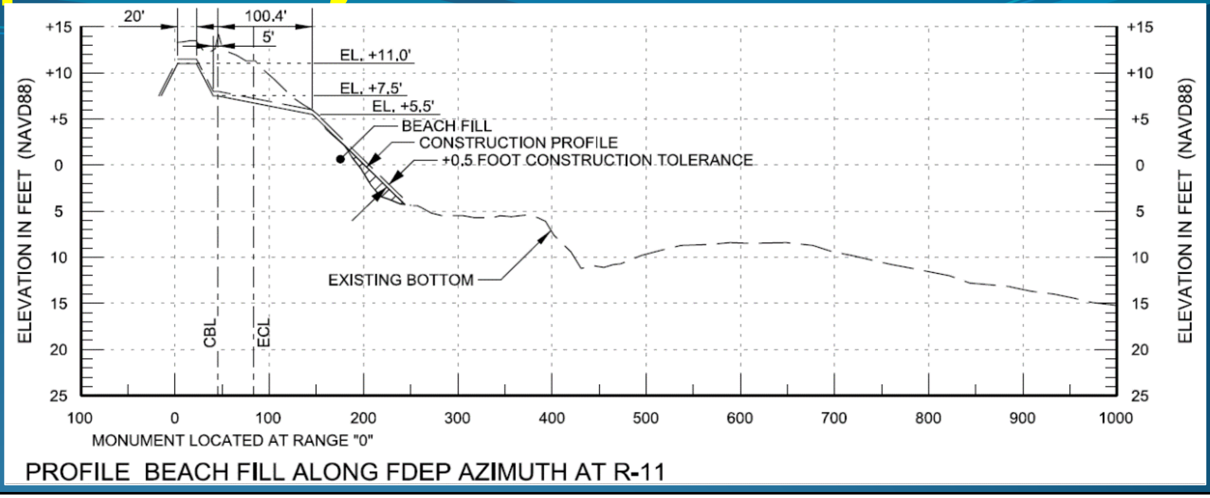




Post-nourishment profile adjustment: Melbourne B. 2nd season -2019

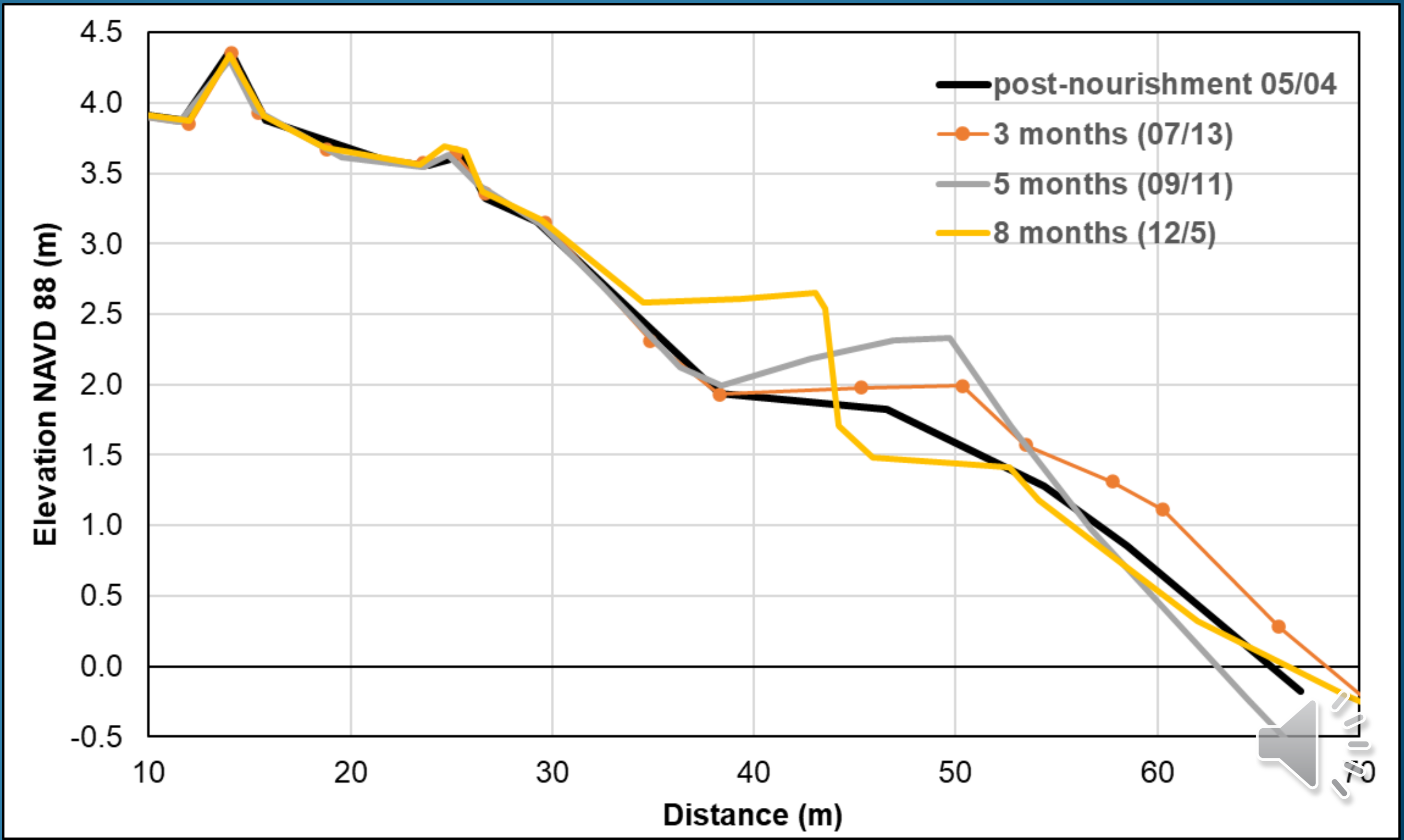


Post-nourishment profile adjustment: Jensen B.



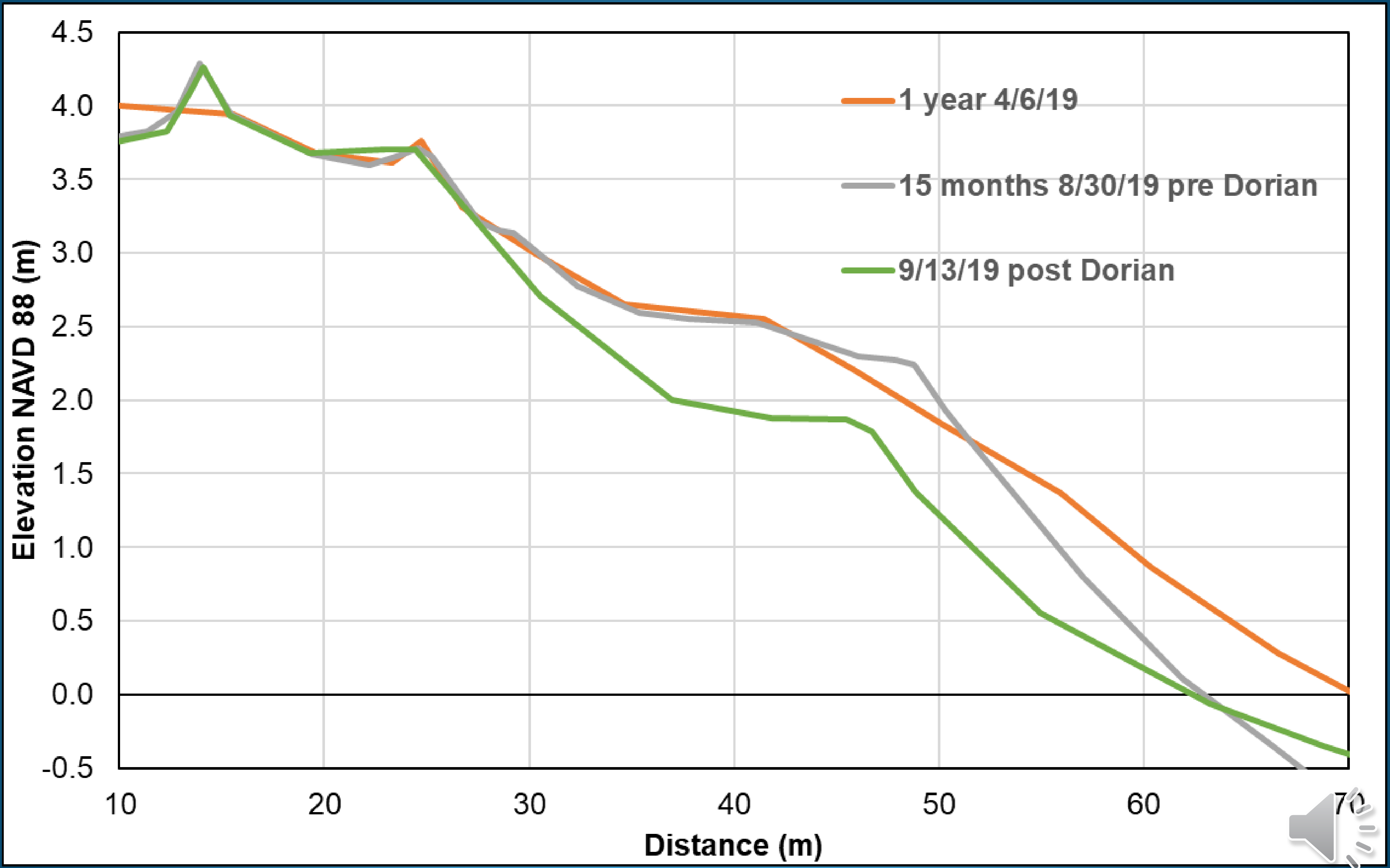
2018

Significant growth of active berm over the lower constructed berm (1st nesting season)



Post-nourishment profile adjustment: Jensen B.

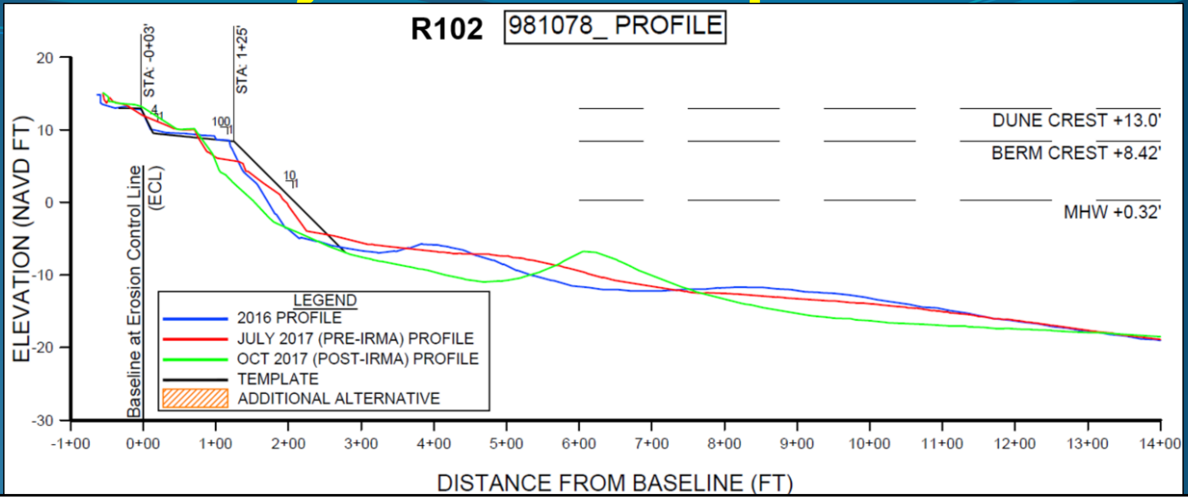
2nd season - 2019

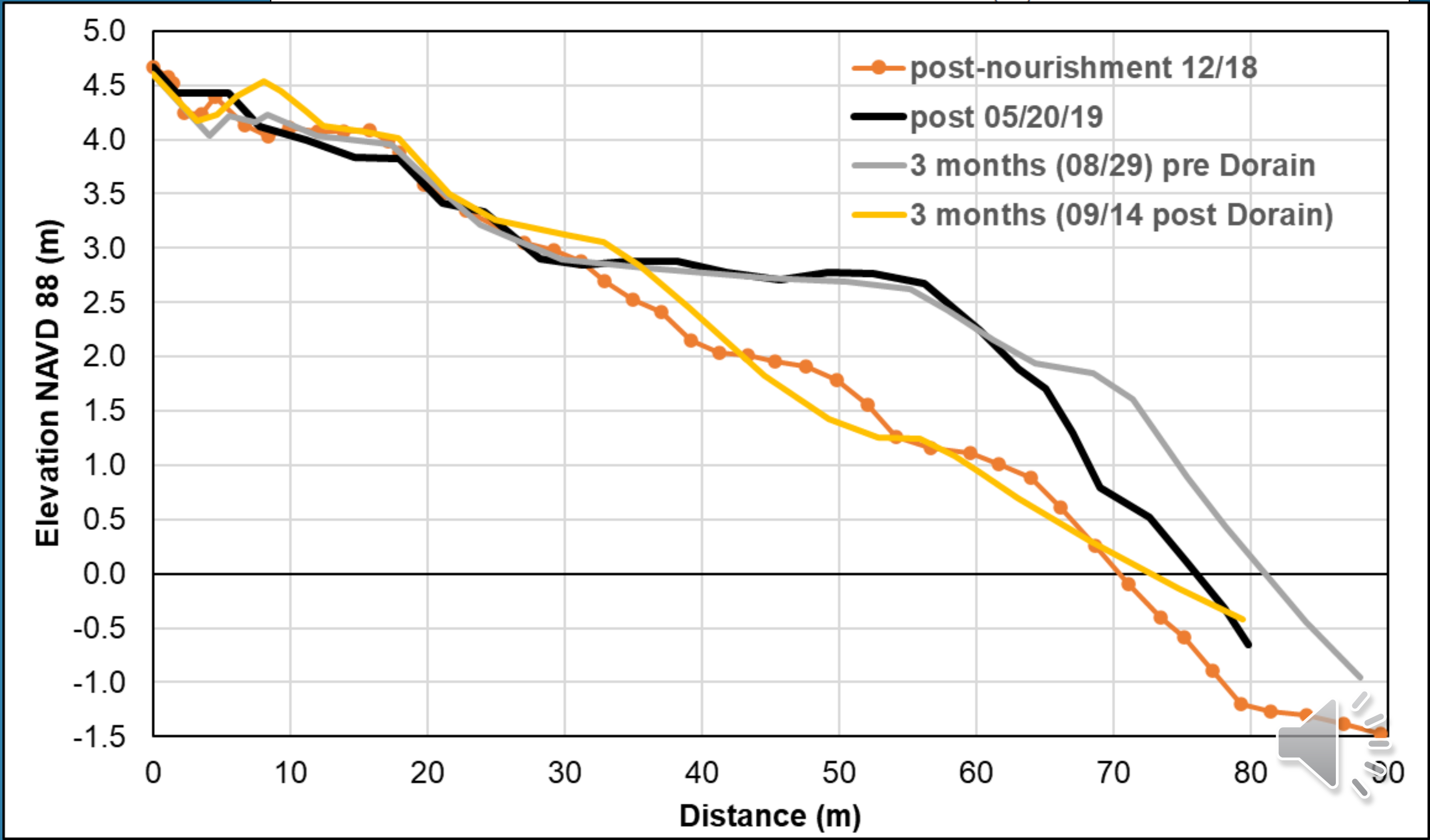


Post-nourishment profile adjustment: Jupiter Is. B.

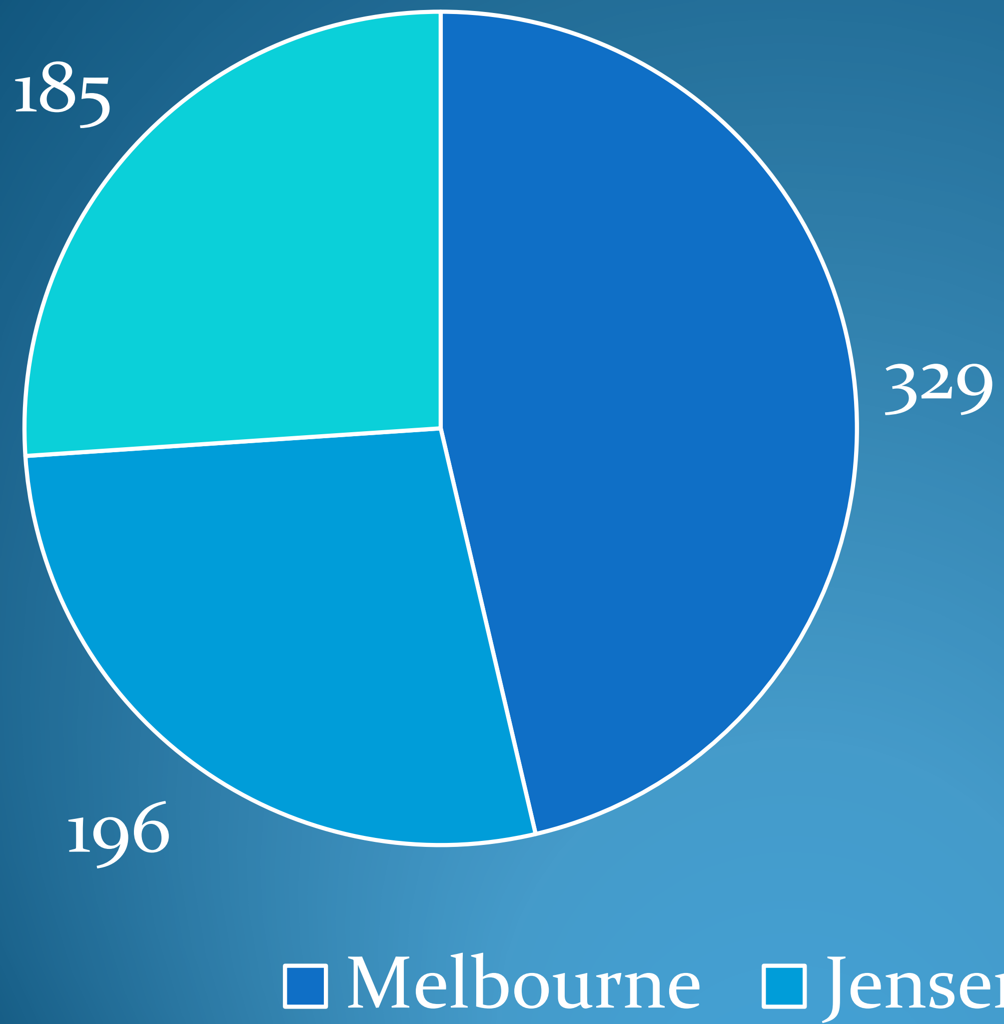
Stable back beach before H. Dorian (1st nesting season).

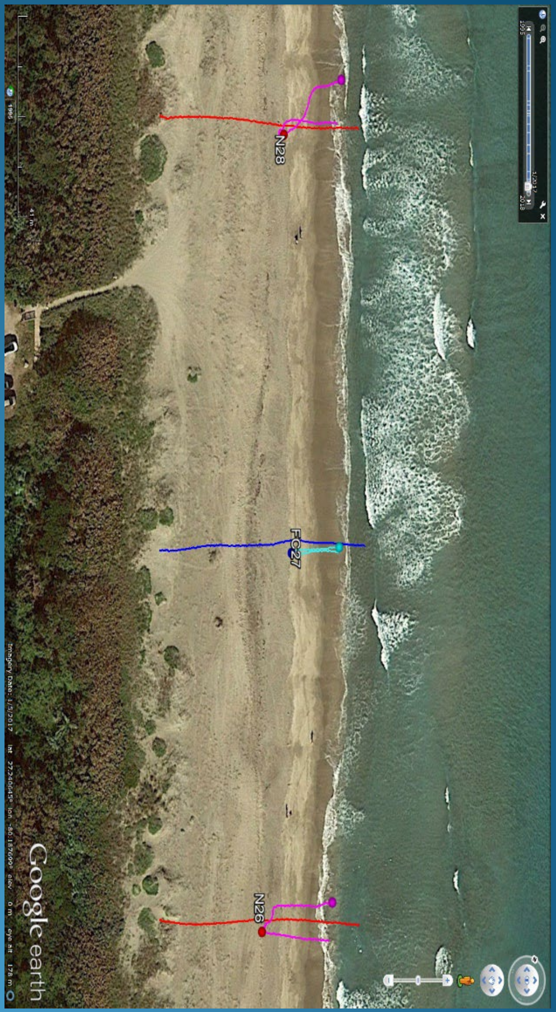
Most fill sand was eroded by H. Dorian.



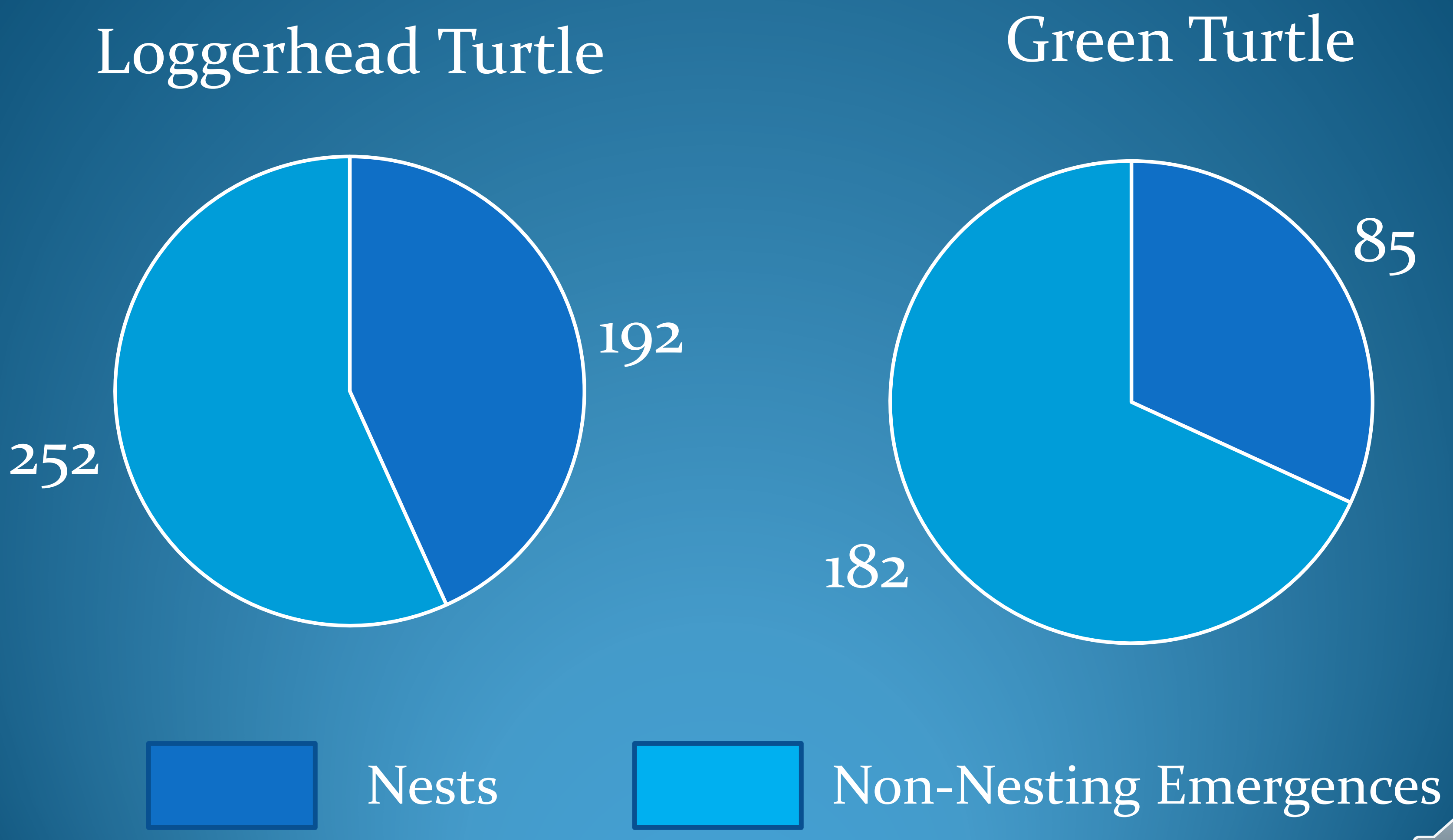


Total Tracks Counted 2018-2019

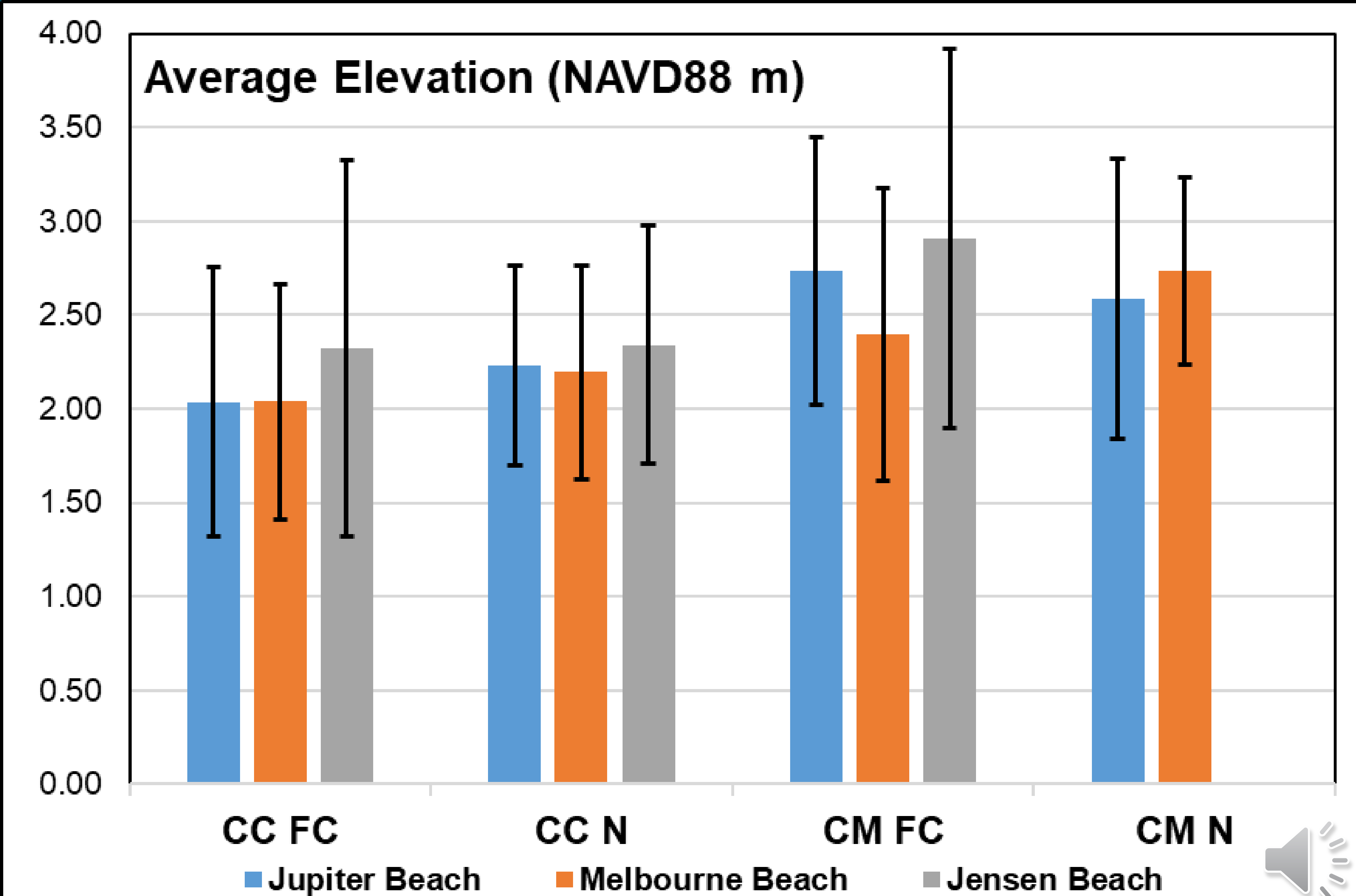




Tracks Surveyed by Species
2018-2019



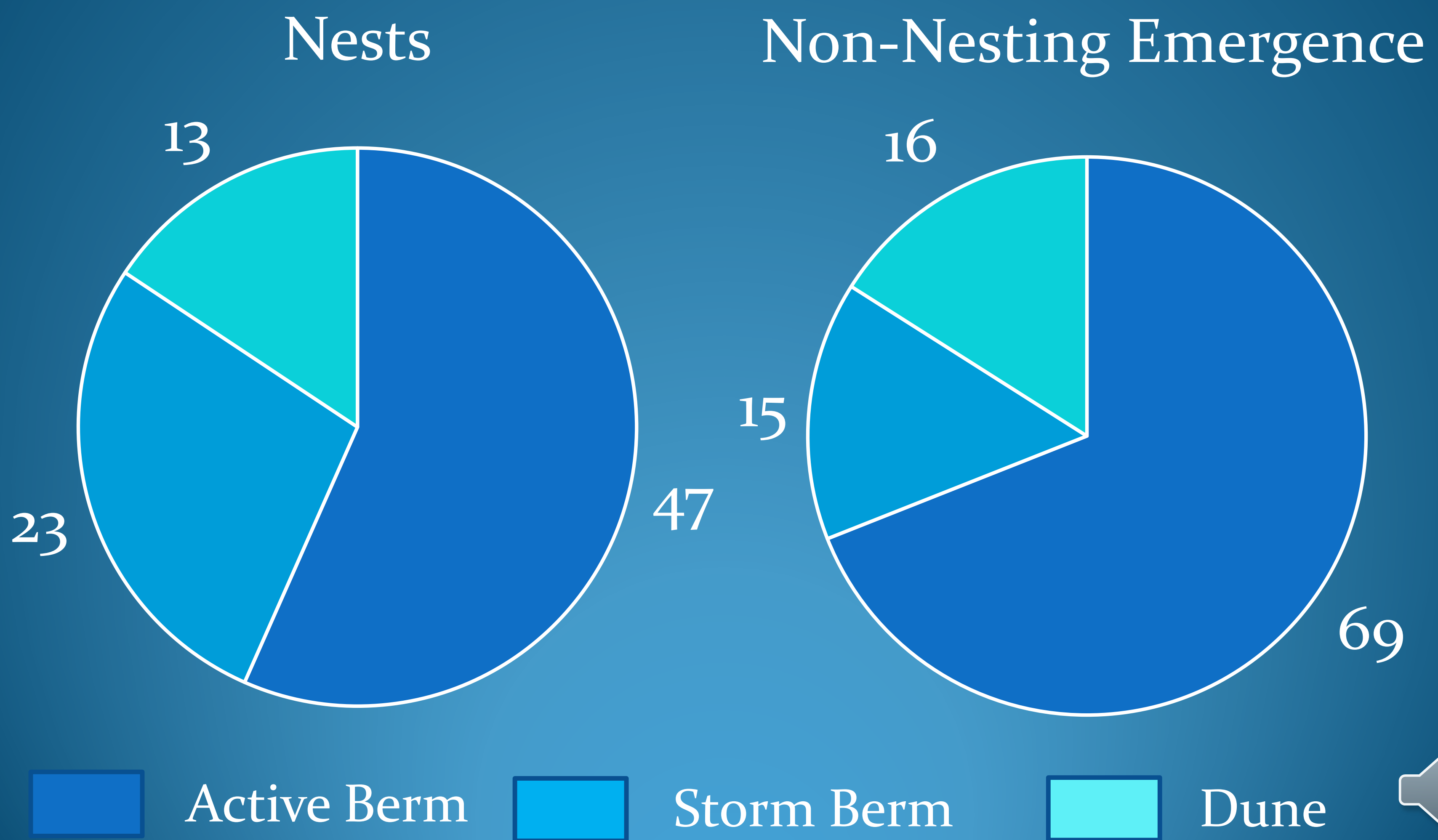
Elevations of nests and apex of non-nesting emergences



Melbourne Beach

2018-2019

Loggerhead Crawl Type (%) Across Profile



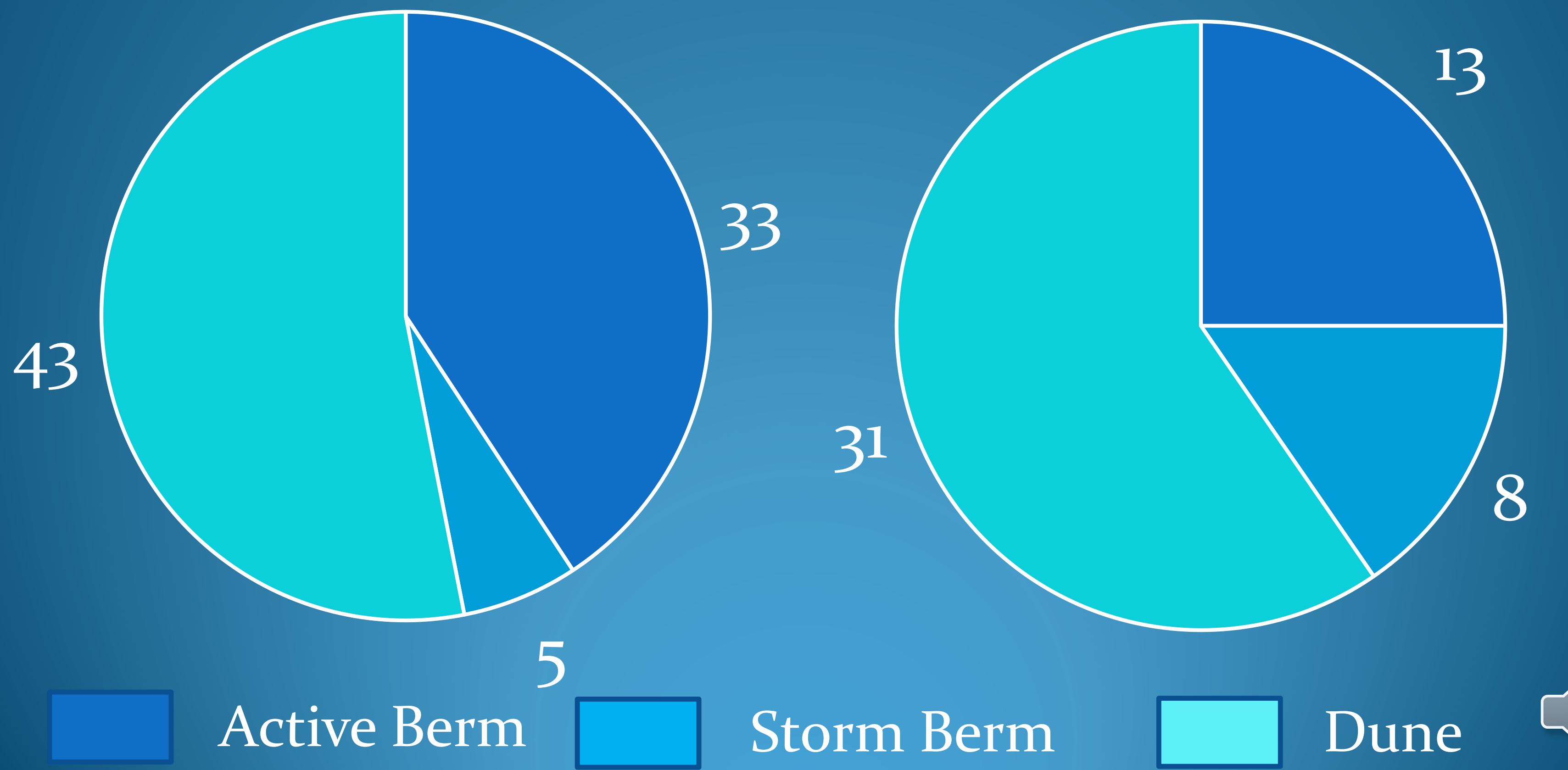
Melbourne Beach

2018-2019

Green Turtle Crawl Type (%) Across Profile

Nests

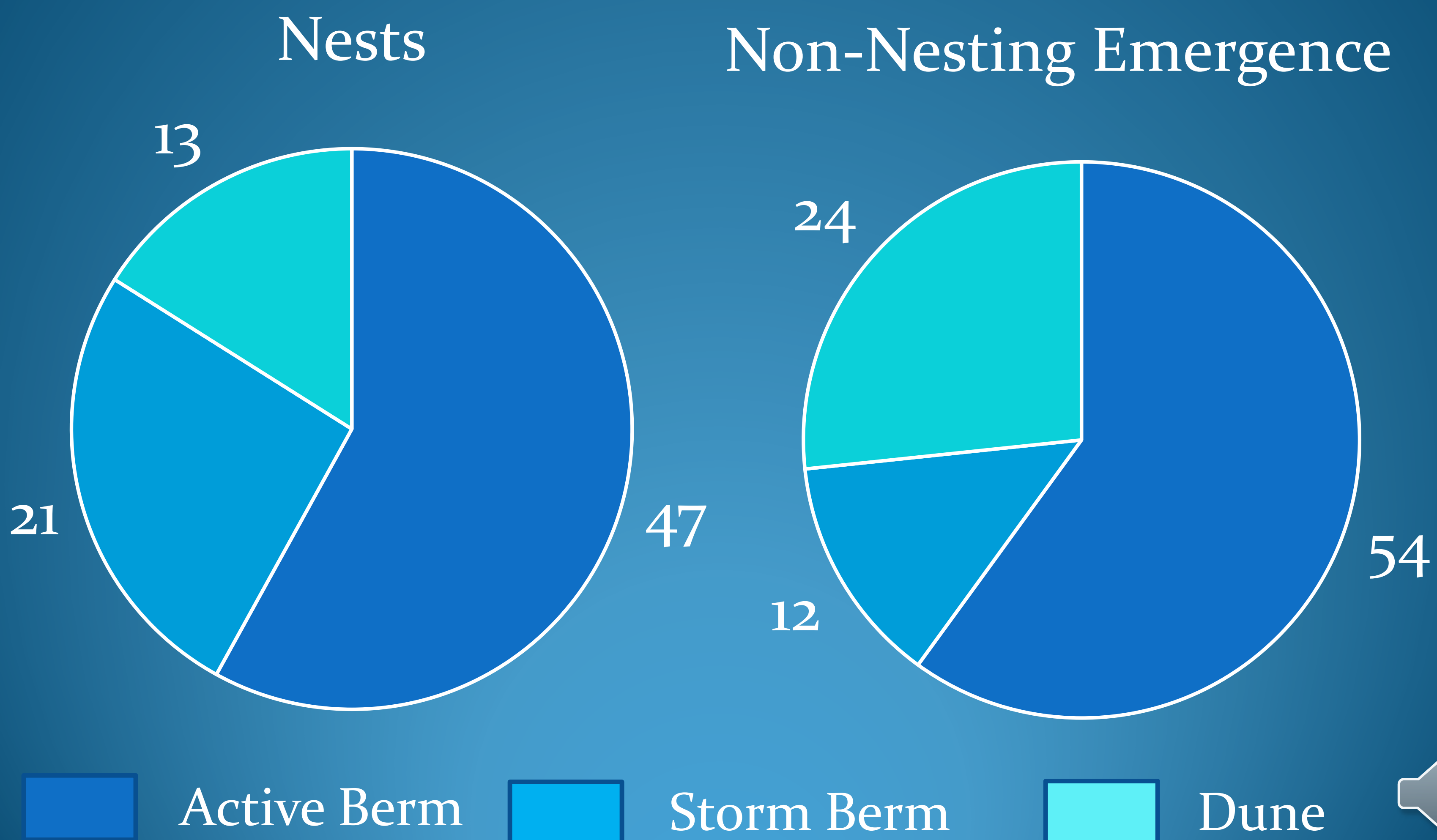
Non-Nesting Emergence



Jensen Beach

2018-2019

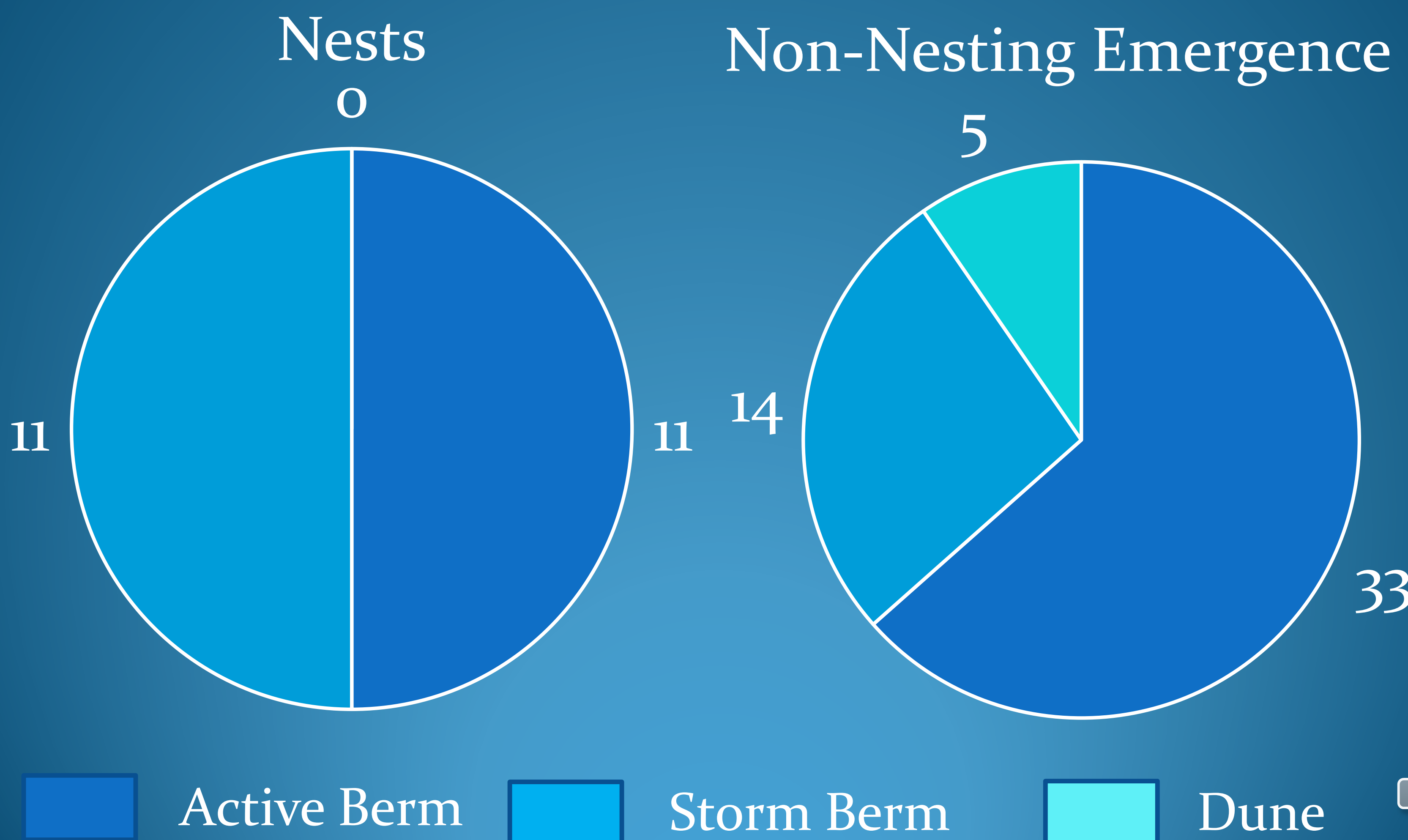
Loggerhead Crawl Type (%) Across Profile



Jupiter Island

2019

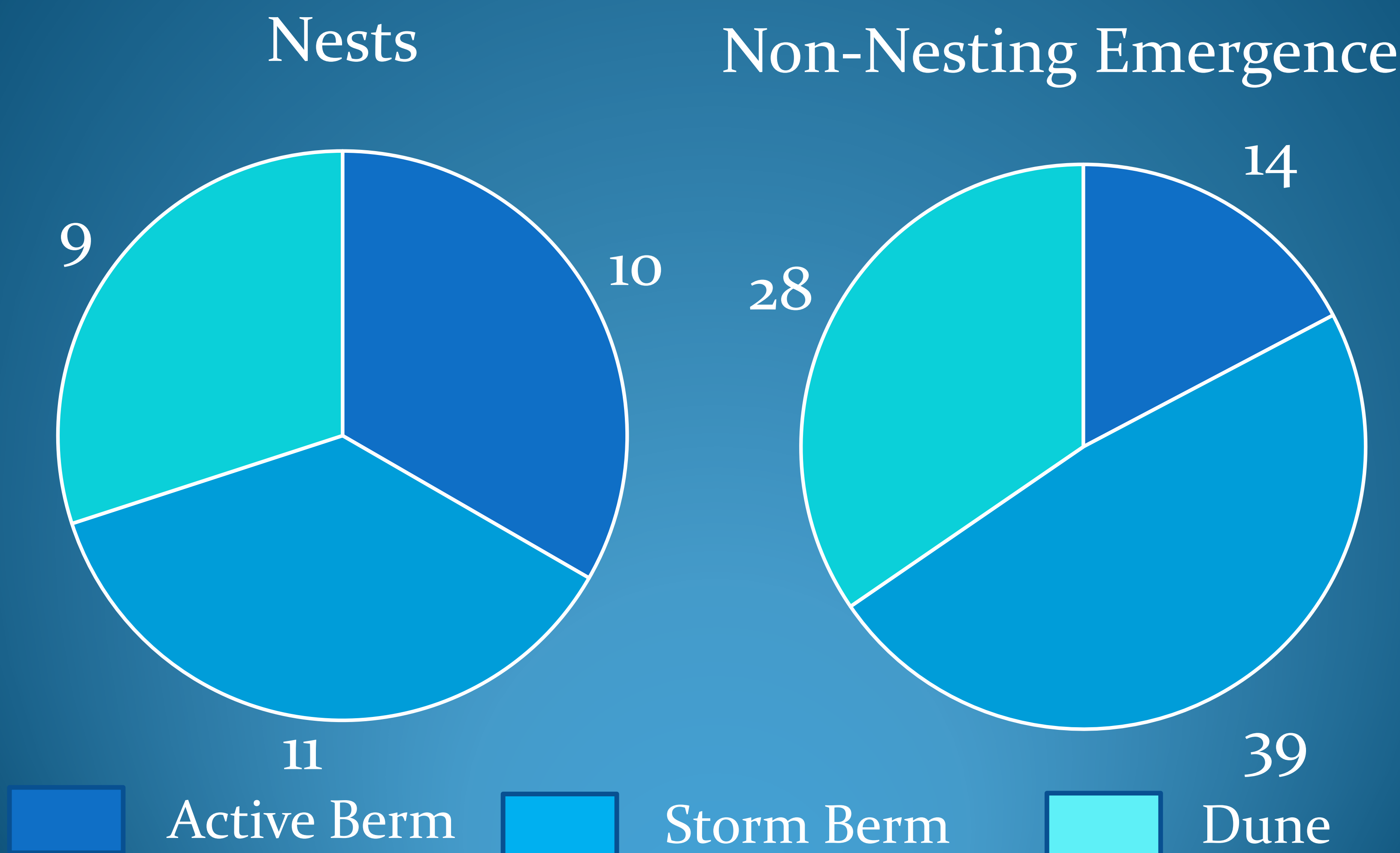
Loggerhead Crawl Type (%) Across Profile



Jupiter Island

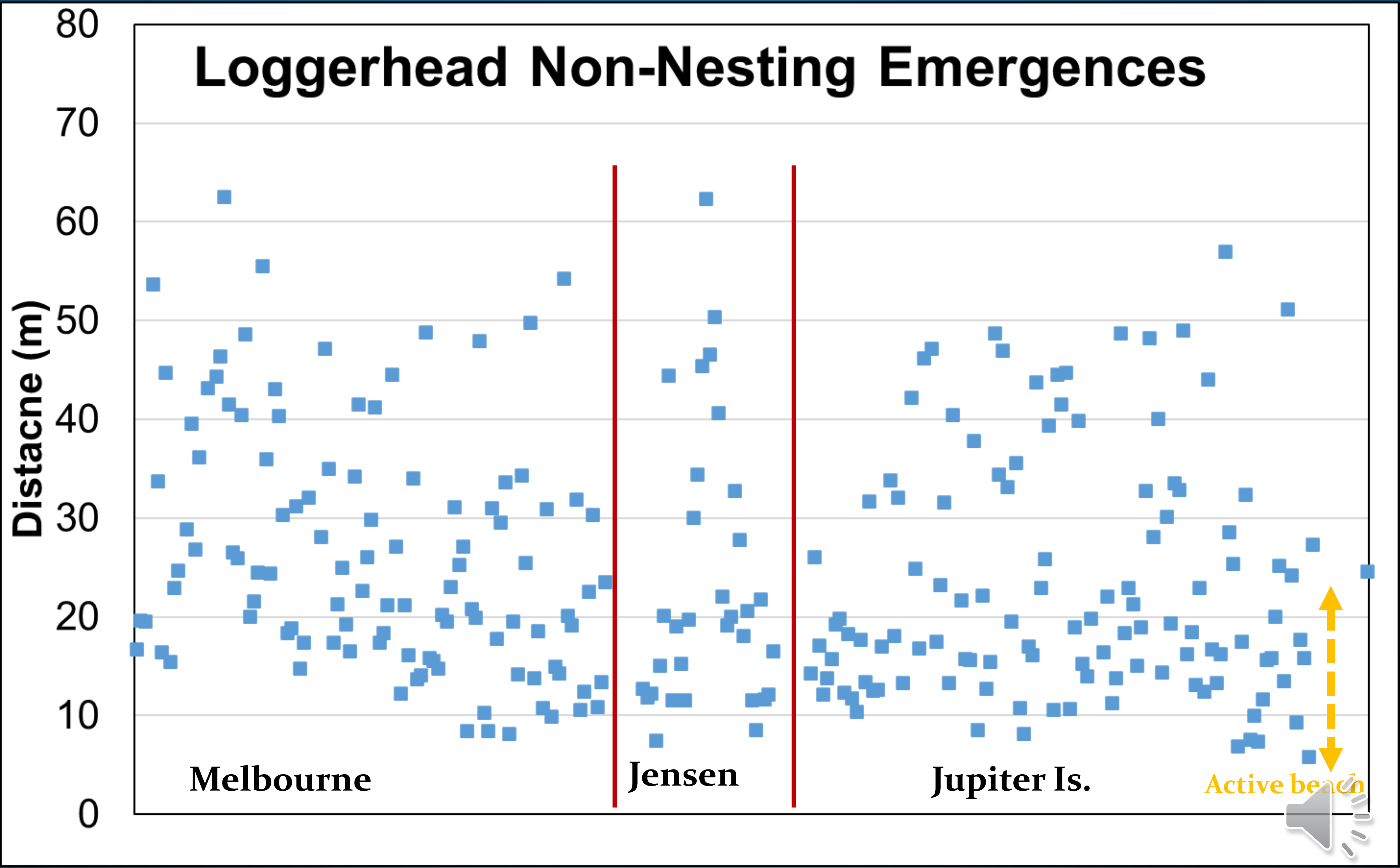
2019

Green Turtle Crawl Type (%) Across Profile



Decision Point to Shoreline Distance

The three beaches seem to show similar patterns



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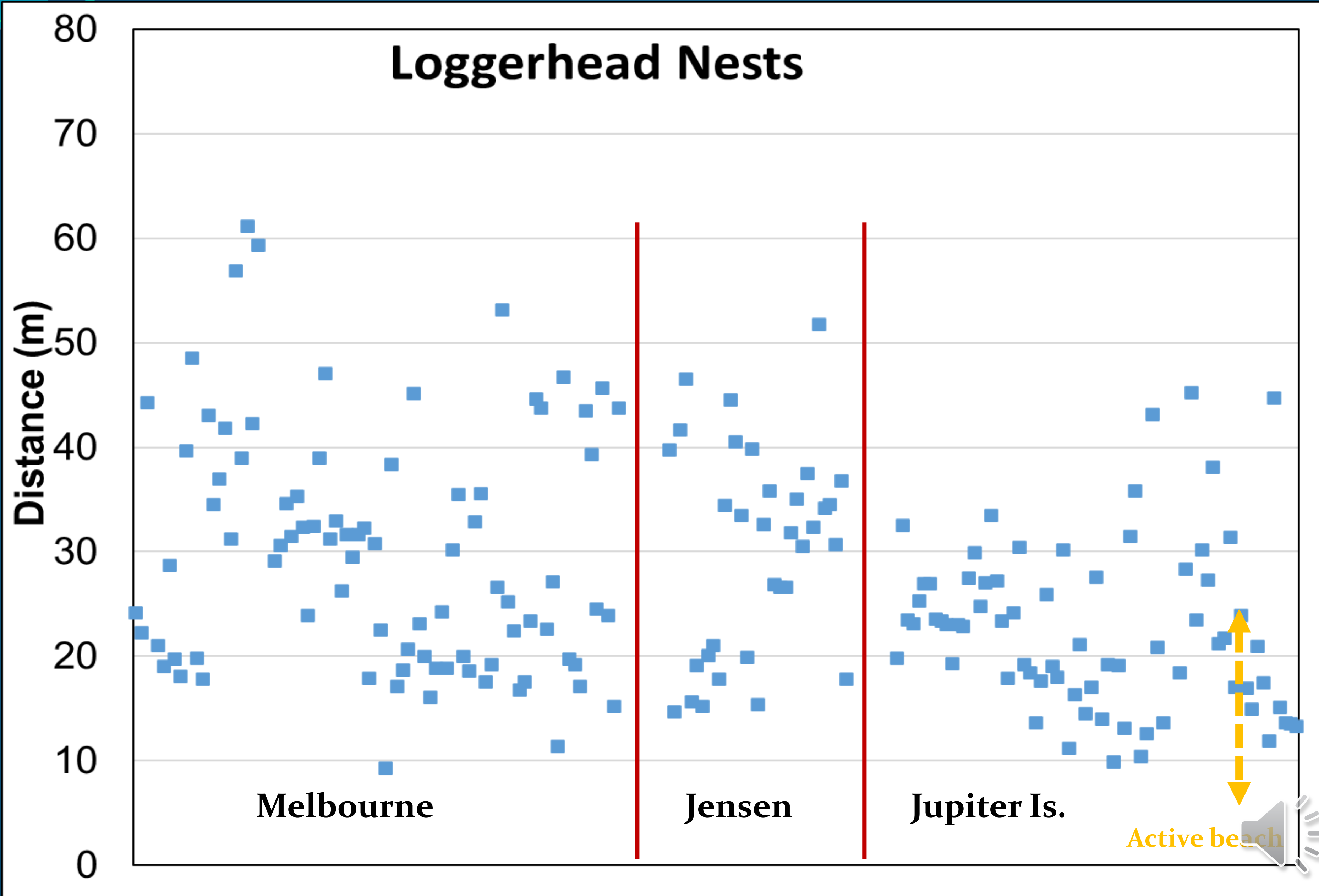
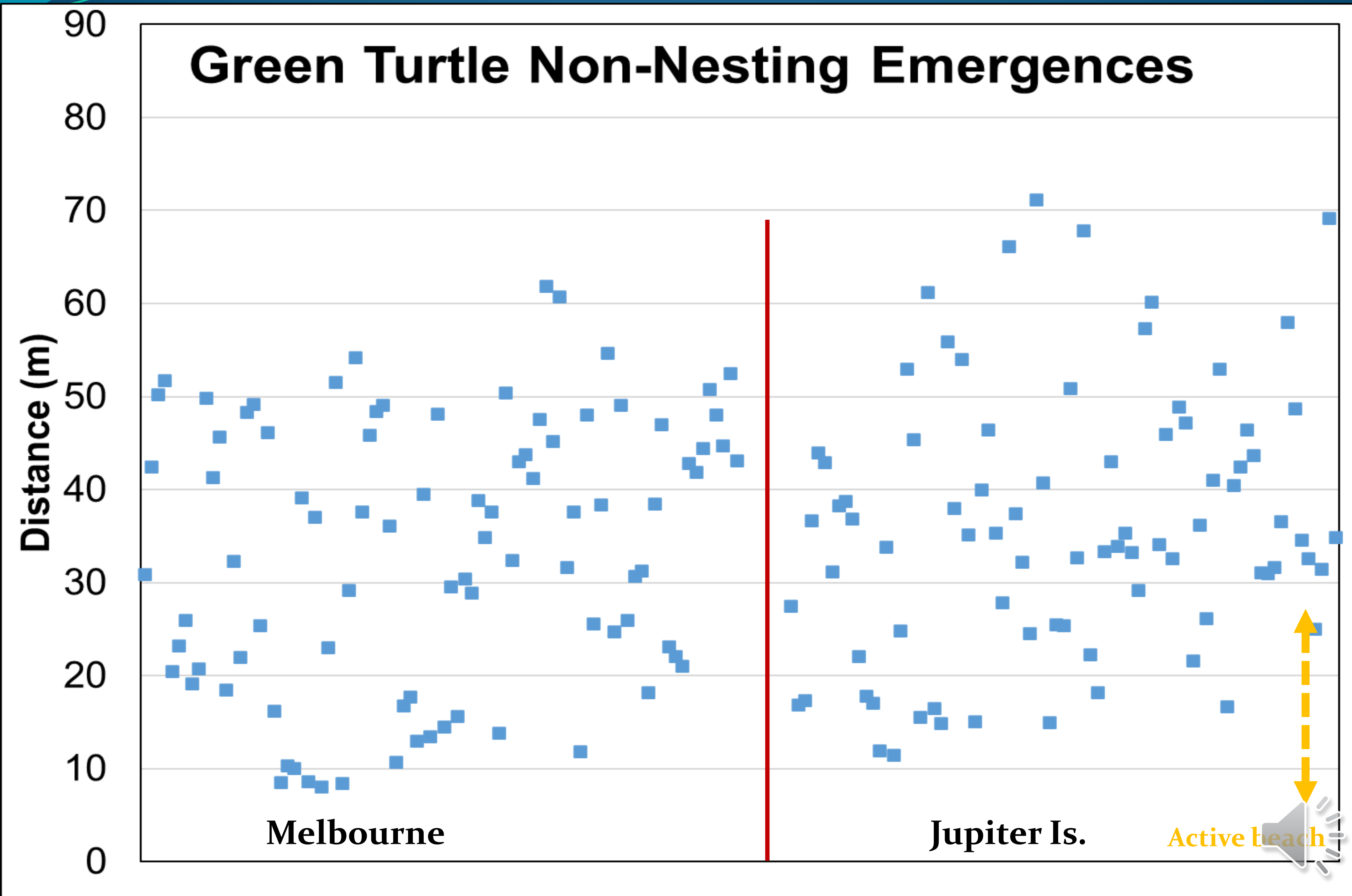
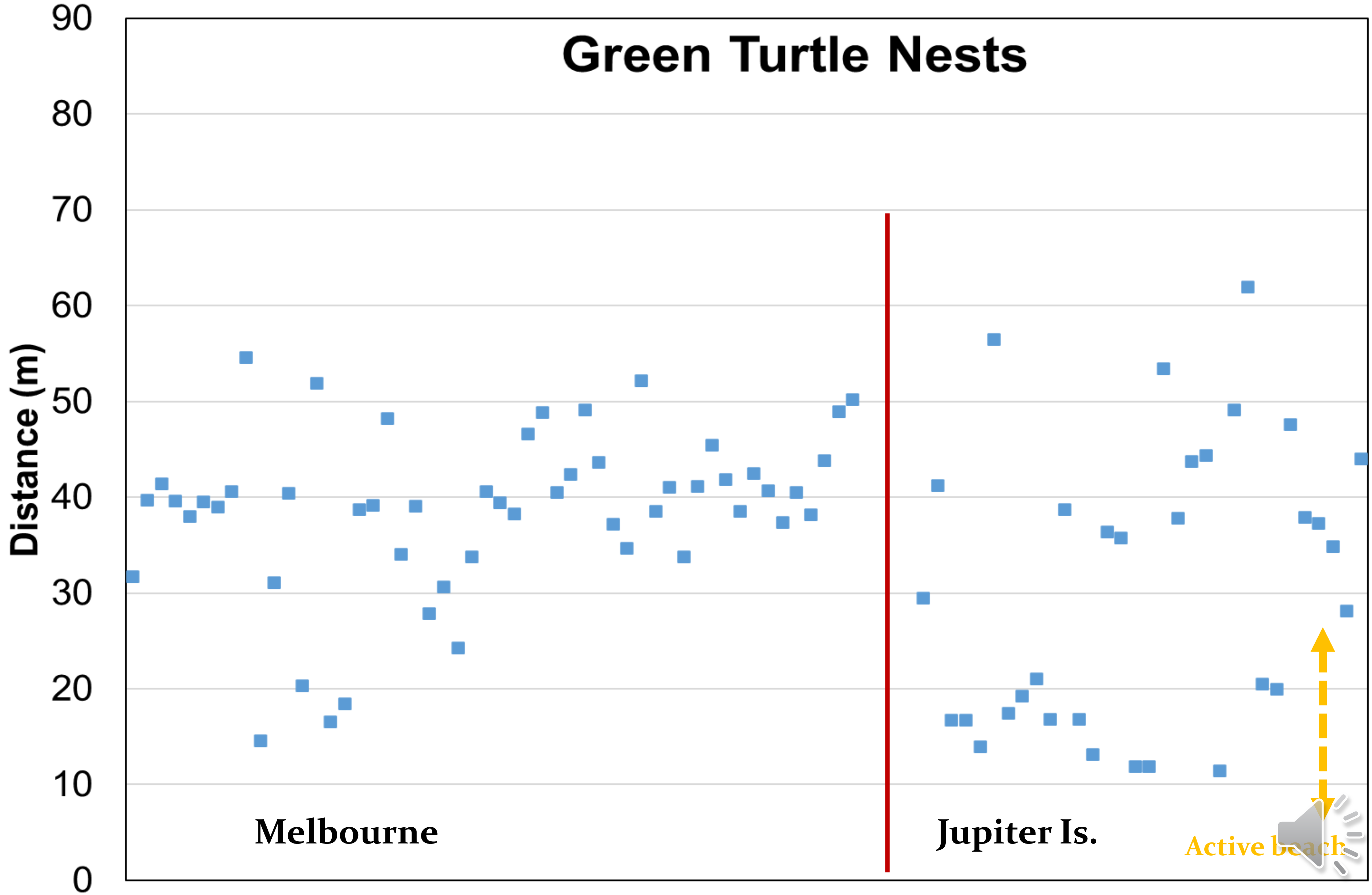


Decision Point to Shoreline Distance

The two beaches seem to show similar patterns

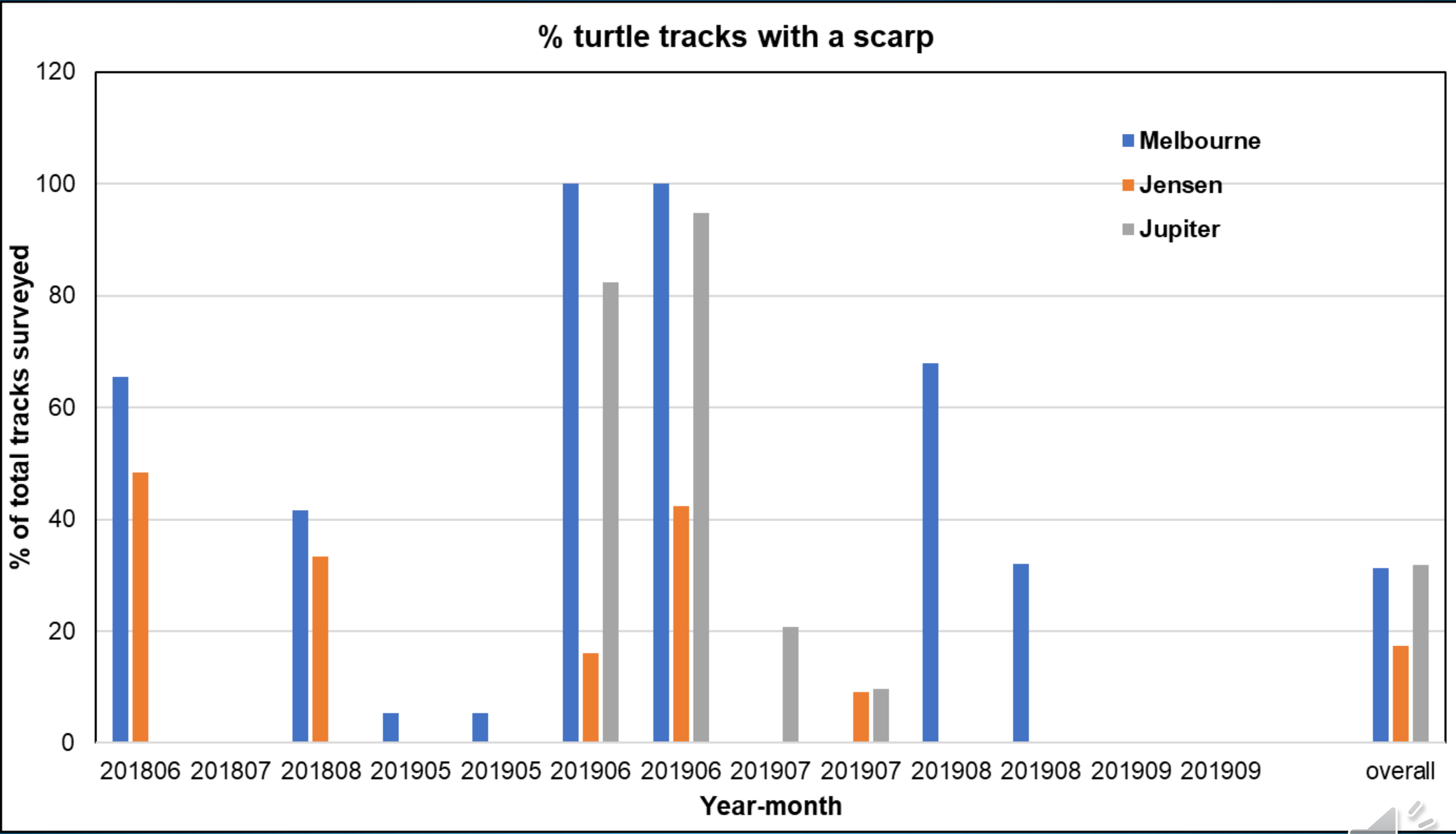


Decision Point to Shoreline Distance



Beach scarping and turtle nesting

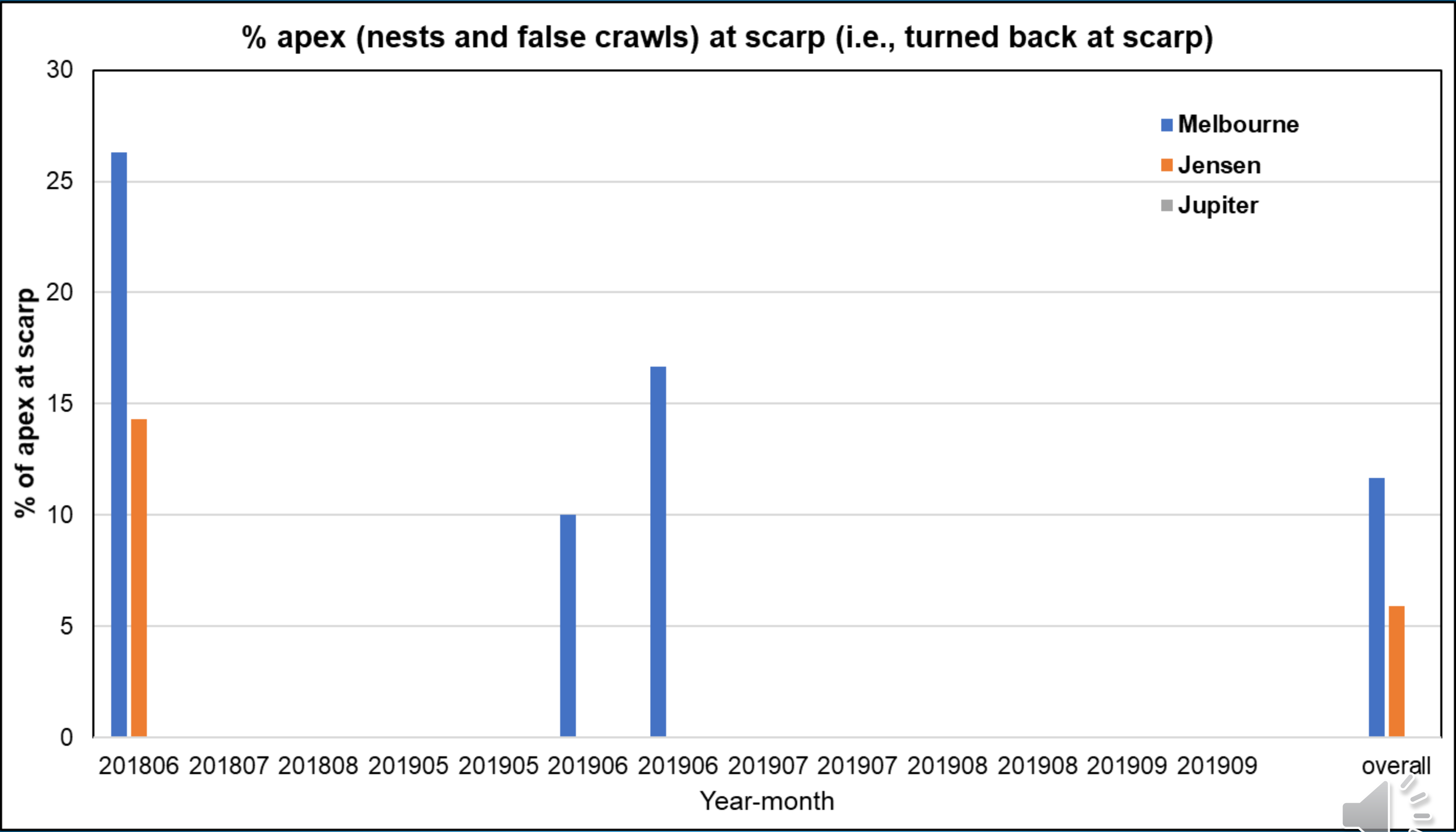
Large temporal and spatial variations.
Jensen Beach with the lowest design berm has the least scarp.



*: defining scarp can be difficult, active and old scarps were not distinguished here

Beach scarping and turtle nesting

No turtle turned around at the scarp on Jupiter Beach, all went over the scarp.



Progressive Findings:

1) Most of the sea turtle decision points ranged from 10 to 60 m from the shoreline at the three studied beaches. On average, Green Turtle decision point was at ~35 m from shoreline, while Loggerhead Turtle at ~26 m from shoreline.
2) The elevation of Green Turtle decision point, averaging ~2.8 m above MSL, tends to be higher than that of Loggerhead turtles, averaging ~2.2 m above MSL.
3) Significant % of the decision points are within the active beach zone that changes on a daily to weekly bases.
4) Two forms of immediate post-nourishment profile adjustment, berm growth and scarp formation, occur in the active zone of turtle nesting.
5) Scarping varied significantly with time, indicating substantial control by hydrodynamic conditions, in addition to beach nourishment design.
6) Based on data collected so far, scarping had minor influence on turtle tracks. Turtles were able to traverse the scarp most of the time.