Manatee Unusual Mortality Event on the Florida Atlantic Coast

Summary of December 2020 – July 2021

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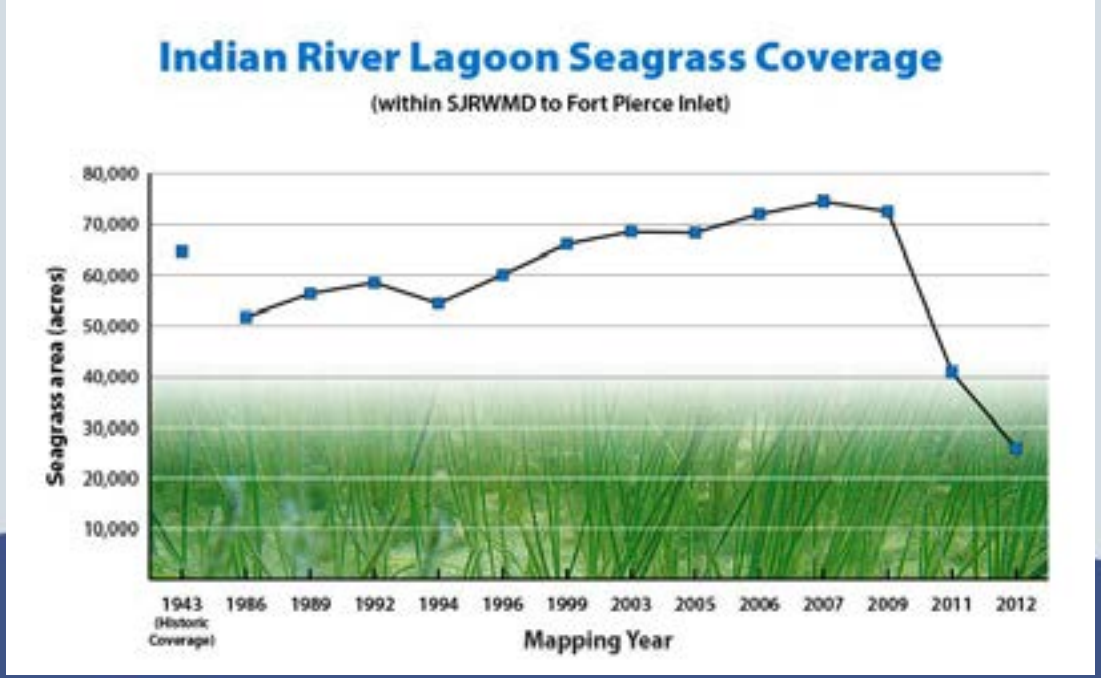
What is an Unusual Mortality Event (UME)

- Under the Marine Mammal Protection Act, a UME is defined as ‘a stranding that is unexpected, involves a significant die-off of any marine mammal population, and demands immediate response’
- NOAA Fisheries established the Working Group on Marine Mammal Unusual Mortality Events (WGMMUME) to determine when an unusual mortality event is occurring based on an assessment from the regional stranding organization
- For manatees, the first trigger we use is more than 7 carcasses and/or rescues in localized area within 72 hours, which is then further investigated by modeling to determine if mortality is above baseline
- Most common cause in manatees is red tide, which are now designated as ‘Repeat Mortality Events’

Algal blooms and seagrass loss in the IRL

- Since 2011, long-term non-toxic phytoplankton blooms in the northern IRL have resulted in reduced water clarity and subsequent reduction of seagrass.



- Consequences of seagrass loss
  - Macroalgal expansion
  - Microbial community shifts due to seagrass decomposition
  - Alteration in food web structure
  - Dietary shift manatees
  - Exposure to new risk factors

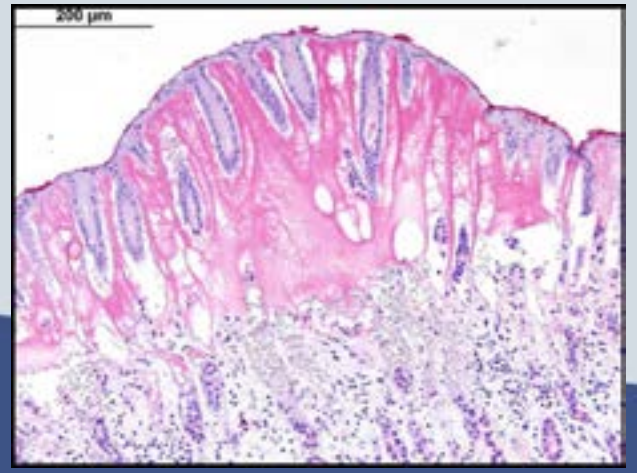
SJRWMD data

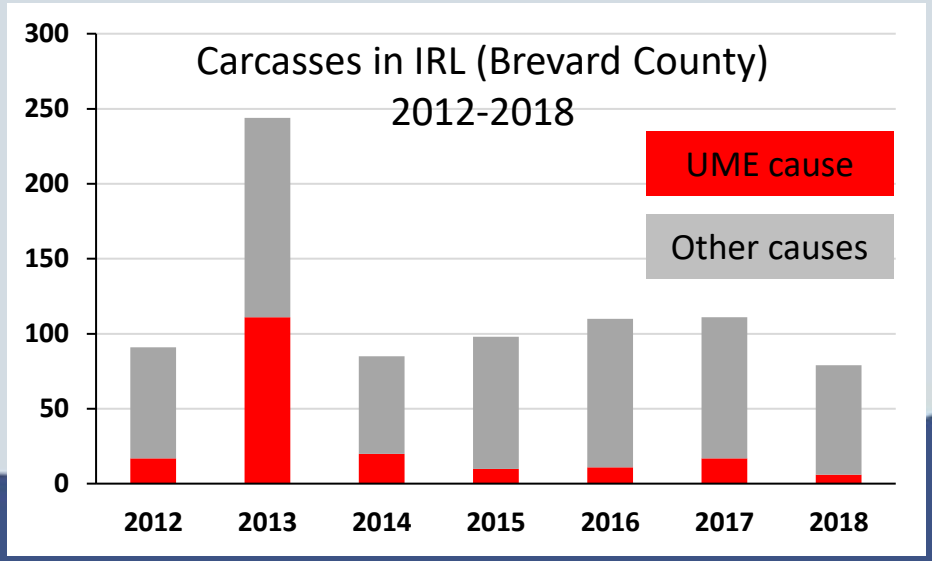
Early indicator of ecological impact on manatees: 2013 UME in the northern IRL

- After the dramatic reduction of seagrass, 2012 marked the onset of a mortality event from undetermined cause
- Gross necropsy findings (*major contrast with 2020-2021 UME*)
  - Carcasses in good body condition
  - Full gastrointestinal tracts, but evidence of diet shift from seagrass to macroalgae
  - Acute death (multi-organ congestion, drowning)

2013 UME in the northern IRL continued

- 199 cases between 2012 and 2019
  - Peak of event was 86 cases in Feb-March 2013
- There was a diet shift to mostly macroalgae but ingested vegetation included numerous species (>15)
- Evidence of dysbiosis
  - Bacterial toxins and virulence factors were identified associated with lesions in the intestine wall
  - Change to macroalgal diet caused compounding dysbiosis or increased the susceptibility to bacterial pathogens
    - Compared with seagrass, macroalgae are low in fiber
    - Adaptation?



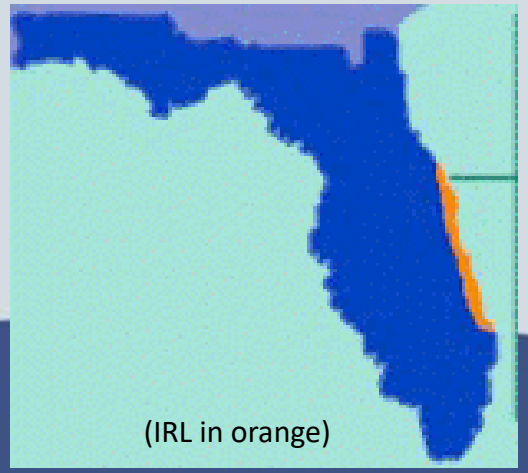


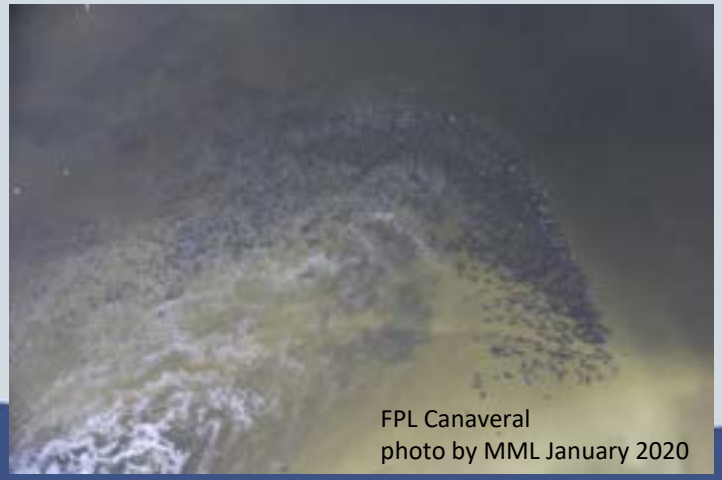
Atlantic Unusual Mortality Event 2020-2021

- Event timeline and spatial progression
- Unusual Mortality Event
- Current status and future considerations

Manatee Atlantic habitat introduction

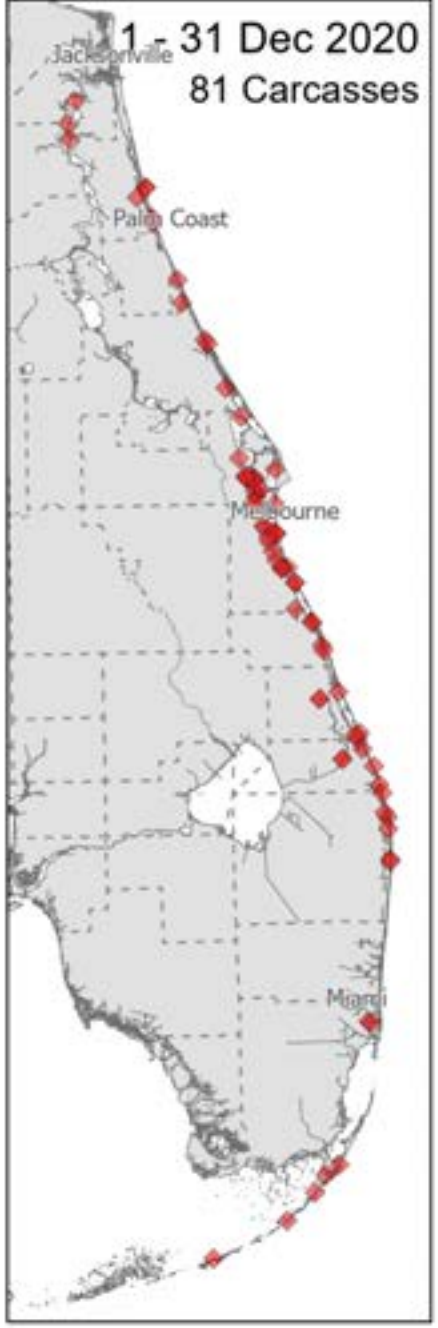
- Manatees migrate seasonally, and can cover large distances on the Atlantic coast
  - Summer range as far north as Virginia (even rare reports in Massachusetts)
  - Seasonal movement patterns are largely driven by changes in temperature
  - The Indian River Lagoon (IRL) has been a central hub for Atlantic coast manatees in all seasons
    - In peak time of spring, the IRL has supported up to 70% of the east coast population
    - 2016: East coast population was estimated at 4,000 manatees (95% CRI, 3,240-4,910)
- Manatees are herbivores and on average may eat about 7% of bodyweight per day


(IRL in orange)


FPL Canaveral
photo by MML January 2020

Manatees and cold

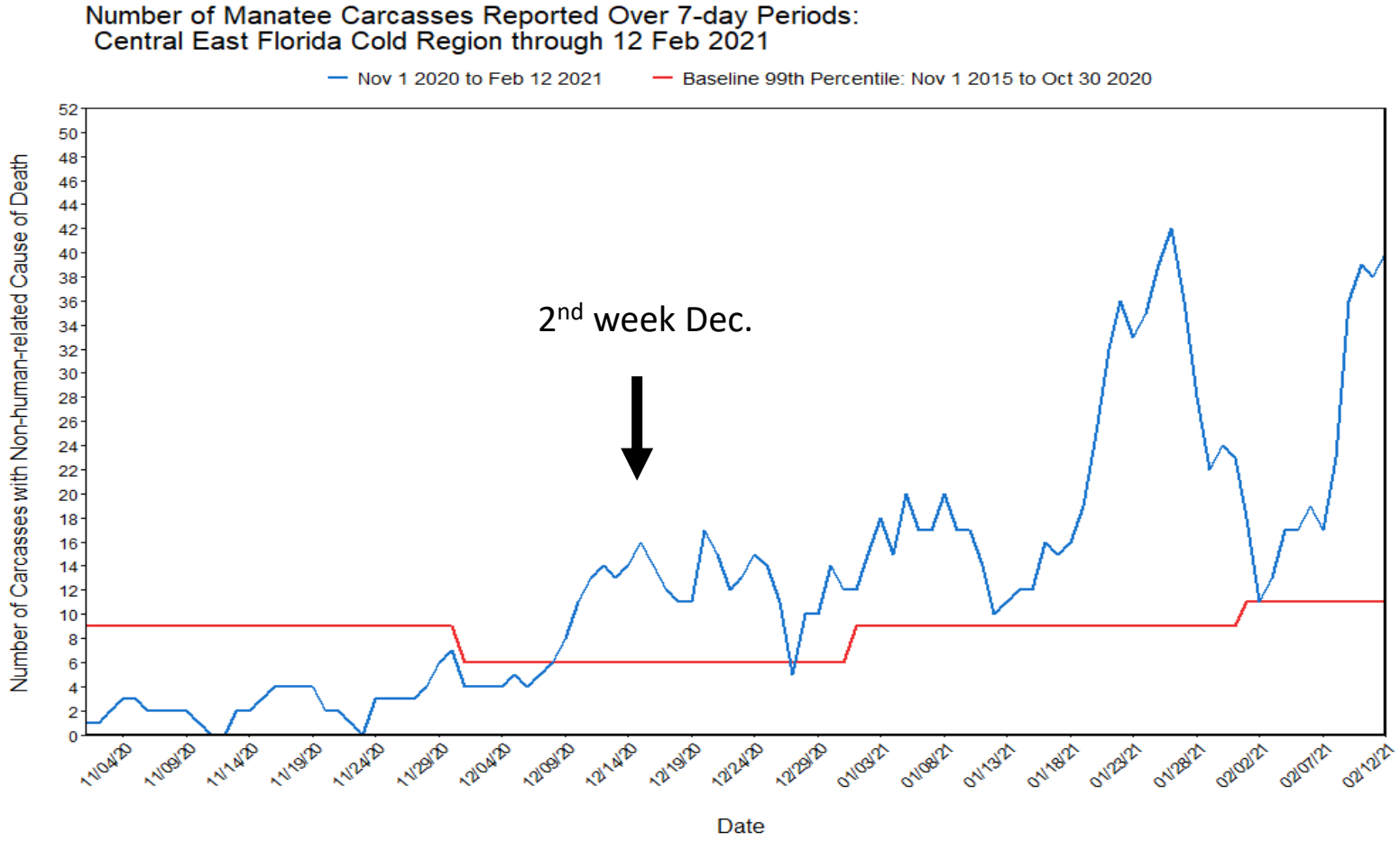
- Poor insulation, low metabolic rate
- Prolonged exposure to temperatures <68°F can lead to cold stress syndrome
  - Complex disease of metabolic and immune system shutdown
- Winter migration to natural springs, warm water discharge from powerplants, thermal basins
  - Strong site fidelity
  - Primary Atlantic warm water habitat sites includes 4 powerplants and 2 passive thermal basins
  - Need for forage nearby to fuel gut/internal furnace



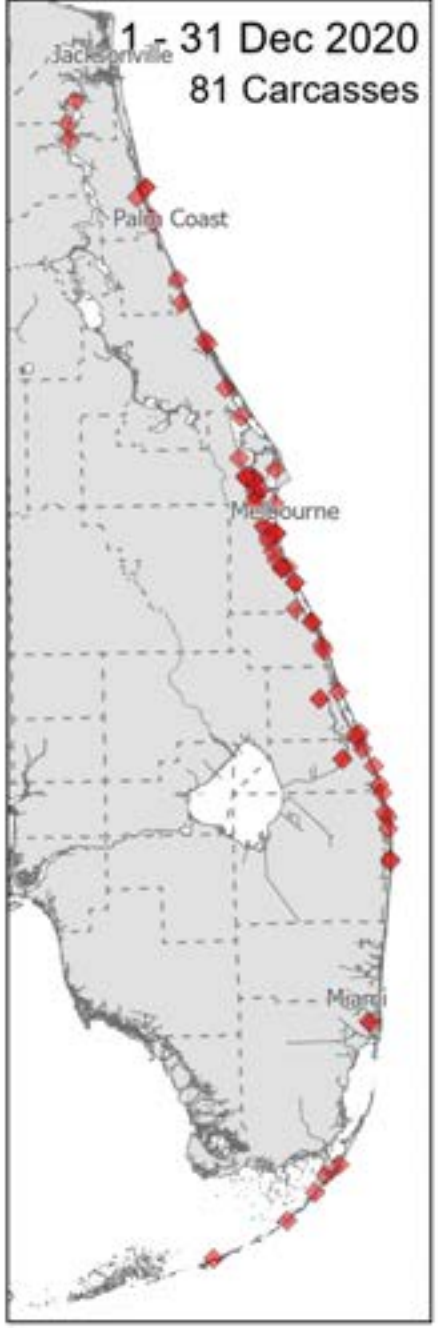
Reported Manatee Carcasses

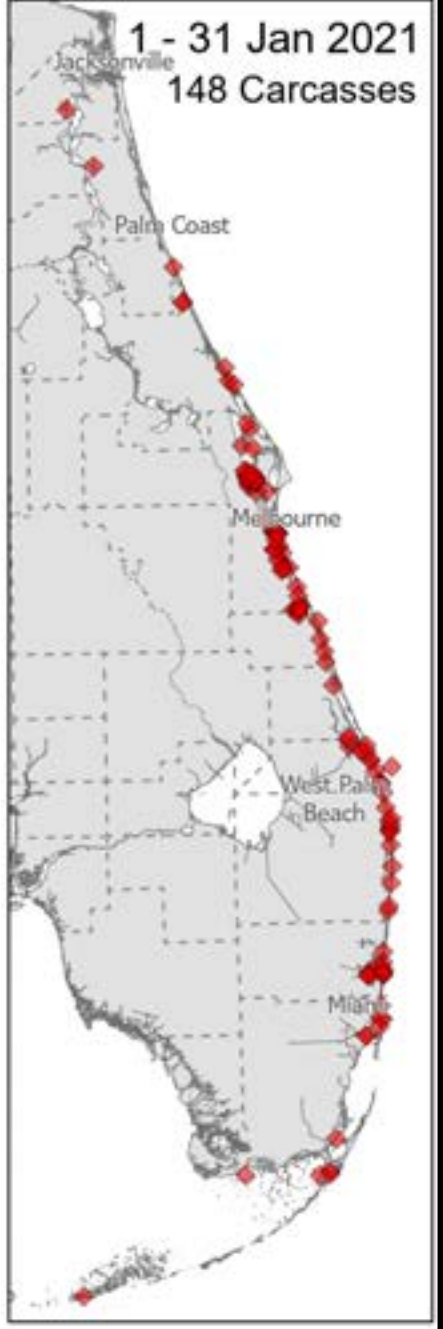
- Early December:

  Carcasses exceeded UME threshold in CE Florida



Base time period excludes .
Analysis includes the following counties: Okeechobee, Martin, St. Lucie, Indian River, and Brevard Counties.
Prepared by A. Krzystan, 16 Feb 2021.



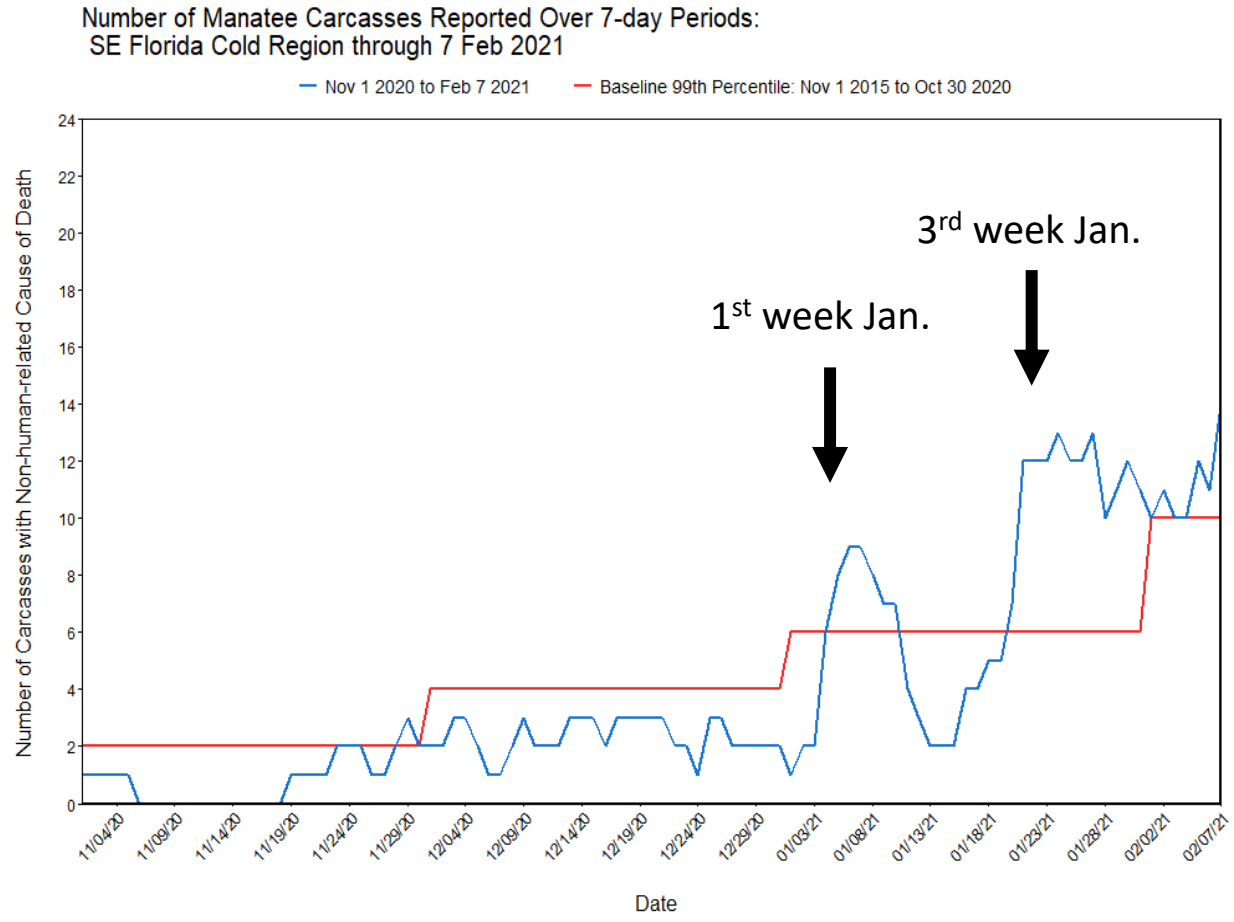


Reported Manatee Carcasses

Preliminary Carcass Location

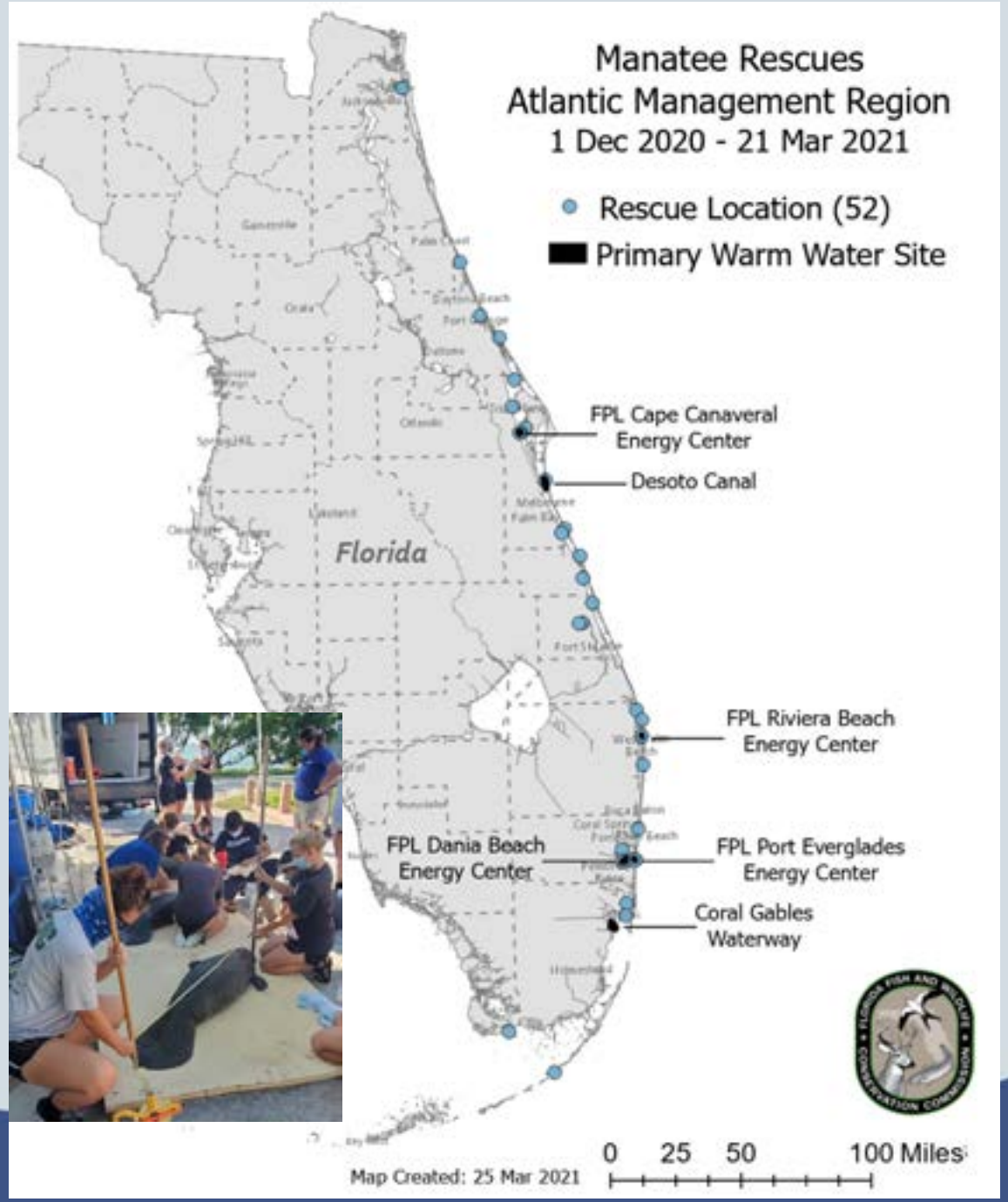
- Early January:

  Carcasses exceeded UME threshold in SE Florida



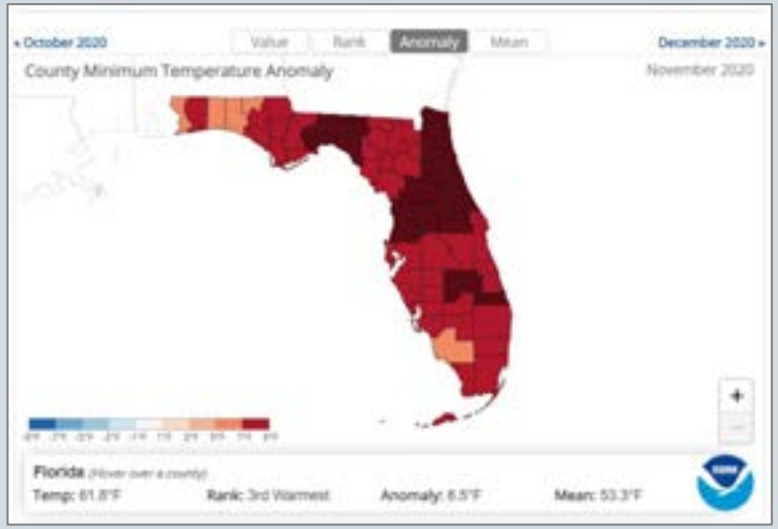
Early event investigation

- Challenges
  - Unprecedented rescue load
  - Working under COVID guidelines
- Subsample of fresh carcasses was prioritized for necropsy
- First evidence for primary starvation determined in carcasses on February 9th
  - Unusually large number of carcasses were adults

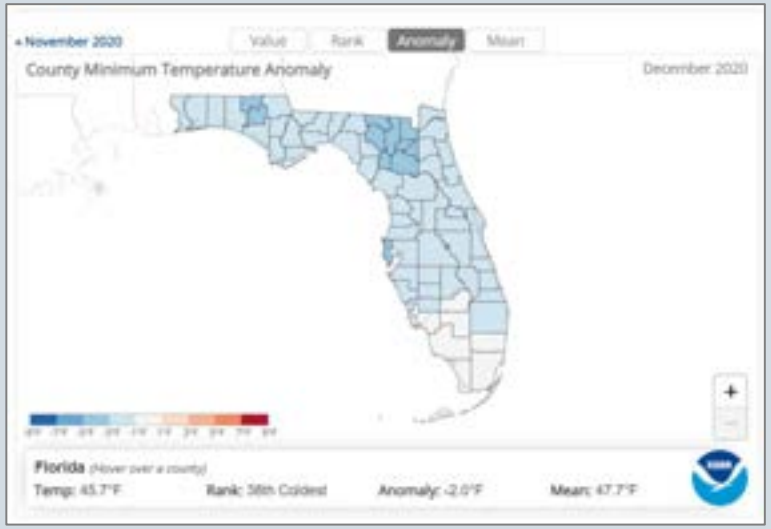


Monthly Anomaly from *Minimum* Air Temperature: 2020-2021

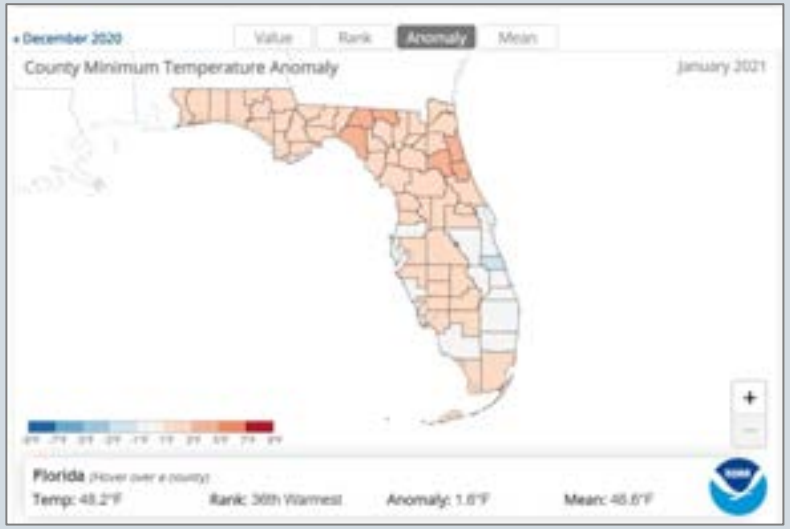
November



December



January



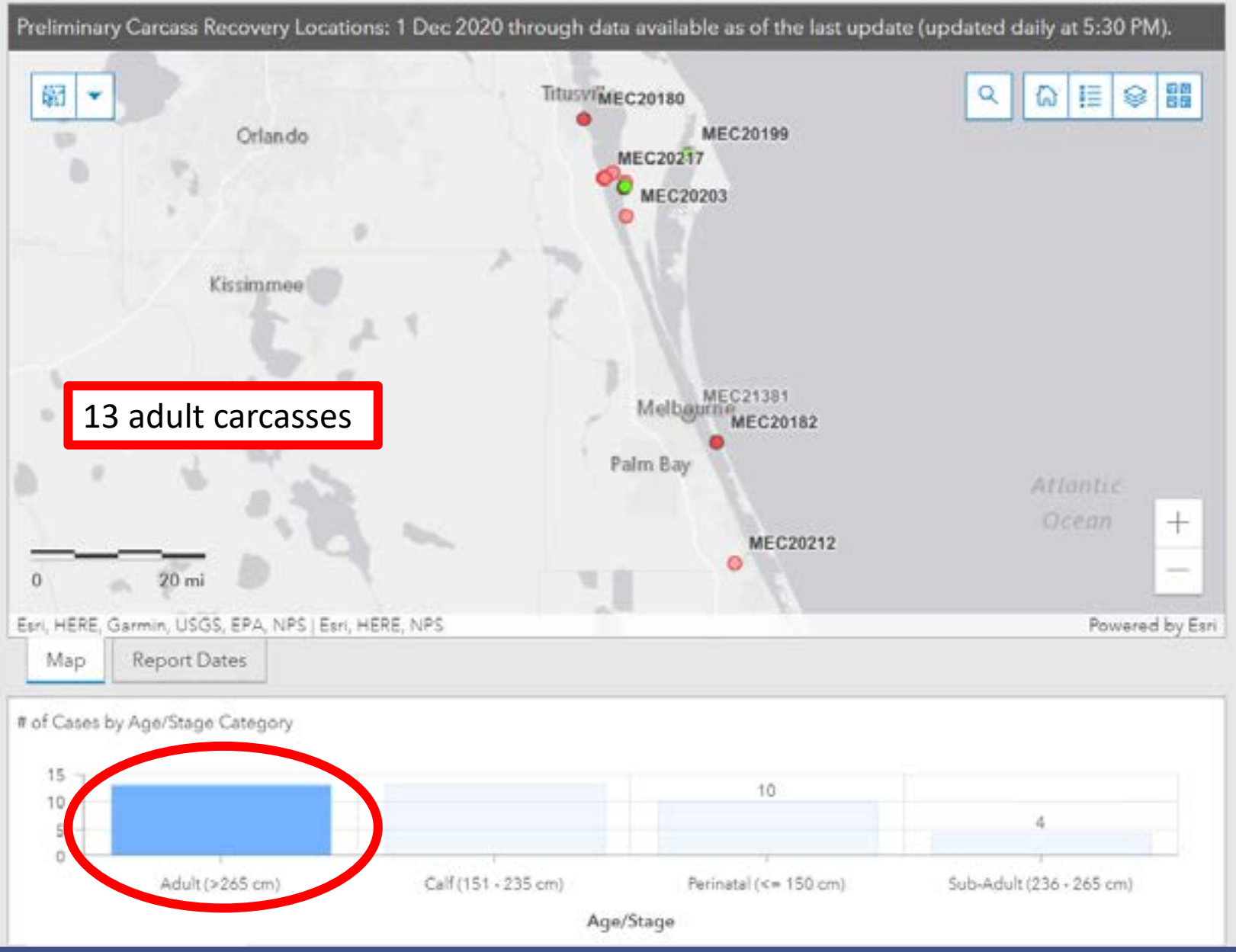
NOAA National Centers for Environmental information

Brevard County:

Year

Year

Adult mortality in Brevard December 2020 (preliminary data – under verification)



Health assessments in Brevard county in January 2019

	CBC1901	CBC1902	CBC1903	CBC1904	CBC1905	CBC1906 mom	CBC1907 calf
Body Condition	3 - normal	3 - normal	3 - normal	3 - normal	3 - normal	3 - normal	3 - normal
Ventrum	flat	flat	flat	flat	flat	flat	round
Ultrasound fat	ok	ok	ok	thin	thin	thin	thin
BCI	thin lowest 10%	normal above 25%	normal low 10-25%	thin lowest 10%	thin lowest 10%	NA	NA
CS exposure	1 - mild	1 - mild	1 - mild	1 - mild	1 - mild	1 - mild	1 - mild
Capture acidosis	significant	significant	significant	significant	mild	significant	significant
Blood SAA	high	normal	high	high	high	normal	high

Photos USGS

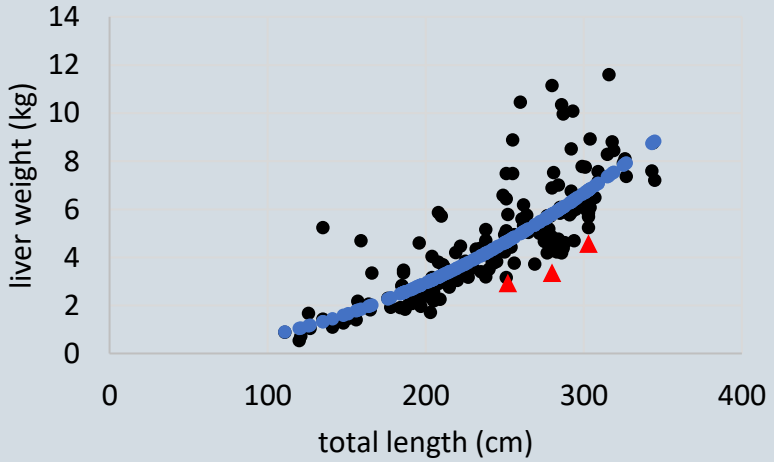

MEC21275

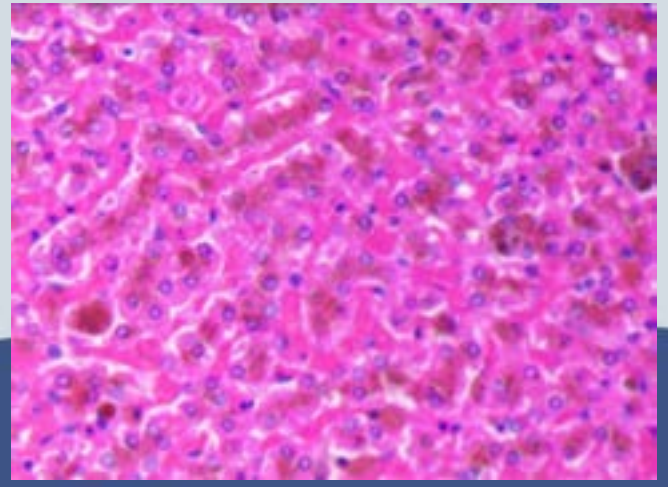

MEC
21015

Carcass and live animal findings consistent with primary starvation

- Severe emaciation
  - Body Condition Indices up to 40% underweight
  - Widespread serous atrophy of muscle, fat
  - Atrophy of liver, heart, hemidiaphragm is remarkable
  - Histopathology of 25 primary starvation cases and 11 ancillary cases
- Blood data of rescued manatees even suggest end-stage starvation
  - More than 40 cases under review

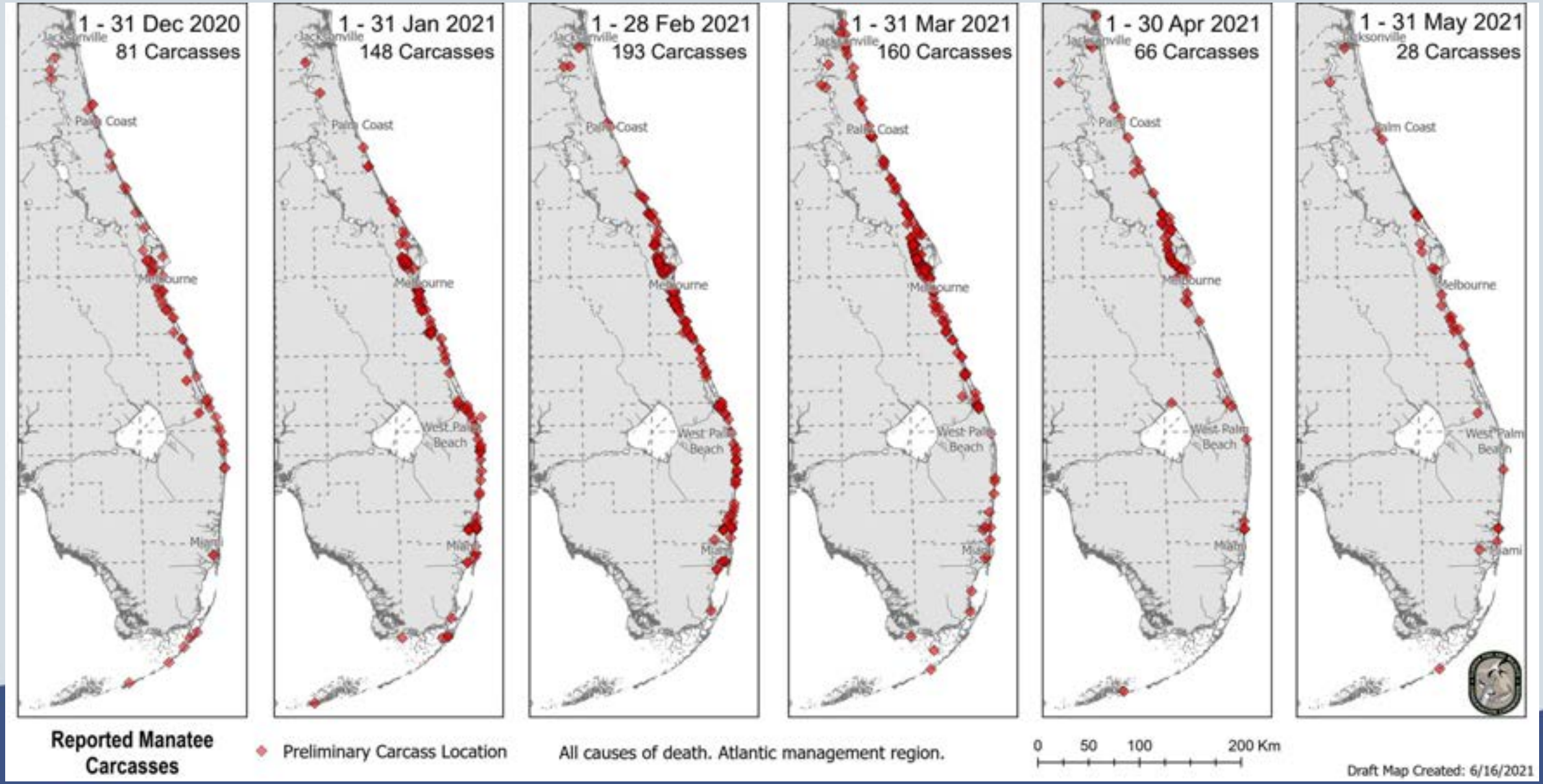
Emaciated calf with presumed mom nearby





L: Liver atrophy
R: Serous atrophy of muscle, fat

Preliminary numbers: **714 carcasses** (all causes of death) and **69 rescues** (all causes) in the Atlantic management unit between 1 December 2020 and 8 August 2021



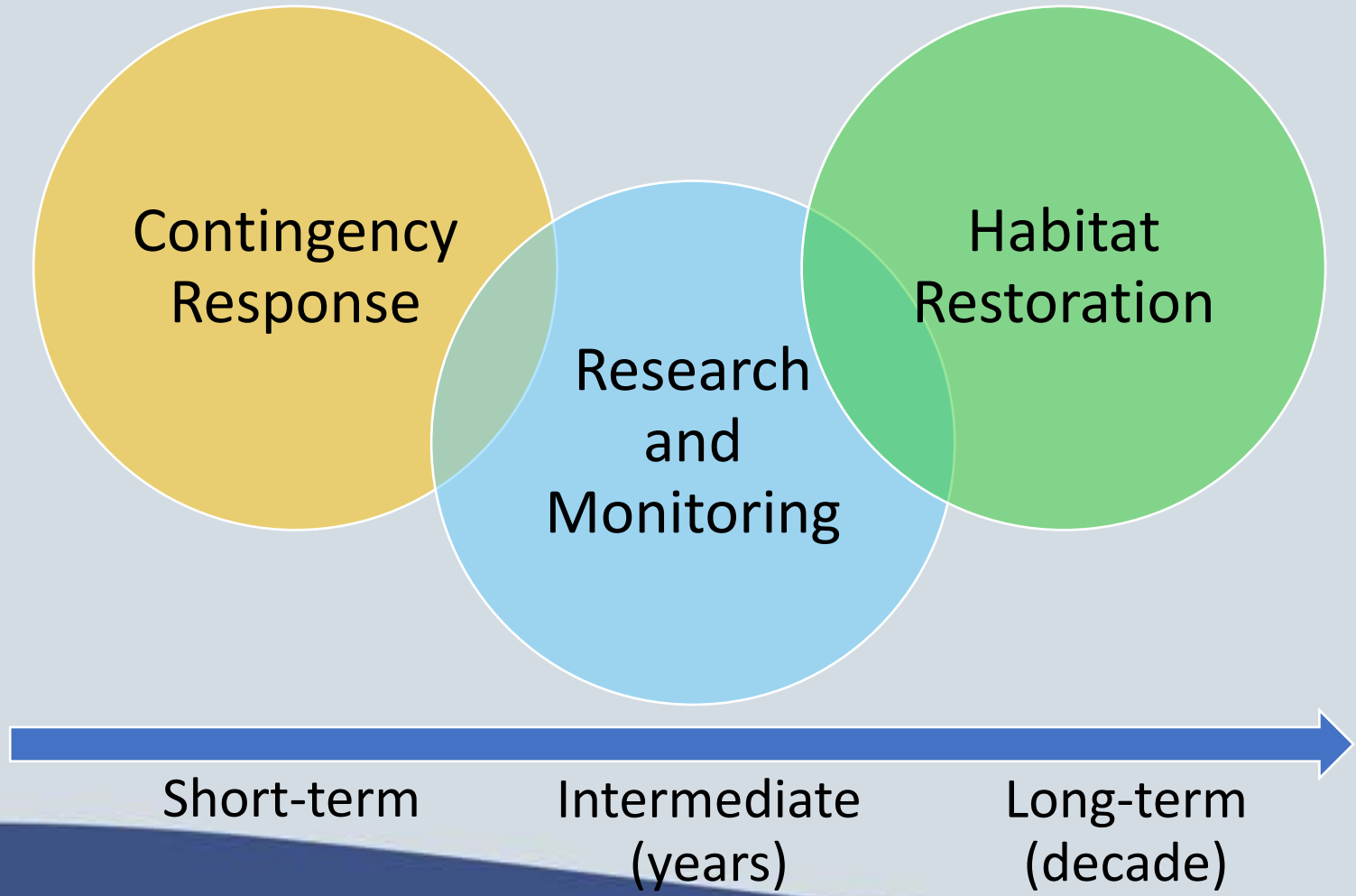
Seasonal aspect to UME

- Did staying warm outweigh hunger?
  - Many carcasses were around warm water (note contrast with cold UMEs)
  - Little cold stress lesions
  - No gut filling = no internal furnace, solely relying on warm water
- Phenomenon of the ‘sideways’ swimmers (previously seen in mostly adult manatees during cold) with lung disease may suggest a lower tolerance for cold
  - Small portion of starvation mortality, more prominent in dataset of rescued manatees
- Once weather warmed, manatees’ range was not restricted by warm water habitat, and they could disperse to other areas with forage
  - Mortality from the effects of starvation was still documented in manatees that had resumed foraging, condition not always reversible

Current status of the UME and future concerns

- Manatees dispersed late February/early March but organ atrophy consistent with effects of starvation was still documented in April despite filled GI tracts
  - Cases were along Atlantic coast as far north as Georgia
- By May, Atlantic coast mortality returned to normal numbers
  - Watercraft-related mortality is again leading among known causes of death
- An aerial survey of the northern IRL reported 755 live manatees (preliminary number) the end of June
- Manatees rescued with signs of starvation took at least several months to recover at rehabilitation facilities
  - Some have been released at this time, others continue to recover in managed care (orphaned calves need several years before release)
- Concern for long-lasting health effects on reproduction, metabolism (current population and next generation)

Spheres of Research and Management Activity related to the Atlantic Coast Manatee Mortality Event




FLORIDA
THK YOU
Save the Manatee