Head Above Water: Stranding of Bottlenose Dolphins Along the East Coast

Gage Gruett, Charlie Ratterree, Jay Papamichail, Markens Desir
rdvarks | Duke University | STA 199 | Fall 2026

Motivation

Why East Coast Bottlenose Dolphins?

- Model System for **Human Health Research** (Quirós et al., 2024)
- Vital **sentinels for ocean health** and marine ecosystem homeostasis (Wells et al., 2004)
- Vital **sentinels for human health** concerns (e.g., bioaccumulation) (Reif et al., 2015)
- Play a crucial role as **apex predators** of their food chain (Reif et al., 2015)

Introducing The Data

Source:
The data comes from NOAA Fisheries' National Marine Mammal Stranding Database and covers bottlenose dolphin strandings from 2017–2019.

Dataset:
- 2,647 rows and 69 columns
- Collected by trained volunteers and marine wildlife organizations

Variables Analyzed:
- Number of strandings
- Date of observation
- Age group
- Types of human interaction
- Evidence of human interaction
- State where stranding occurred

What Is a Stranding?
A stranding occurs when a dolphin washes ashore, becomes trapped in shallow water, or is found dead along the coast or floating in the water.

Research Question:

What factors contributed to east coast bottlenose dolphin strandings from the years 2017 to 2019?

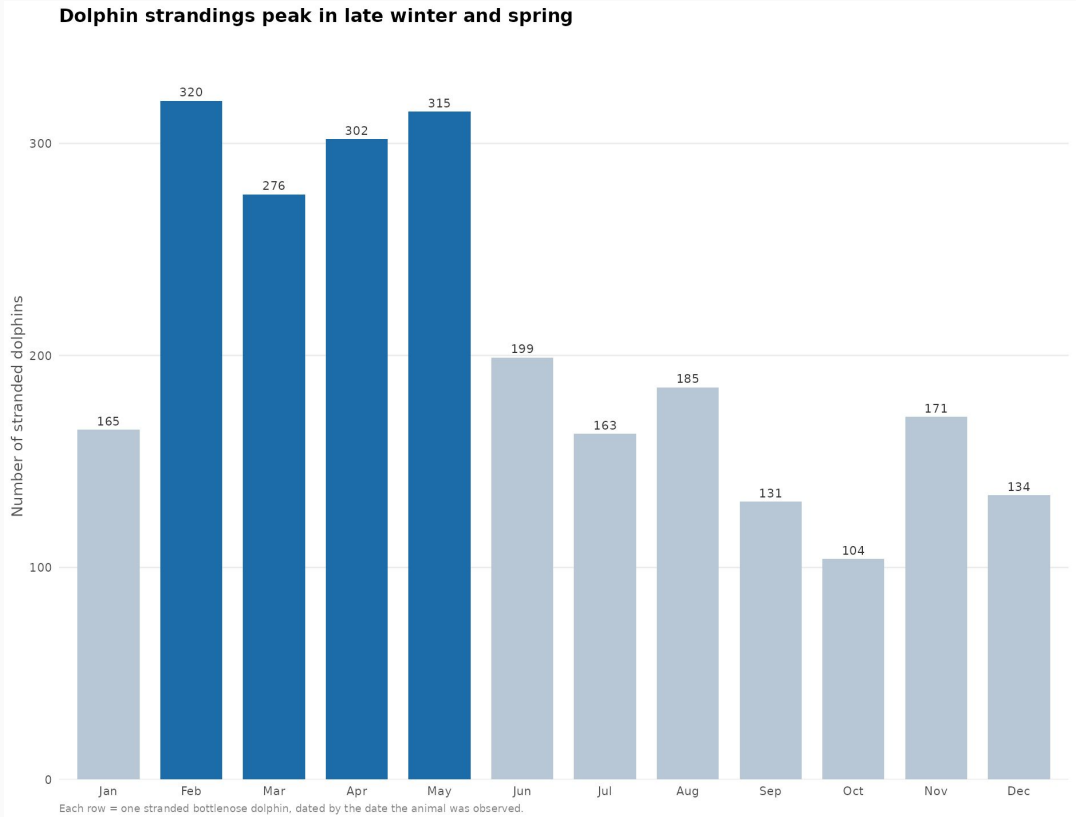
Subtopics:

From 2017 to 2019, what times of the year were dolphins stranded most?

How are age range and type of human interaction associated with dolphin strandings?

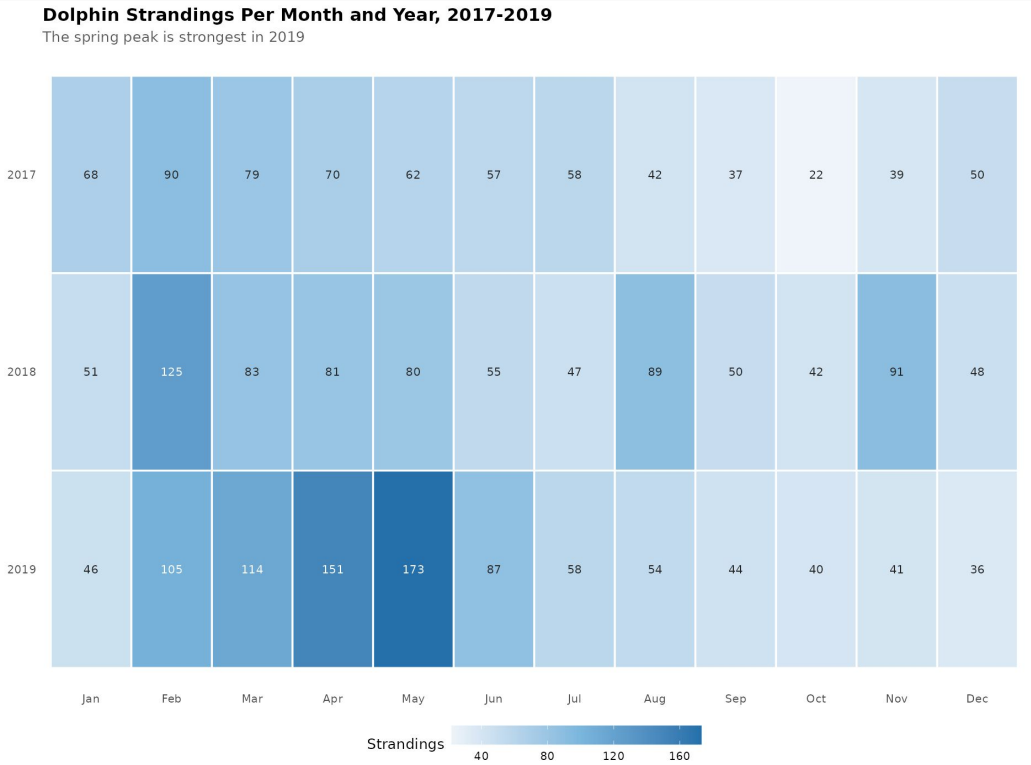
How does the number of dolphin strandings vary by state?

EDA 1 - Condition at stranding over a typical year



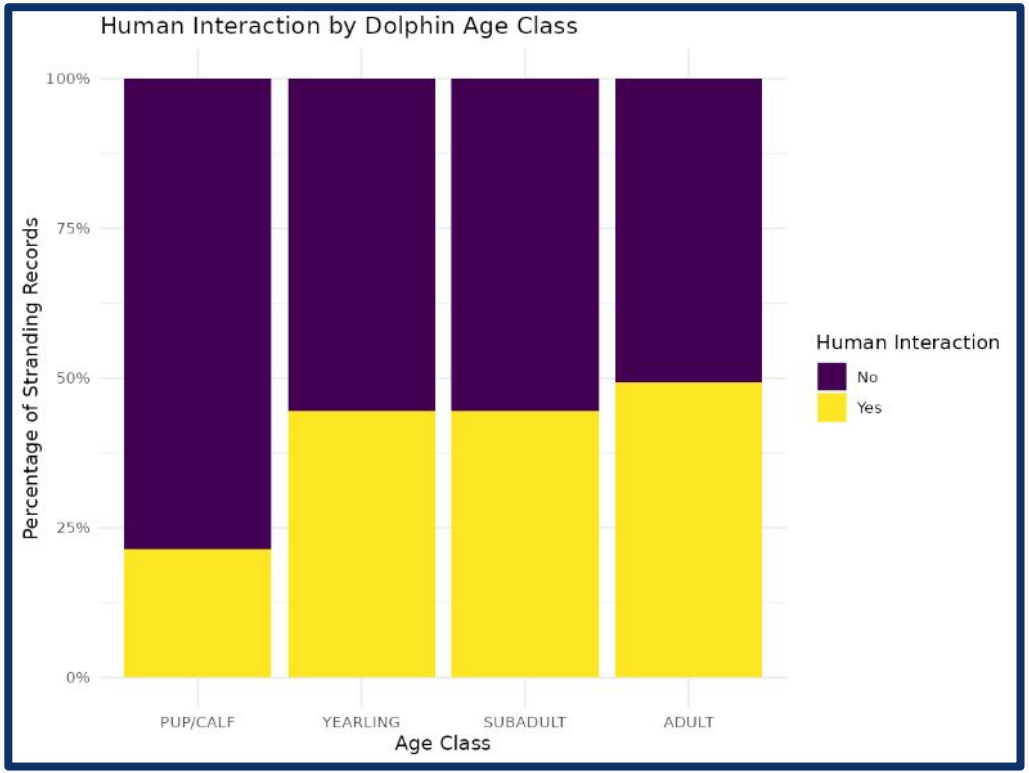
- Feb–May accounts for 1,213 strandings, about 49% of the total
- Feb–May is when response teams and necropsy capacity are stretched most, so surge staffing and funding should be timed to it.

EDA 1 - Peaks from 2017-2019



- In 2018, August and November stand out. That is consistent with the 2018 red tide.
- The 2018 and 2019 spikes show that single events can matter as much as the season. Surveillance should be able to trigger an early alert when counts jump above the usual monthly range.

EDA 2 - Age & Human Interaction



Note: Pup/calf (0-1 year), yearling (1-2 years), subadult (immature), and adult (sexually mature); age ranges are approximate and may vary by population.

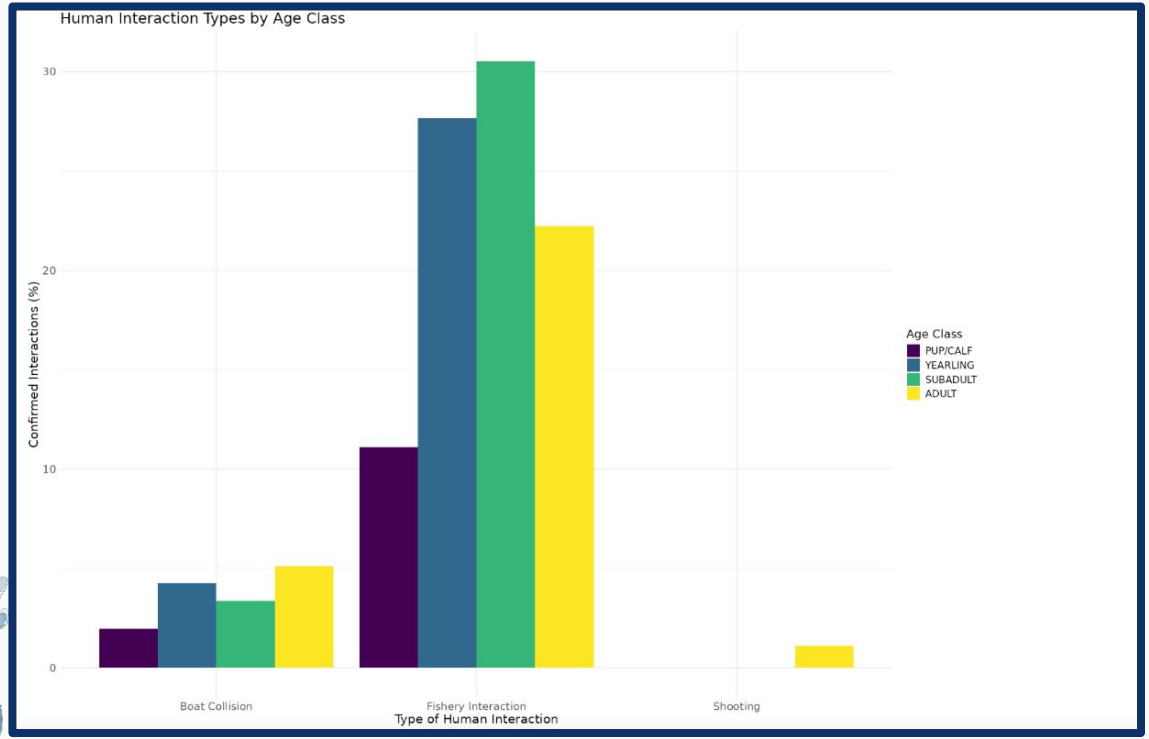
Key Takeaway:

- The proportion of stranded dolphins with documented human interaction generally increases with age class (pups/calves → adults)

Conservation Implication:

- Investigate whether older dolphins truly face greater exposure to human interaction
- Focus on age-specificity across different conservation strategies

EDA 2 - Types of Human Interactions & Age Class



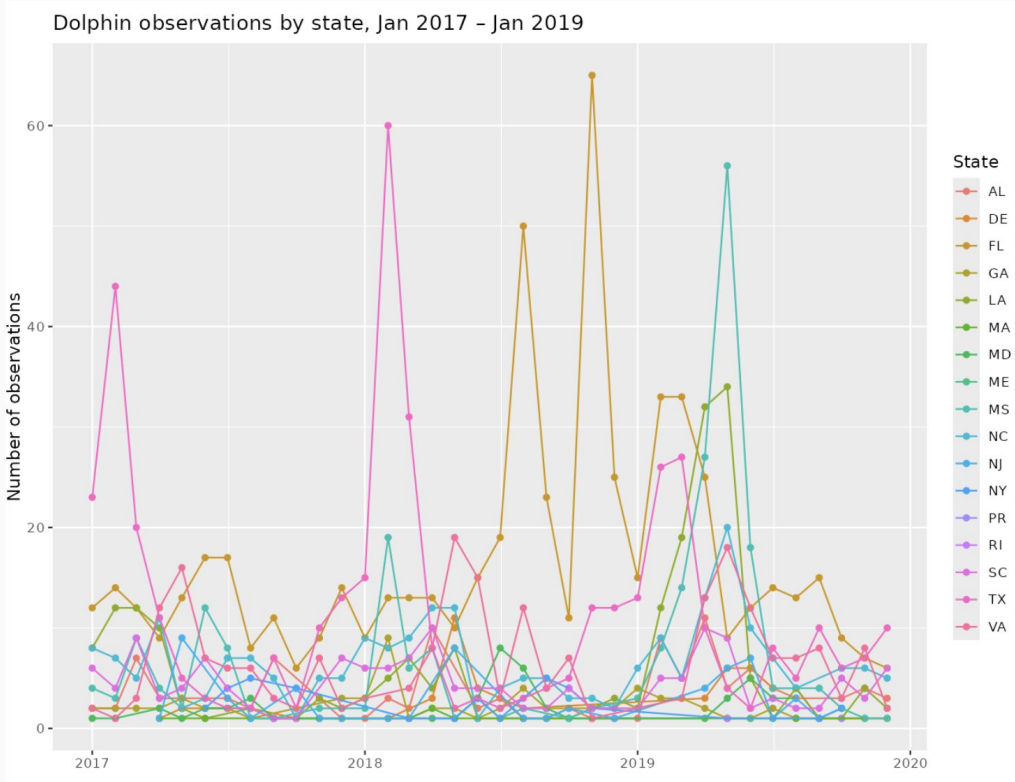
Key Takeaway:

- Fishery interactions are the most document interaction type across all age classes
- Subadults and yearlings show greater proportions of fishery interactions than adults & pups
- Boat collisions and shootings are relatively uncommon

Conservation Implications:

- Prioritize fishing-related hazards and policies to reduce harm
- Need more age-specific research for conservation efforts

EDA 3 - Charlie: Regional Rankings



How does the number of dolphin strandings vary by state?

EDA 3 - Charlie: Regional Rankings

```
# A tibble: 7 × 2
  state     n
  <chr> <int>
1 FL      142
2 TX      142
3 VA       67
4 NC       66
5 LA       54
6 MS       48
7 SC       48
```

```
# A tibble: 7 × 2
  state     n
  <chr> <int>
1 FL      266
2 TX      157
3 VA       76
4 NC       73
5 SC       53
6 MS       45
7 LA       34
```

```
# A tibble: 7 × 2
  state     n
  <chr> <int>
1 FL      191
2 MS      142
3 TX      128
4 LA      117
5 NC       91
6 VA       81
7 SC       54
```

Key Takeaways:

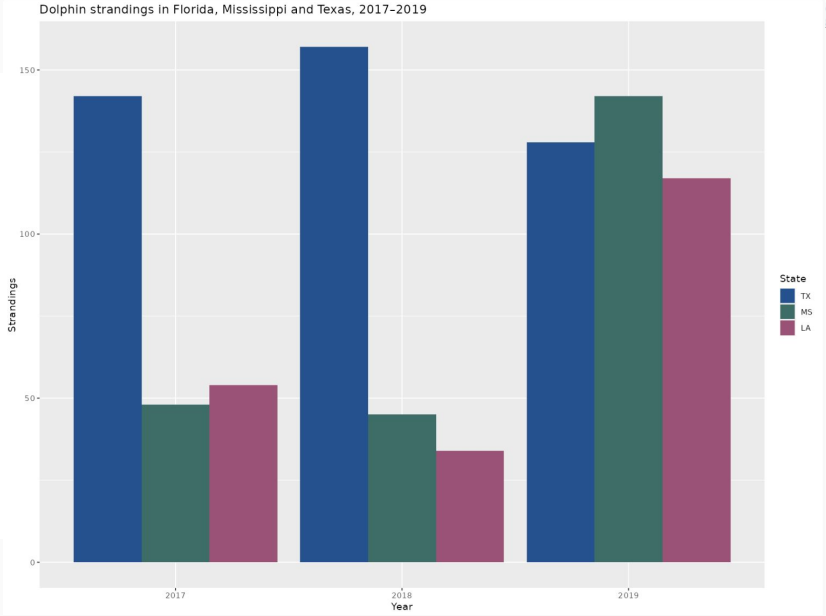
- Florida ranked highest in dolphin strandings across all three years
- FL, TX, VA, NC, LA, MS, and SC all consistently rank within the top 7
- MS and LA have unusually high strandings in year 2019

EDA 3 - Charlie: Critique/Limitation

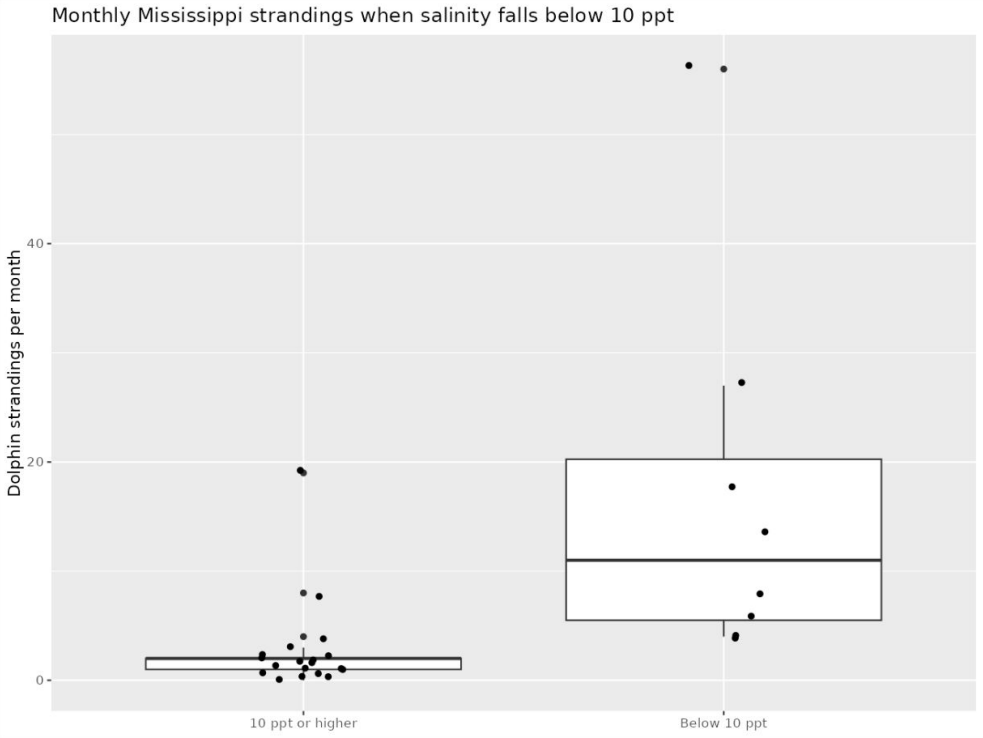
```
# A tibble: 7 × 2
  state     n
  <chr> <int>
1 FL      142
2 TX      142
3 VA       67
4 NC       66
5 LA       54
6 MS       48
7 SC       48
```

```
# A tibble: 7 × 2
  state     n
  <chr> <int>
1 FL      266
2 TX      157
3 VA       76
4 NC       73
5 SC       53
6 MS       45
7 LA       34
```

```
# A tibble: 7 × 2
  state     n
  <chr> <int>
1 FL      191
2 MS      142
3 TX      128
4 LA      117
5 NC       91
6 VA       81
7 SC       54
```



EDA 3 - Charlie: Critique/Limitation



Method:

- Joined daily salinity data from western Mississippi Sound USGS monitoring station with NOAA stranding data
- Compared MS strandings when salinity was below vs. above 10 ppt, the level NOAA cites as harmful to dolphins
- Months below 10 ppt averaged about six times more strandings (17.1 vs. 2.7)

Conservation Implications:

- In 2019, the ACE was forced to open the Bonnet Carré Spillway to protect New Orleans
- Before reopening the spillway, the ACE should know the dolphin cost
- NOAA should monitor dolphin pop. whenever salinity drops below 10 ppt

Putting It All Together

Conclusion & Discussion

- Conservation efforts should focus on…
  1. February → May
  2. Fisheries
  3. FL, TX, VA, NC, LA, MS, and SC
  4. Bonnet Carré Spillway
  5. Older Dolphins*
- Need further research into age-vulnerability & behavior

Critique & Limitations

- Skewed by natural events
- Missing data & reporting bias
- Limited time span (only 3 years)
- Can’t establish causation…
  1. Not a controlled experiment (many confounding variables)
  2. Can’t assume human interaction *caused* stranding

AI Citation

- Used to identify the cause of errors in code
- EDA 1 / 2; used for initial hex code color selection and minor plot formatting adjustments
- Used to look up functions

Full AI disclosure will be available on the write-up.

References

Bernaldo de Quirós, Y., Mahoney, S. A., VanDongen, N. S., Greenberg, N. T., Ravinandan Venkatasubramanian, Saavedra, P., Bossart, G., Brunt, V. E., Clayton, Z. S., Fernández, A., & Seals, D. R. (2024). The bottlenose dolphin (tursiops truncatus): A novel model for studying healthy arterial aging. *AJP Heart and Circulatory Physiology*, *327*(3), H660–H665. https://doi.org/10.1152/ajpheart.00464.2024

Fisheries, N. (2021, February 17). *National stranding database public access | NOAA fisheries*. NOAA. https://www.fisheries.noaa.gov/national/marine-life-distress/national-stranding-database-public-access

Reif, J. S., Schaefer, A. M., & Bossart, G. D. (2015). Atlantic bottlenose dolphins (tursiops truncatus) as a sentinel for exposure to mercury in humans: Closing the loop. *Veterinary Sciences*, *2*(4), 407–422. PubMed. https://doi.org/10.3390/vetsci2040407

U.S. Geological Survey. "Mississippi Sound near Grand Pass, LA – USGS-300722089150100: Daily Mean Salinity." USGS Water Data for the Nation, 2025, waterdata.usgs.gov/monitoring-location/USGS-300722089150100. Accessed Nov 1.

Wells, R., Rhinehart, H., Hansen, L., Sweeney, J., Townsend, F., Stone, R., Casper, D., Scott, M., Hohn, A., & Rowles, T. (2004). Bottlenose Dolphins as marine ecosystem sentinels: Developing A health monitoring system. *EcoHealth*, *1*(3). https://doi.org/10.1007/s10393-004-0094-6