N.C. Red Drum Satellite Tagging

DEPARTMENT OF ENVIRONMENTAL QUALITY

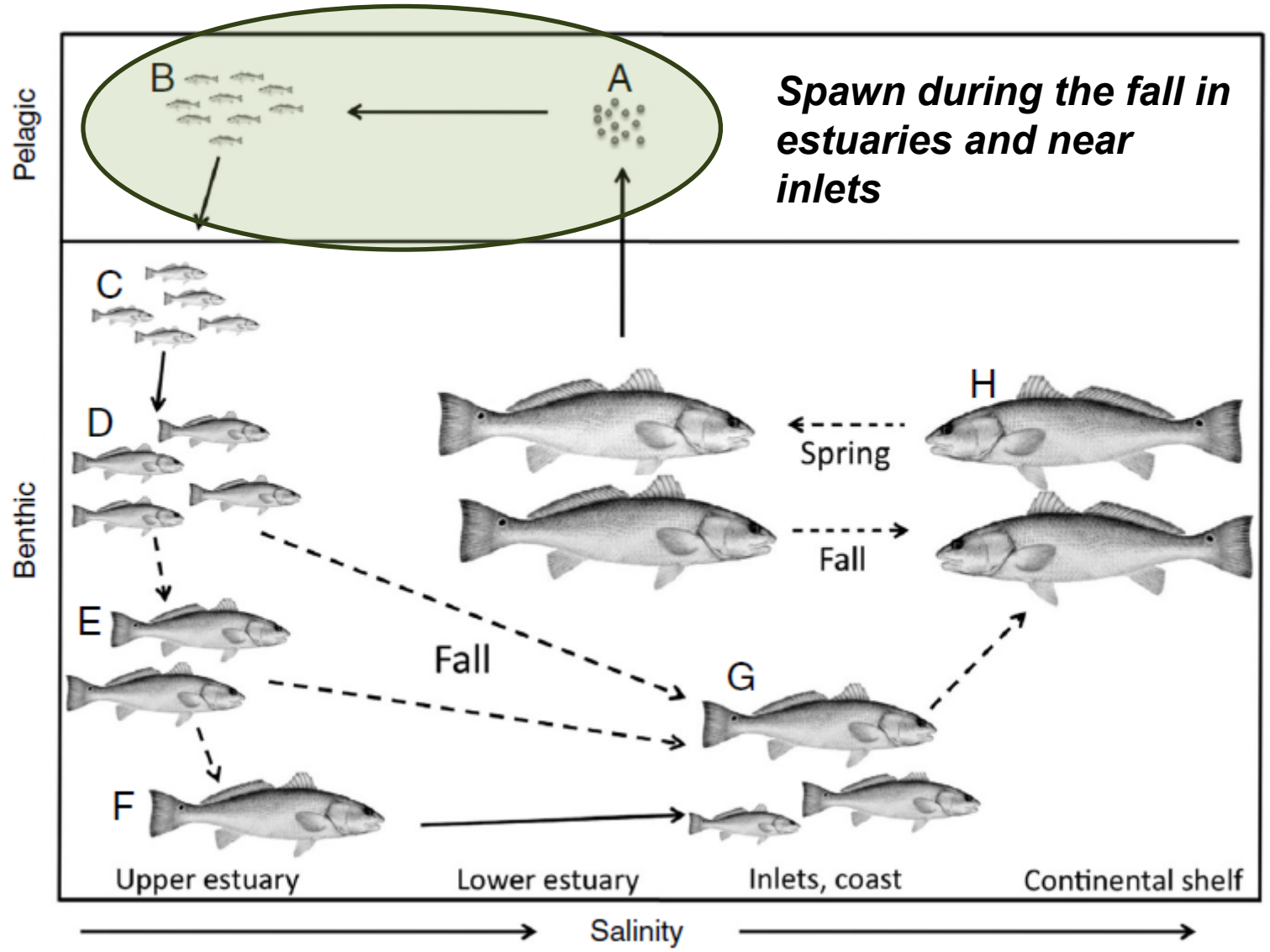
Marine Fisheries
NC Marine & Estuary Foundation

Marine Fisheries Commission | Cara Kowalchyk & John Mohan | May 2026

Outline

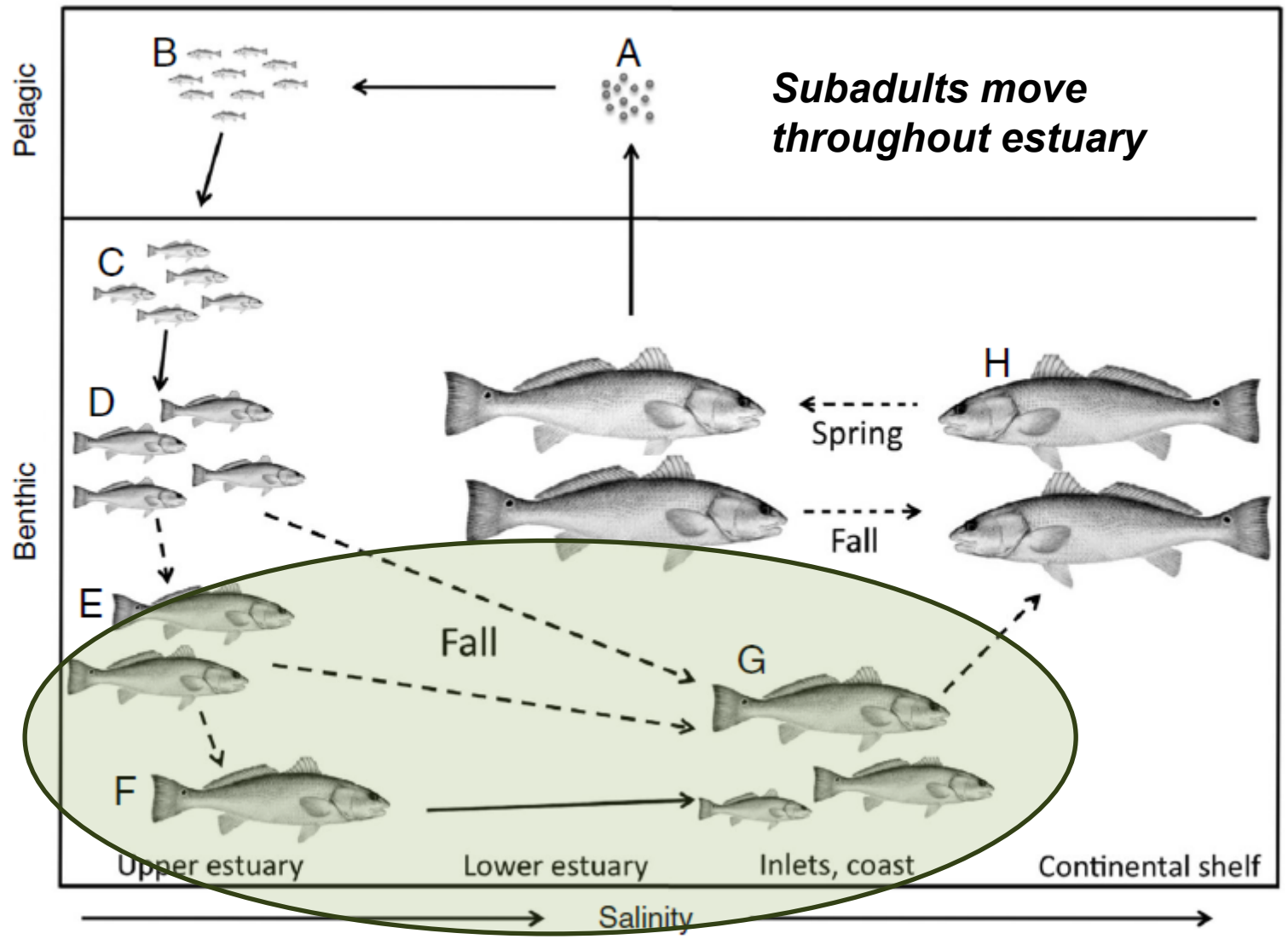
- Red Drum Life History
- Satellite Tag Project Development
  - Research Needs
  - Uses and Importance of Tagging Data
  - Satellite Tag Technology
- Year One Pilot Study (2024) Summary
- Year Two (2025) Summary
- Year Three (2026) Plans

Red Drum Life History



Bacheler et al. 2009. Variation in movement patterns of red drum inferred from tagging and telemetry

Red Drum Life History



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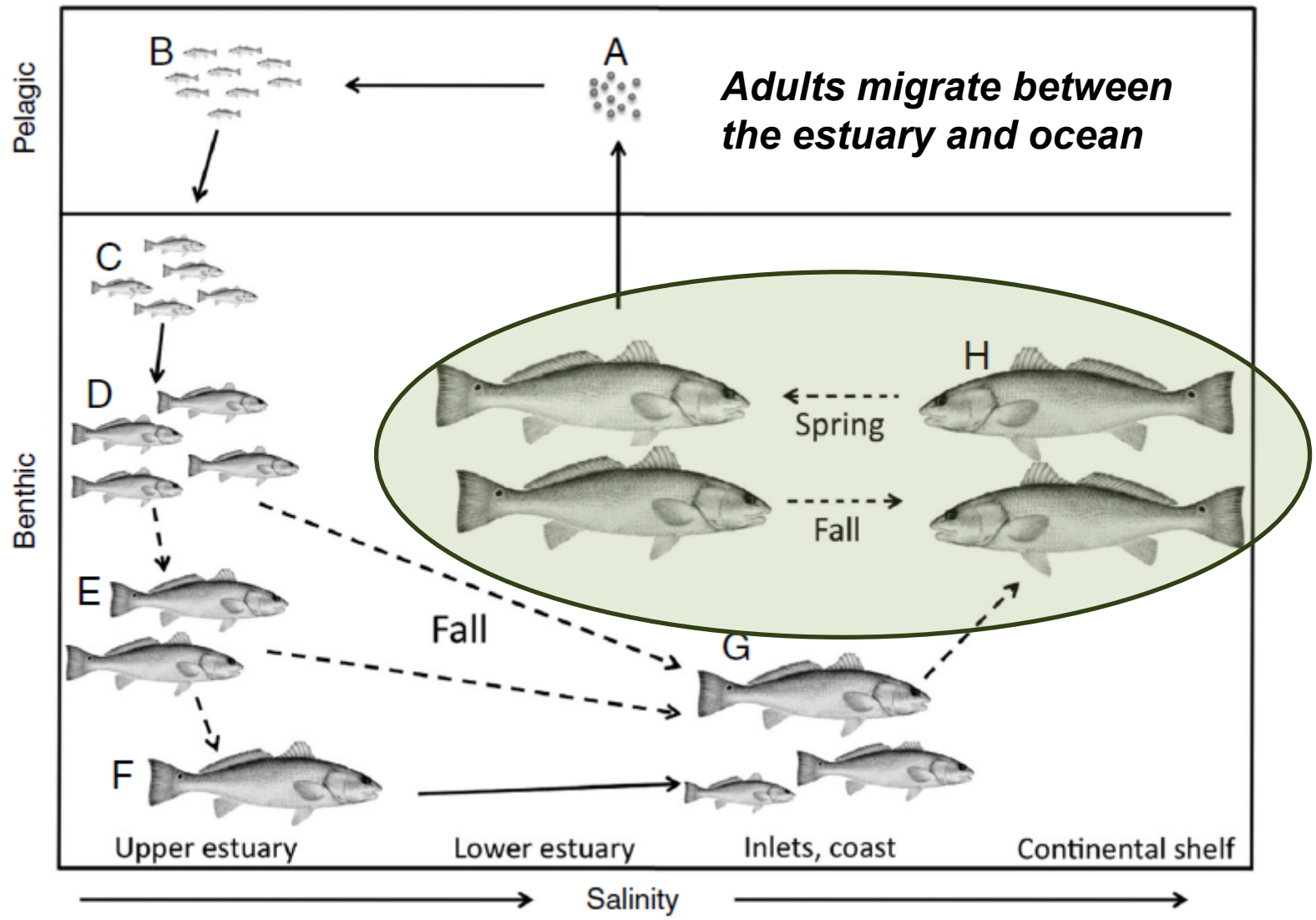

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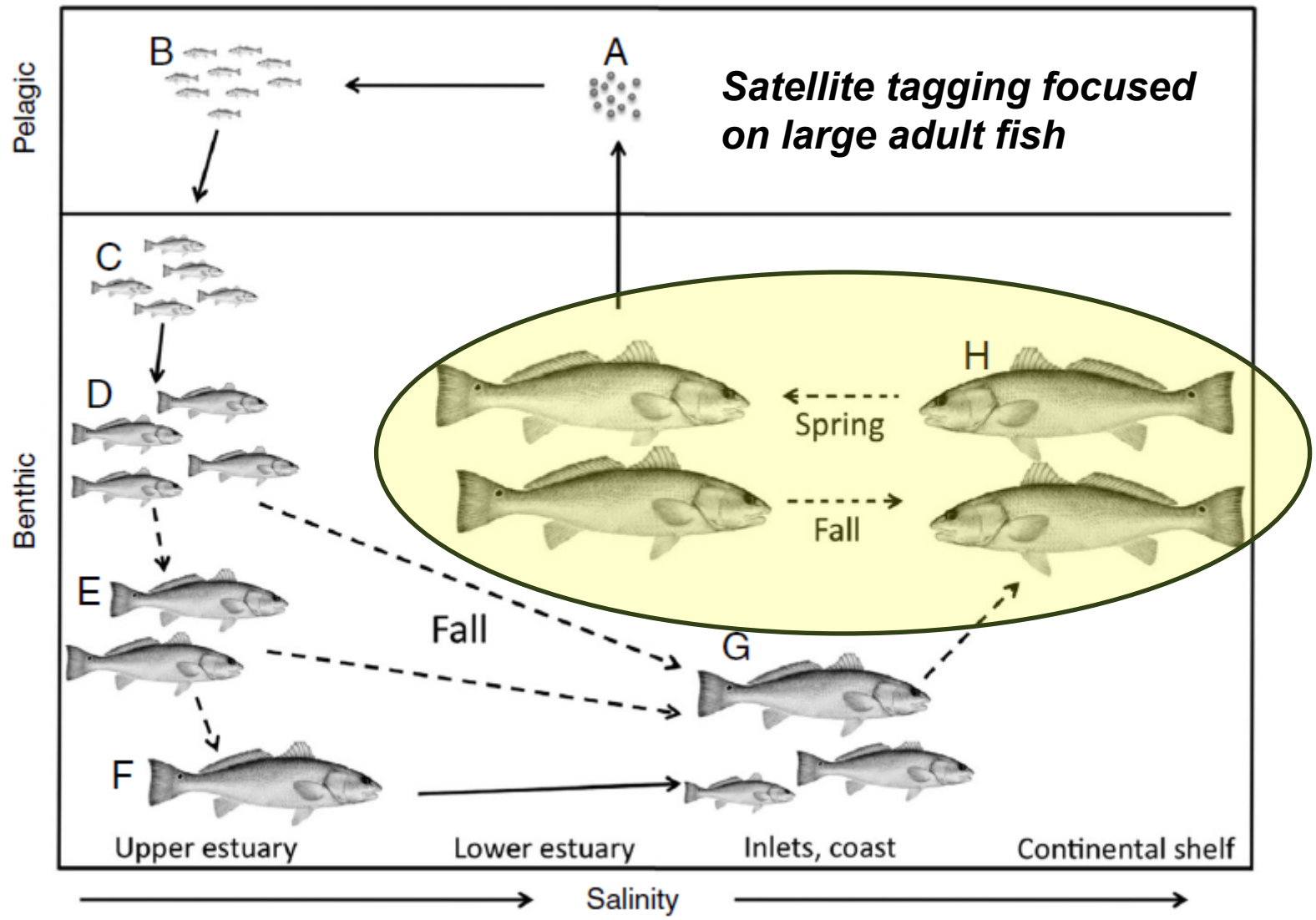

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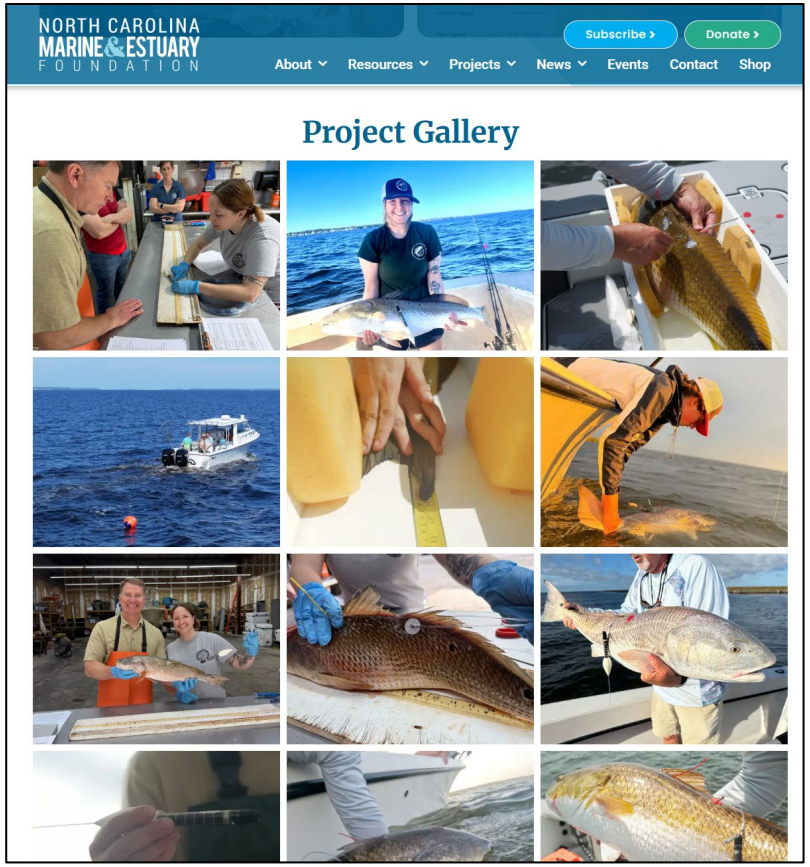
Project Development (2023)

- The Marine and Estuary Foundation contacted NC Division of Marine Fisheries to collaborate on a project highlighting North Carolina's state fish, **Red Drum**

- Reviewed research recommendations in *Fishery Management Plans* and stock assessments to identify an addressable research need



Research Needs

- Persistent **data gaps** for **adult fish**

- Previous assessments listed overfished status as **"undetermined"** because of limited sampling of adults
  - Adult red drum (>4 years) believed to occup deeper offshore habitats
    - Reduced fishing pressure & harvest restrictions
    - Unknown release mortality
    - Social and economic importance to recreational fishery

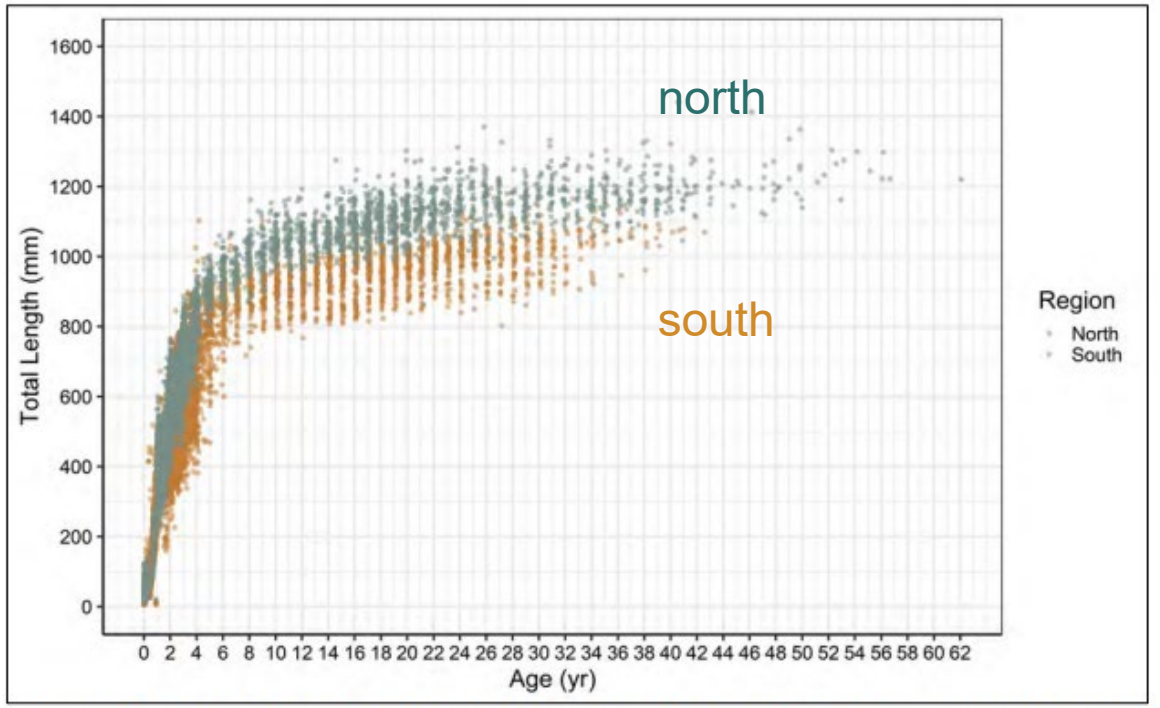
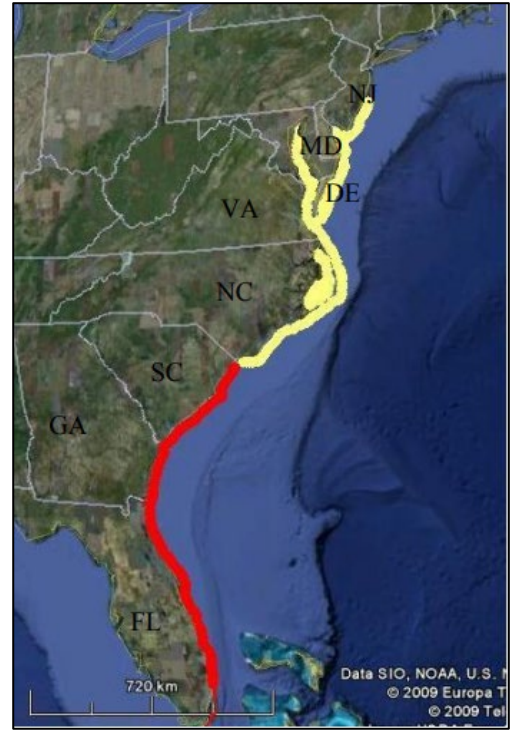


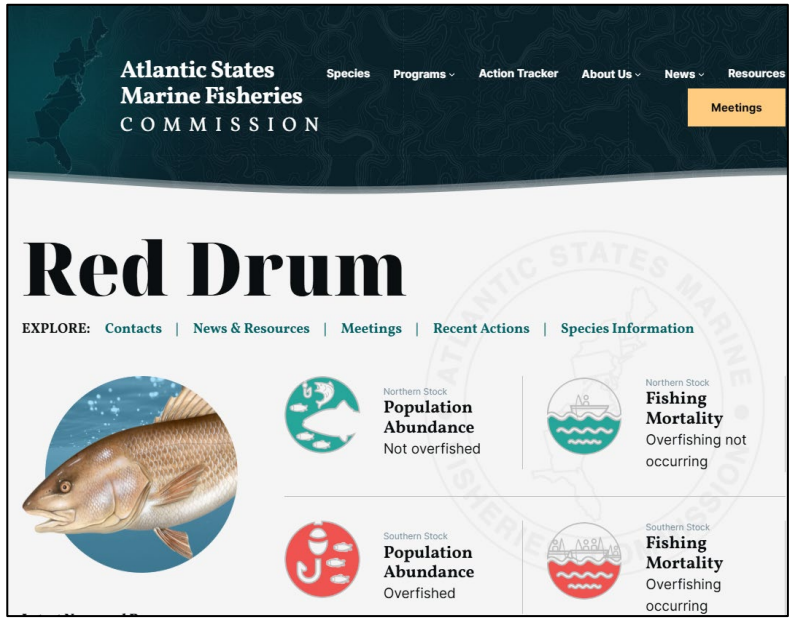
Figure 9. Scatterplot of the length-at-age by stock/region for red drum collected on the Atlantic coast of the U.S. from 1981 – 2022.

Research Needs

- Northern Stock (NJ-**NC**):
  - *Not overfished, no overfishing*
- Southern Stock (SC-FL):
  - *Overfished, and overfishing*

- Stock boundary re-assessed in 2024 ASMFC stock assessment





Red Drum Satellite Tagging in NC

Can satellite tags help address these research needs?

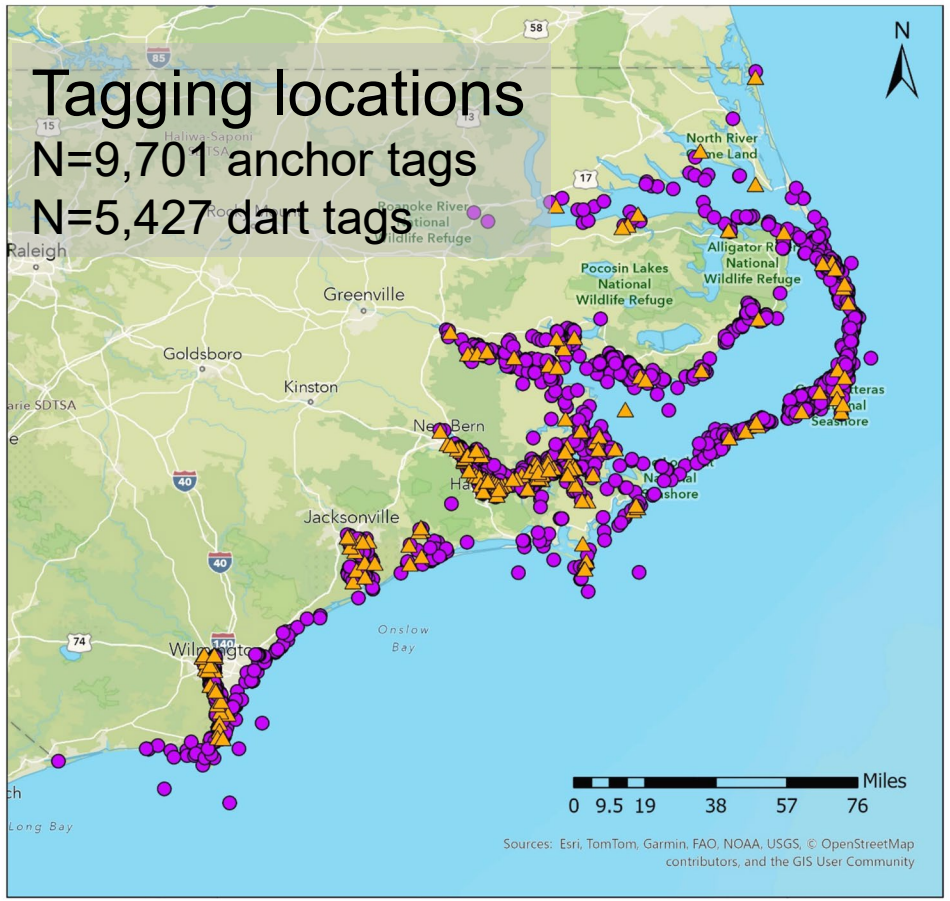
Post-spawning behavior: What *offshore* habitats are important?

Stock identification: How connected are north and south populations?

Red Drum Conventional Tag Data

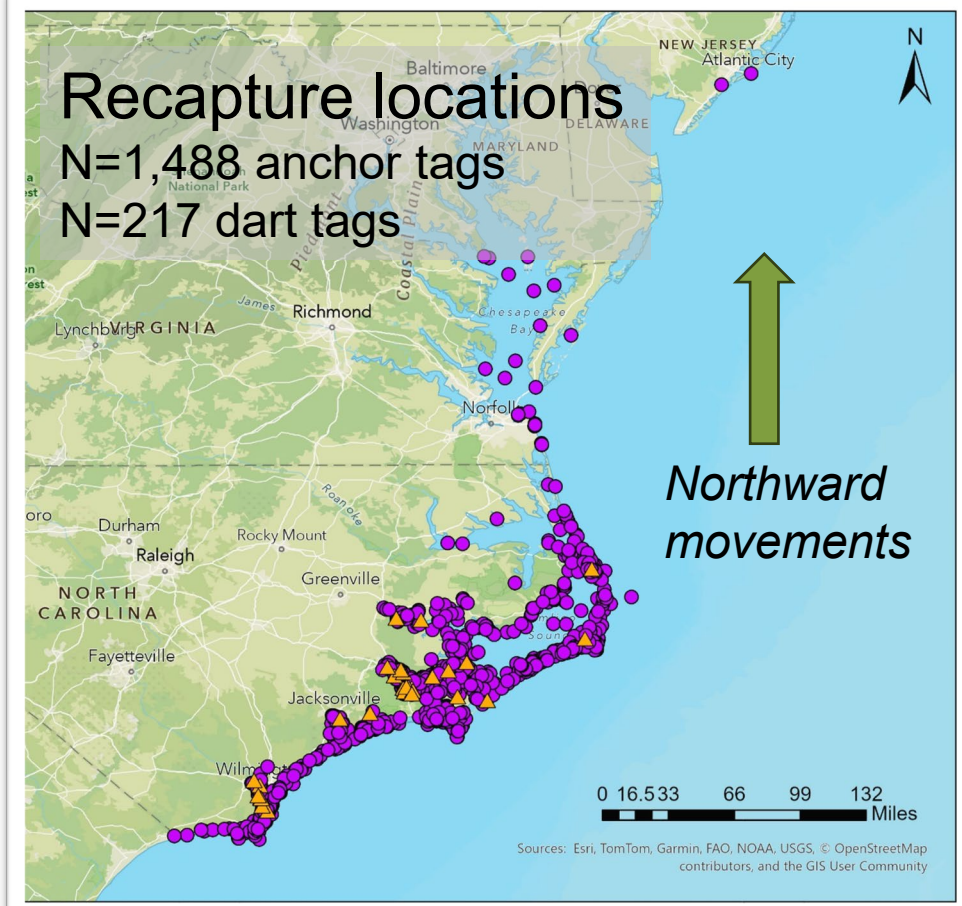
< 27 inches = internal anchor tag in belly

> 27 inches = steel dart tag in back



Original tag release distribution:

- Red Drum Releases (2023)
- Red Drum Releases (2014-2022)



Tag recapture distribution:

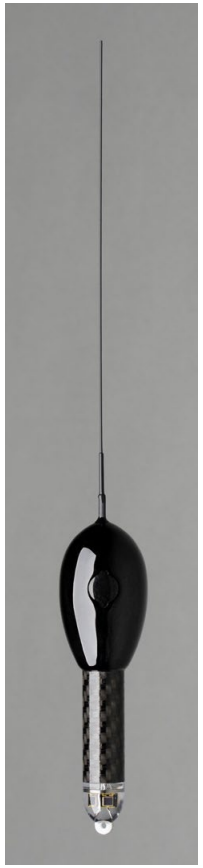
- Red Drum Recaptures (2023)
- Red Drum Recaptures (2014-2022)

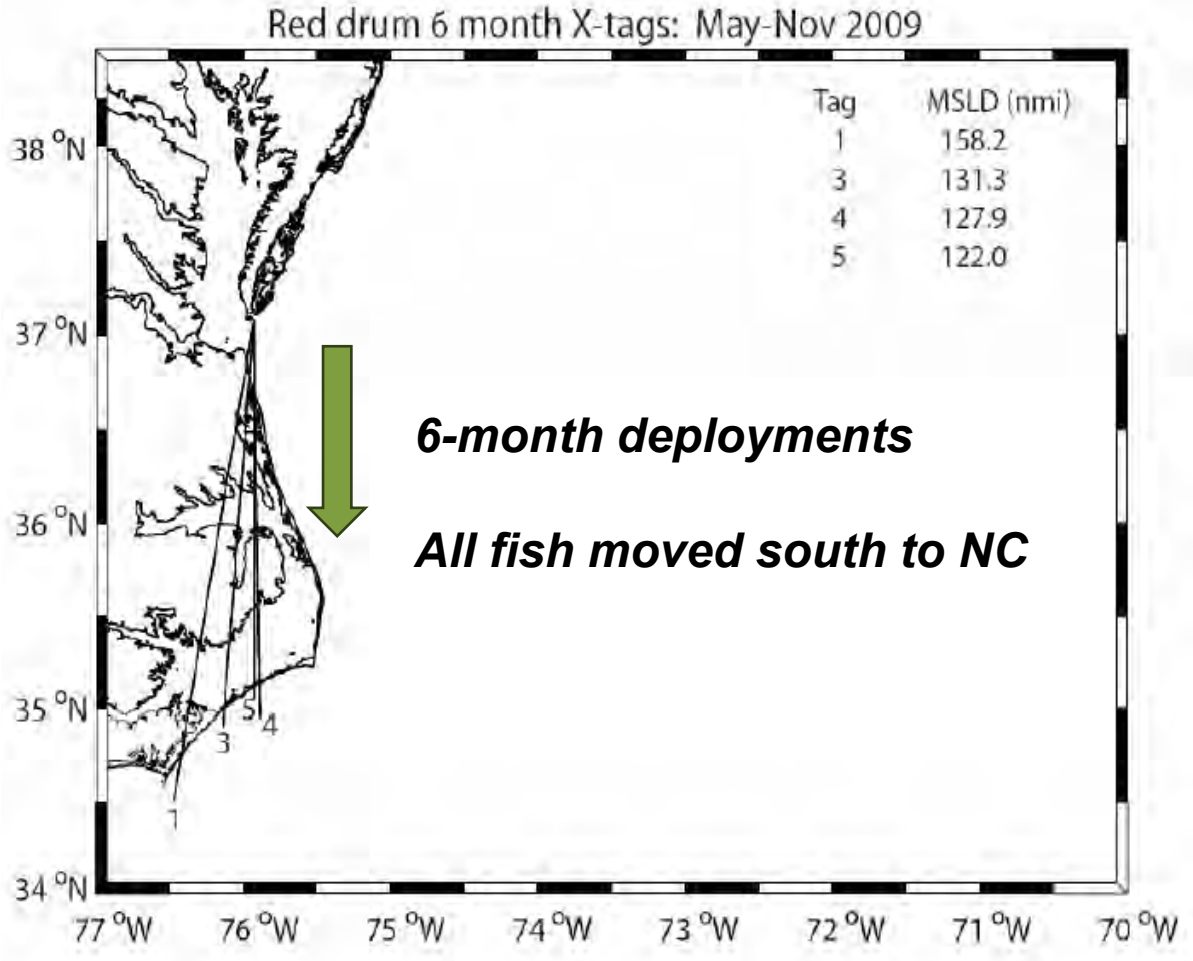
Previous Red Drum Satellite Tagging Study

- Virginia deployed **15 satellite tags** on large adult red drum from May to November 2009 (Graves et al., 2010)
  - High **post-release survival** in the recreational fishery
  - Substantial **connectivity** between the Virginia and North Carolina red drum populations July-Sept

Microwave Telemetry X-tag
Provides *depth* and *temperature* readings

Previous Red Drum Satellite Tagging Study



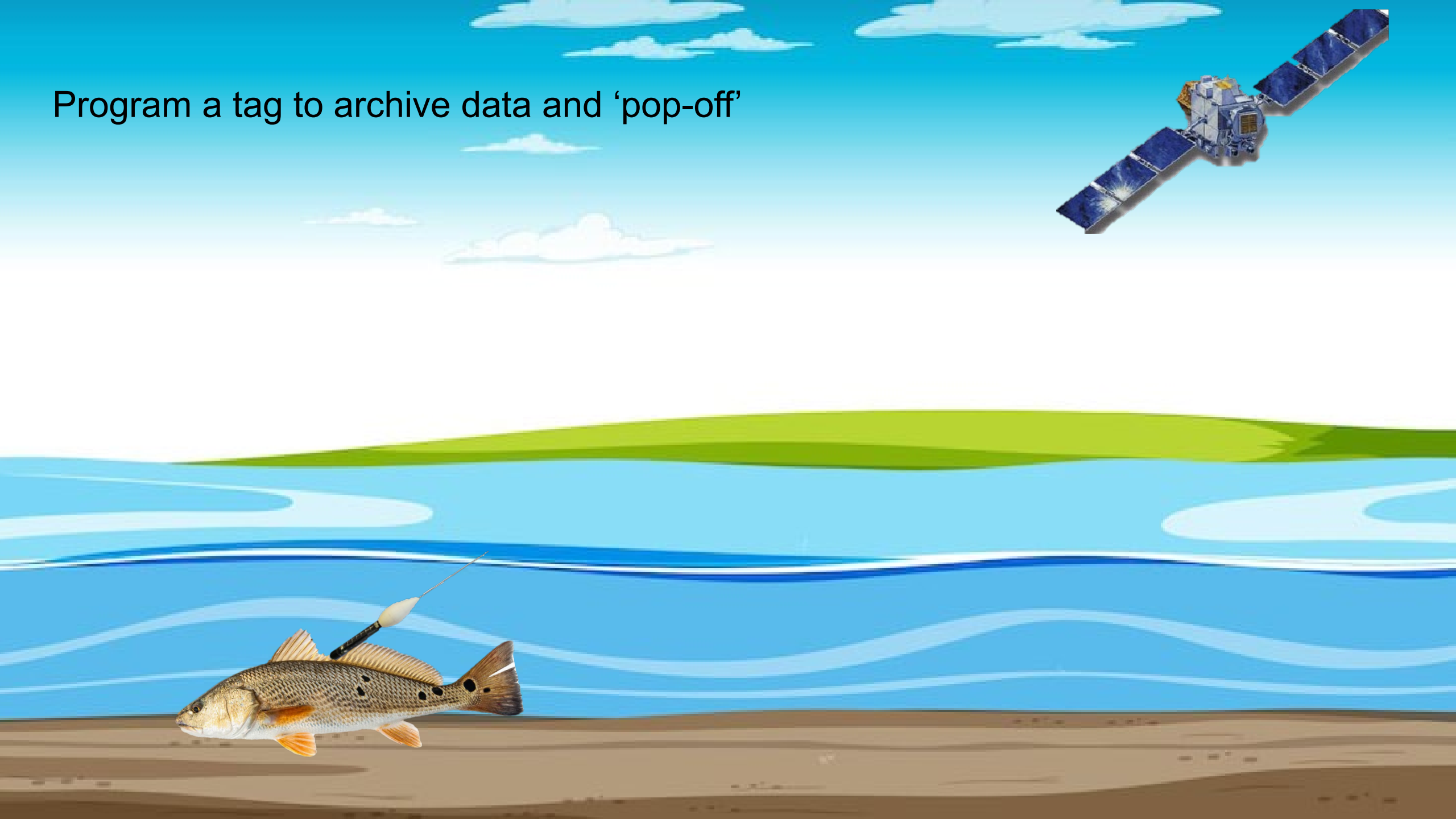


6-month deployments

All fish moved south to NC

How do satellite tags work?

Program a tag to archive data and ‘pop-off’



Tags archive data as fish swim:

- Temperature
- Magnetic intensity
- Light level
- Depth

If tag antenna exposed to air, radio signal could transmit to a passing satellite

Satellite and antenna alignment determines data accuracy

If tag detaches, floats to surface and transmits data

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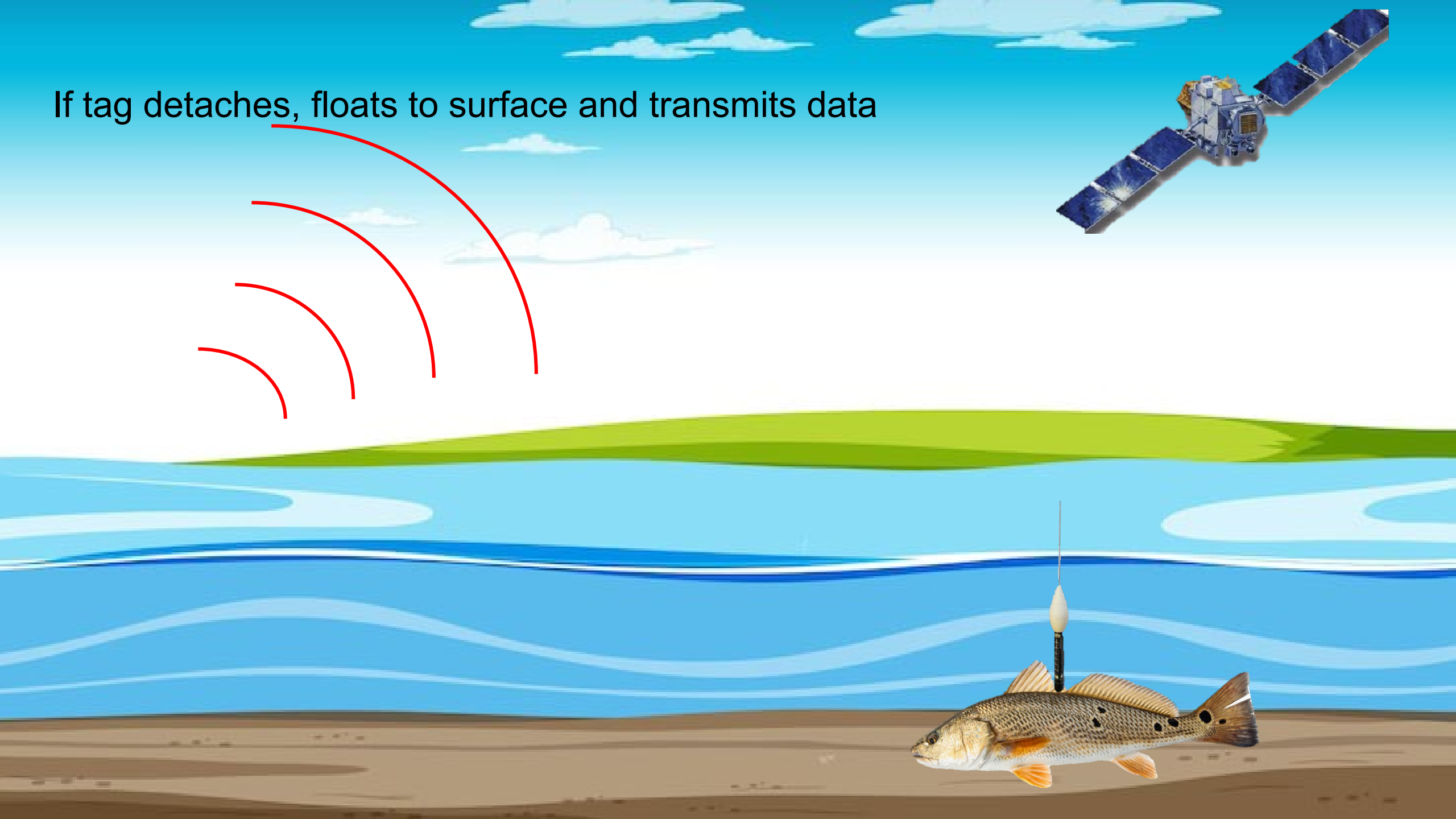

Tag location accuracy varies by **Location Class (LC)**

LC 3 → highest quality (error < 250 m)
LC 2 → error between 250–500 m
LC 1 → error between 500–1500 m
LC 0 → error > 1500 m (no upper bound)
LC A → no estimated error, but generally better than B
LC B → no estimated error, lower reliability
LC Z → invalid location (should not be used)

Waves and weather affect data transmission

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Filter low quality positions in analysis

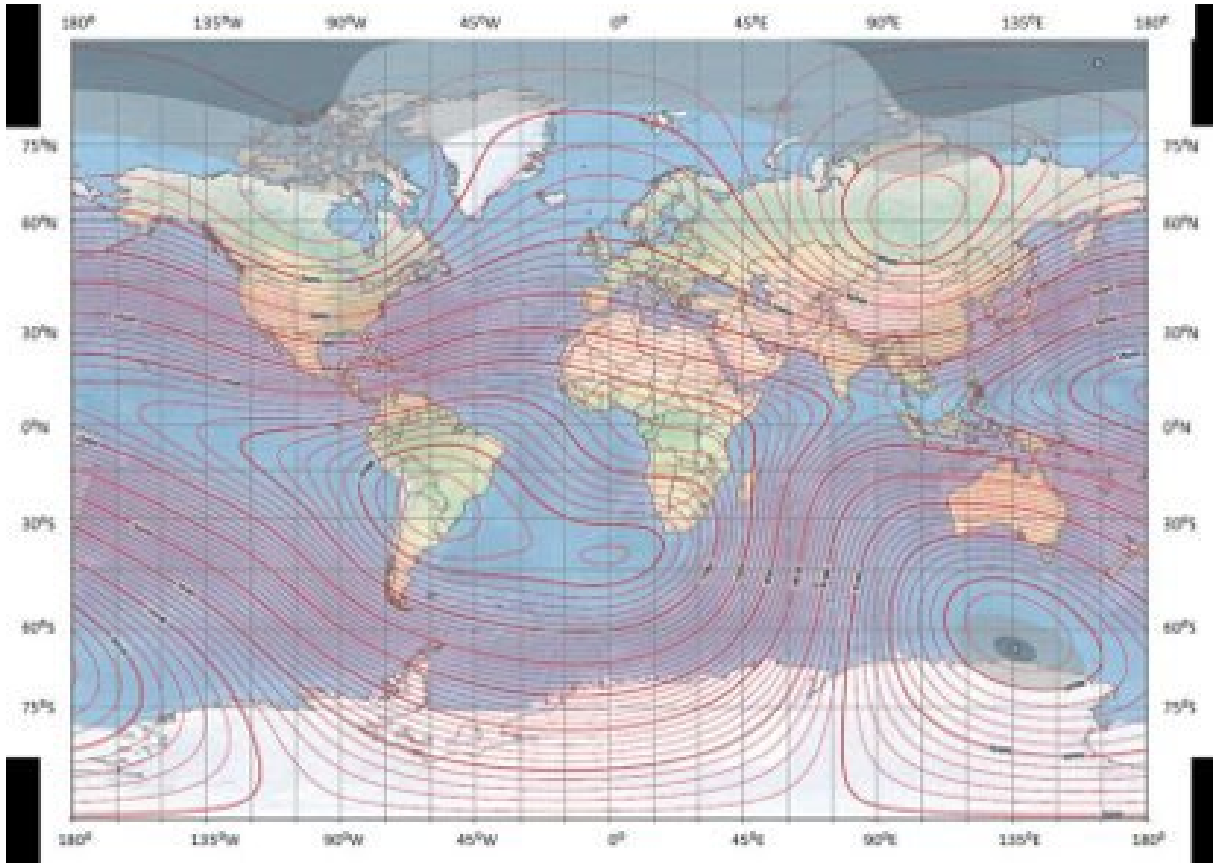
How does light-based geolocation work?

- **Day length** – changes by *latitude* (north/south clue)
- Time of sunrise/sunset and **local noon** – changes by longitude (east/west clue)
- Tags measure **daily**: *day length* (latitude) + *local noon* (longitude) = *Estimated position*
- Larger error associated with latitude (during equinox, day = night)

Earth's Magnetic Gradient

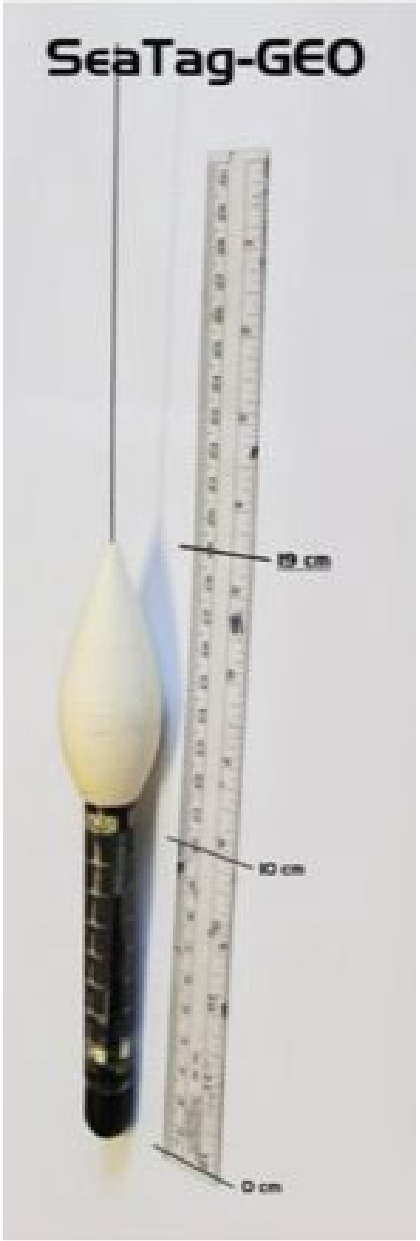
- The earth has a predictable magnetic gradient (red contour lines)

- Magnetic data could help resolve latitude



Desert Star SeaTag GEO

- Wrap-around solar panel
- Constant transmission – opportunistic locations if tag at surface
- Tag records daily:
  - *Temperature*
  - *Light level*
  - *Magnetic intensity*
  - *Day length*
- Does not provide depth data



Pilot Study (2024): Objectives

1. **Evaluate effectiveness of satellite tagging methodologies and data return**

2. **Characterize post-spawning migration patterns, with particular emphasis on offshore movements of adult red drum**

Pilot Study (2024): Tag Attachment Method

5 tags: ***side-dart*** method

5 tags: ***top-through*** method: longer tether

Pilot Study (2024): Results

- 10 Desert Star SeaTag-GEOs deployed with tag times 1-3 months beginning Oct 2024
  - DMF conducted all tagging primarily Hook and Line effort
  - Determined top-stream through method preferred for long term retention, access to the surface, fish balance

- Characterizing post-spawning movement and habitat
  - Still processing the 2024 data to refine position estimates

Year Two (2025): Objectives

1. **Investigating stock structure, spawning and offshore migration patterns, and habitat use of adult red drum**

2. **Increase public engagement in North Carolina fisheries and address data gaps related to recreational fishing effort for adult red drum**

Year Two (2025): Methods

- Increased tagging effort July-Sept 2025
- Standardized tagging methodology
  - 33 fish total
    - 19 deployed by NCDMF
    - 14 deployed by the Foundation
- Extended on-fish deployment durations
  - 3-12 months
- Foundation partnered with charter guides

NORTH CAROLINA MARINE & ESTUARY FOUNDATION

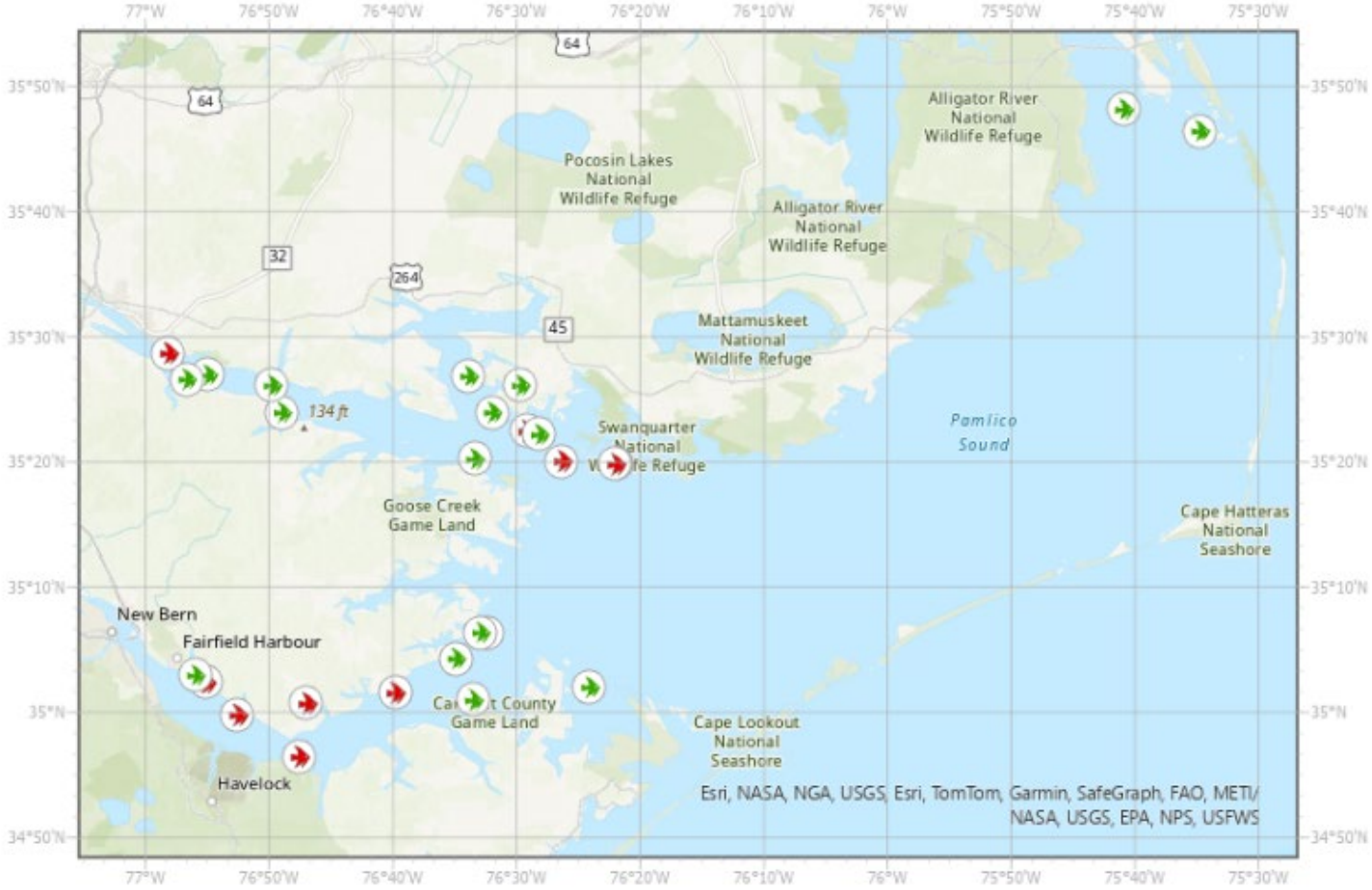
NORTH CAROLINA MARINE FISHERIES

Year Two (2025): Thank you Captains!

- **Captain Bryan DeHart**
- **Captain Scooter Lilley**
  - **Chris Douglas**
- **Captain Richard Andrews**

- Additional guides interested in assisting included Bobby Brewer, Matt Lusk, Sam Sellars, Steve Wells, Chris McDonald, Brandon Dean, Seth Vernon, Jot Owens, Christian Wolf, and Brendan Guthrie

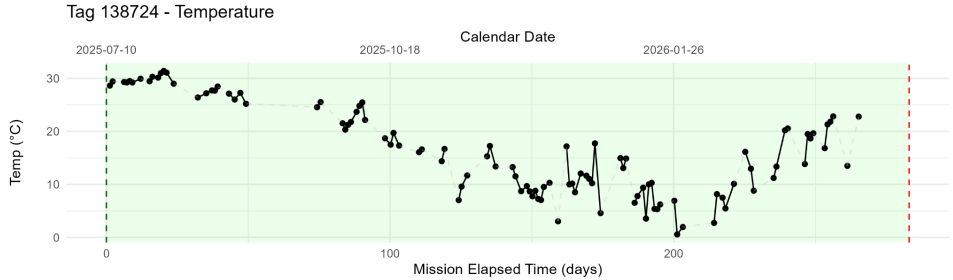
Satellite Tag Deployments: NCMEF and NCDMF



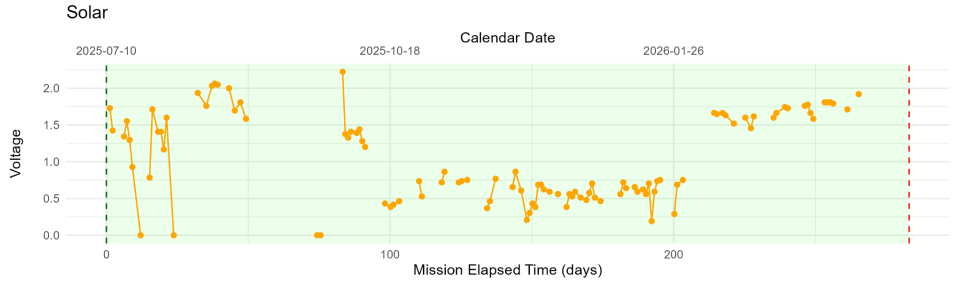
2024 **10** tag deployments in October for 1-3 months

2025 **33** tag deployments in June, July, Aug, Sept, for 6-12 months

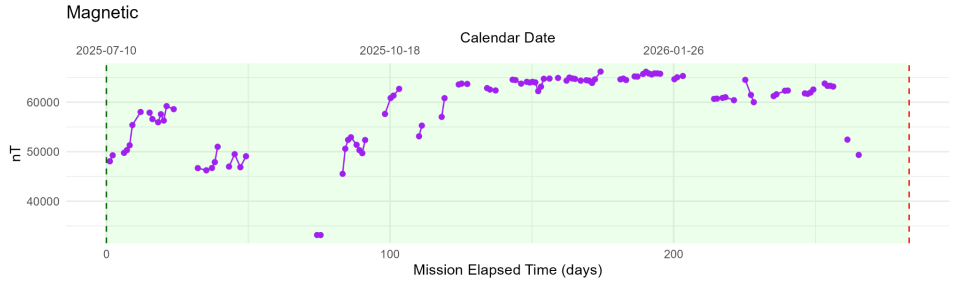
Preliminary Results – Example of Transmitted Data



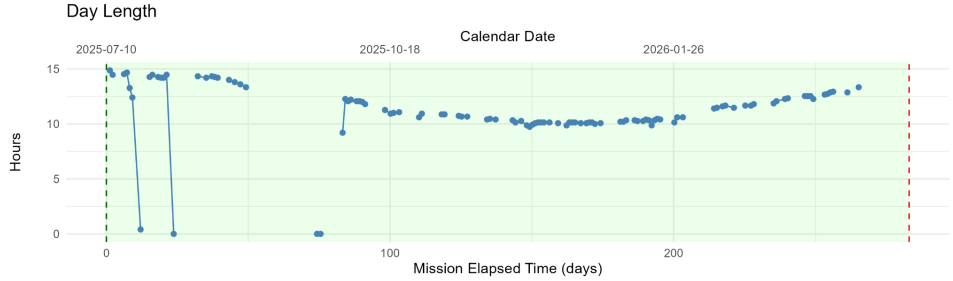
Temperature



Light level



Magnetic intensity



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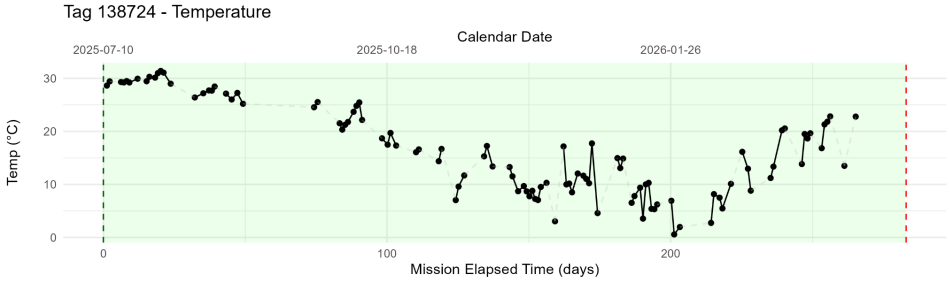

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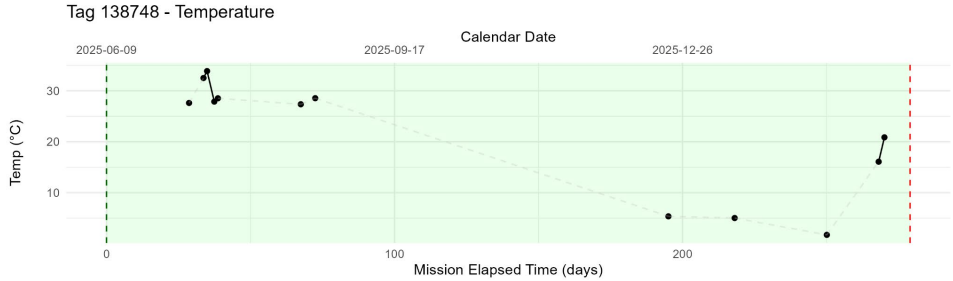

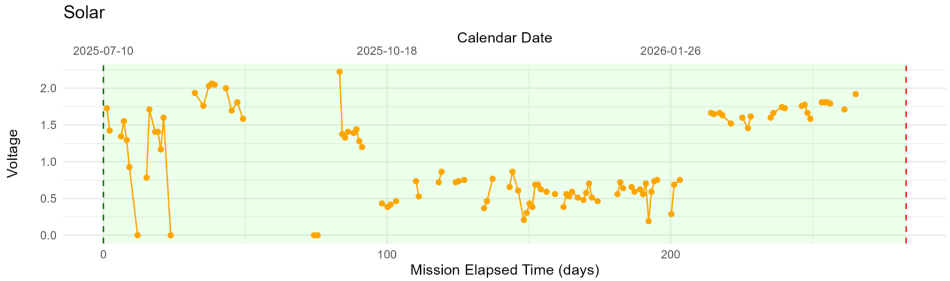

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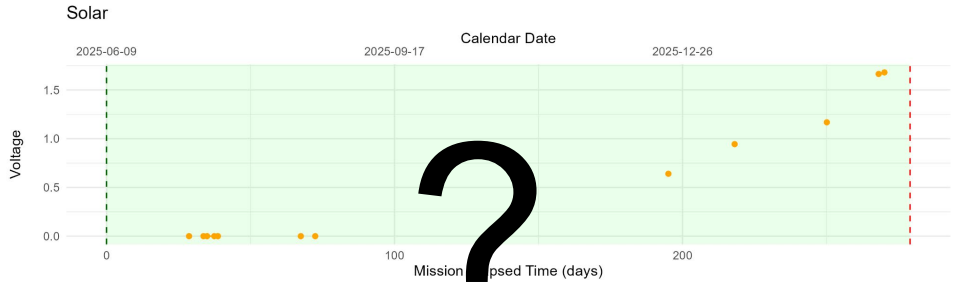

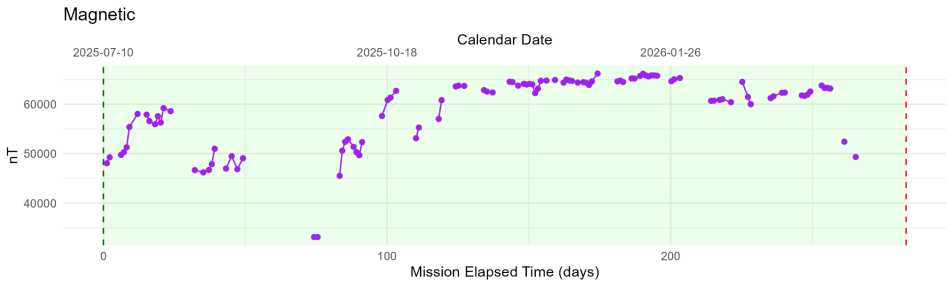

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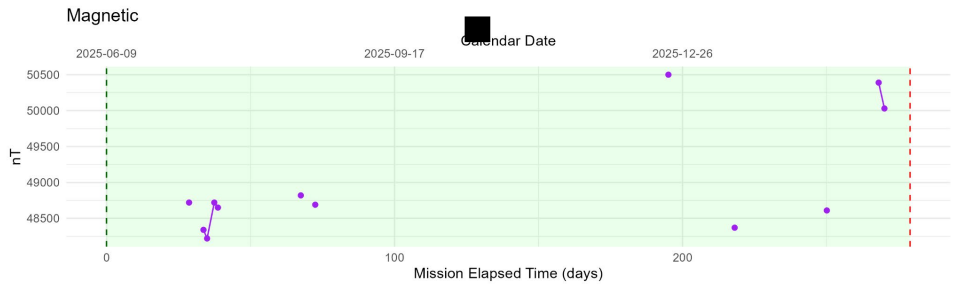

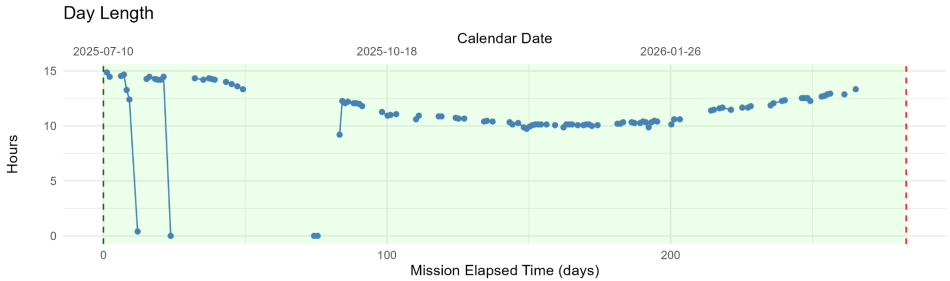

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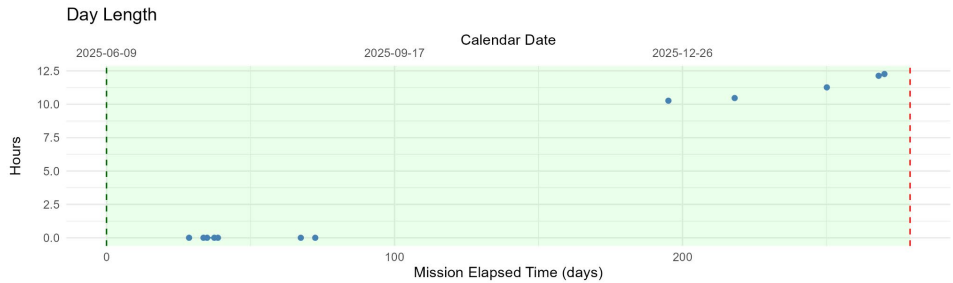

Year Three (2026): Plans

- Continue analyzing data from tags that released
- Estimate geolocations and compare magnetic-based to light-based
- 11 tags still deployed on fish
- Deploy additional tag type:
  - **Wildlife Computer microPAT** to obtain *depth* data
- Continue outreach and public engagement

THANK YOU! Questions?

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