# Modeling the small-scale spatial distribution and movement of tropical tuna in the central eastern Atlantic

UNIVERSITY OF MIAMI

## Utilizing AOTTP data to validate an Agent-Based Model

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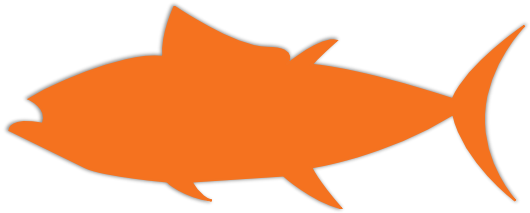
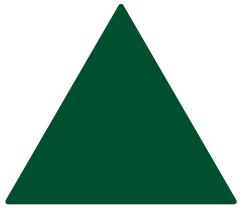
# Developing an Agent-Based Model

## Agents



Yellowfin
Bigeye
Skipjack

Fish Aggregation Devices
Fishers
Seamounts



**Goal: Model schooling behaviors so we can test management strategies that will improve the catch composition and yield.**

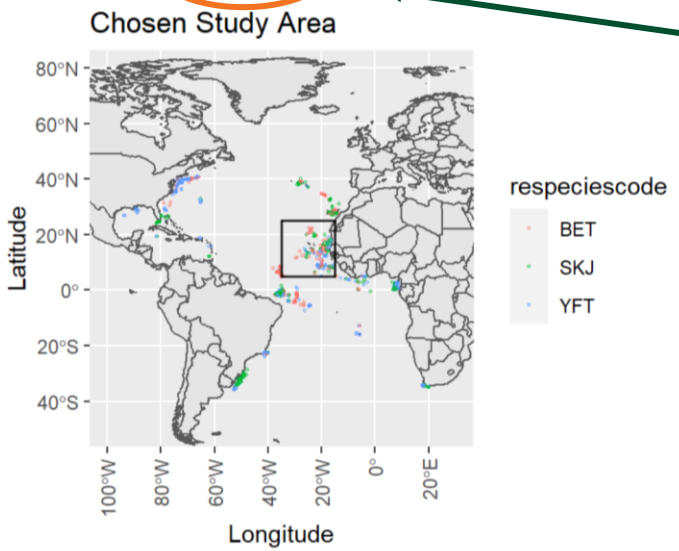
1. Use meta-analysis to develop parameters for the model
2. Make the model in Java MASON
3. **Validation – test how closely the simulated movement matches the *in situ* movement**
4. Test management strategies in the simulated fishery

# RMarkdown

## Study Area Definitions

The study area for this run is defined with the ranges of 5 to 25 degrees latitude and -35 to -15 degrees longitude.

We are only looking at the fisheries: BET, YFT, SKJ.




**Changing these numbers or species list changes the entire report output.**

**Thus, as the ABM changes scale, the validation information can change with it.**

## Distributions of Releases and Recaptures

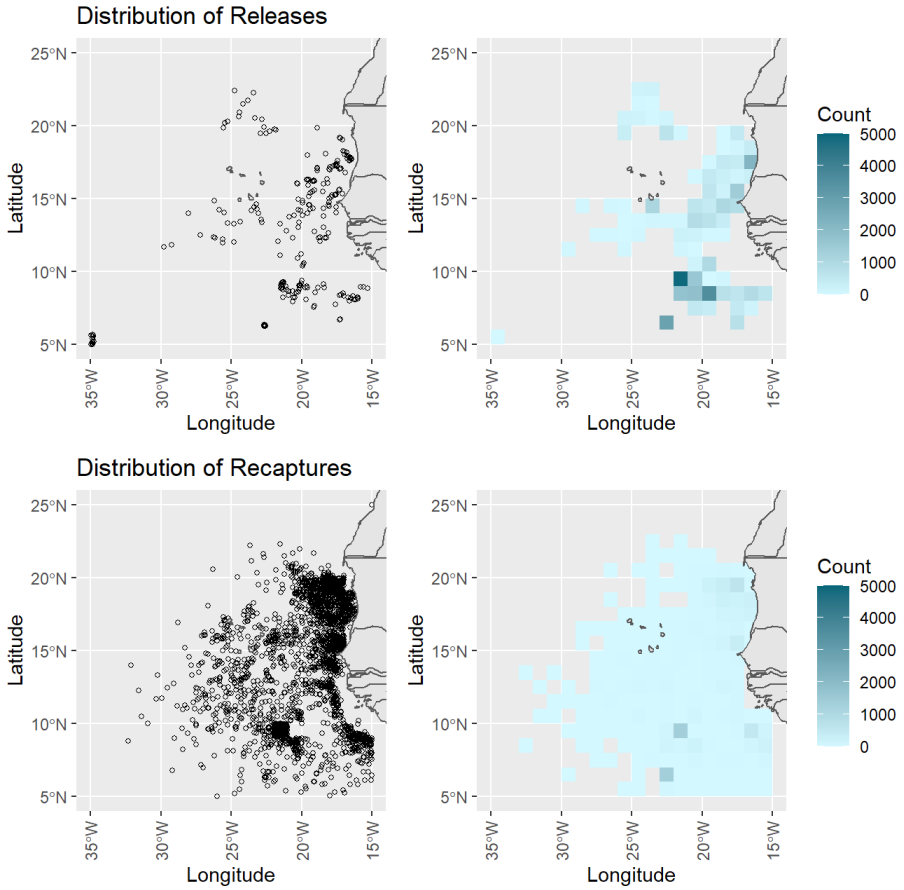
In the chosen study area, 39754 fish were released, 10011 fish were recaptured. Of the fish released in this area, 9794 individuals or 24.64% were recaptured in the same area.

The average distance traveled by the fish released in this area was 189.89 nm with a maximum distance traveled of 2253.22 nm. The average time at liberty was 91.77 days with a maximum time at liberty of 1382 days.

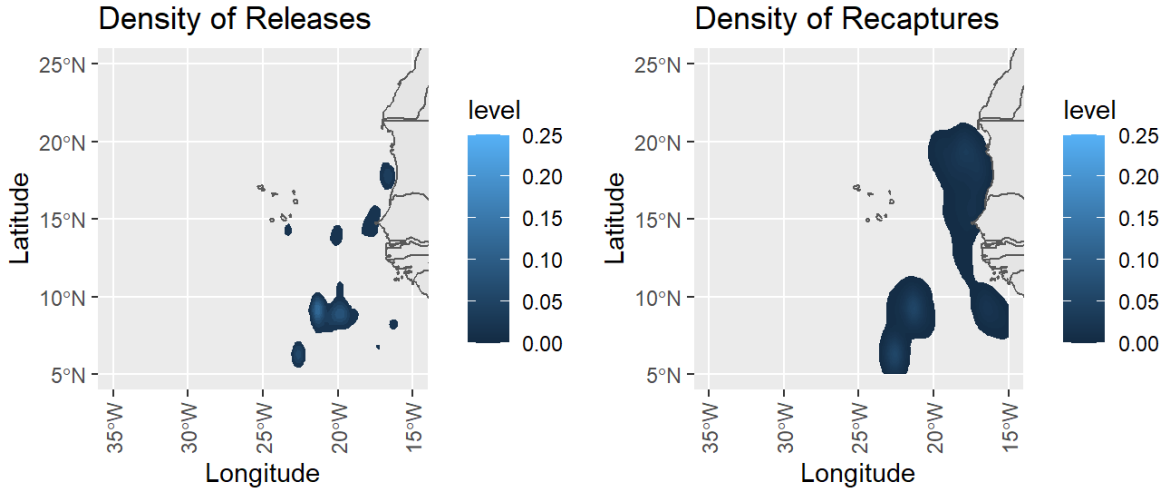
# Study Area Summarized

## Distribution of Releases and Recaptures

### Tile Map

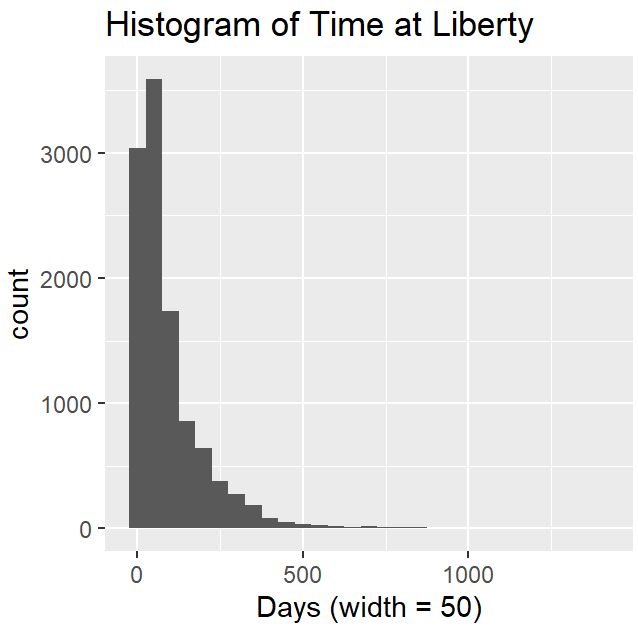


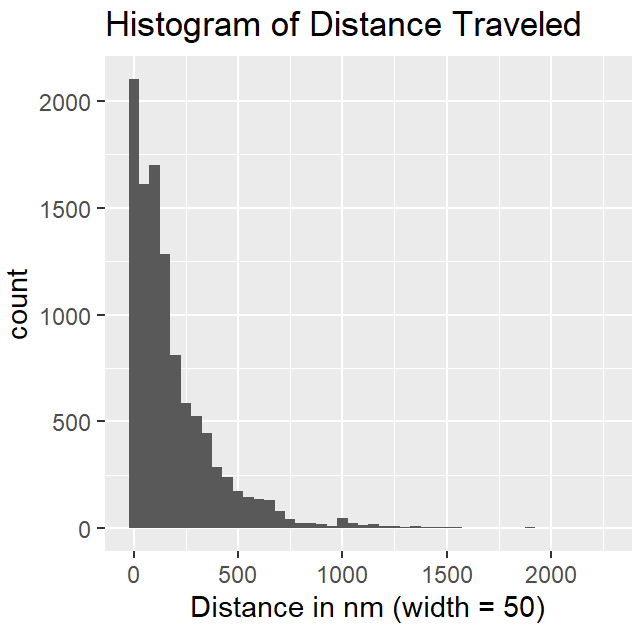

### Density Map



# Study Area Summarized

## Distance Traveled and Time at Liberty




| | Total Releases | Total Recaptures | Releases Recaptured in Area | Percent Recaptured in Area | Average Time at Liberty | Maximum Time at Liberty | Average Distance Traveled | Maximum Distance Traveled |
|---|---|---|---|---|---|---|---|---|
| BET | 11998 | 3295 | 3168 | 26.40440 | 107.37582 | 1382 | 210.5923 | 2142.811 |
| YFT | 15496 | 4342 | 4325 | 27.91043 | 97.94556 | 1168 | 184.2746 | 2253.221 |
| SKJ | 12260 | 2374 | 2301 | 18.76835 | 57.75120 | 1112 | 172.1563 | 2195.484 |

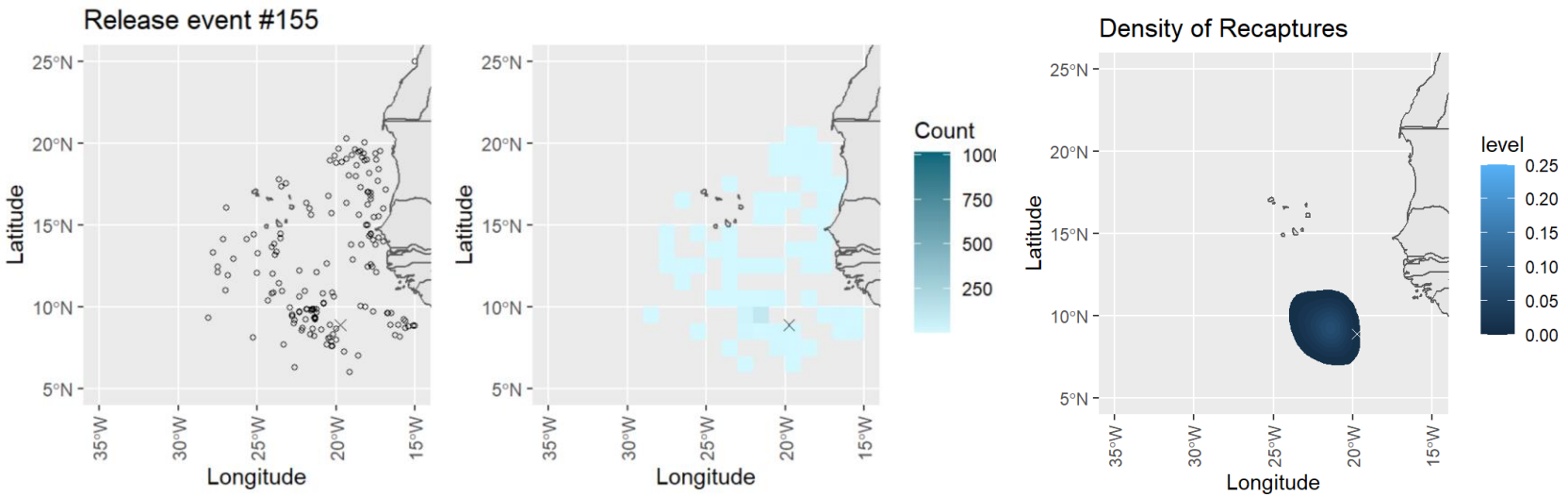
# The Largest Release Event

The release event chosen was #155. The released fish had a school type of DRF.

This event included 1358 individuals. In the table below is the breakdown of all the previous statistics calculated for the entire area applied to just this school.

| | Total Releases | Releases Recaptured in Area | Percent Recaptured in Area | Average Time at Liberty | Maximum Time at Liberty | Average Distance Traveled | Maximum Distance Traveled |
|---|---|---|---|---|---|---|---|
| All | 1358 | 343 | 25.257732 | 140.5397 | 1112 | 287.4629 | 2253.2208 |
| BET | 400 | 114 | 28.500000 | 141.8250 | 723 | 267.9416 | 1450.1850 |
| YFT | 710 | 212 | 29.859155 | 137.8728 | 520 | 306.7509 | 2253.2208 |
| SKJ | 248 | 17 | 6.854839 | 167.2353 | 1112 | 177.8371 | 999.4368 |

The distributions of the release point and subsequent recaptures are below.



# Conclusions

1. The RMarkdown report increases the efficiency of model validation allowing for flexible model development.

2. This tool can be used for analyzing specific release events or smaller areas for other projects.



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# Thank you

I am open to collaborations, questions, and comments at apn26@miami.edu.

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