Predicting the Long-Distance Dispersal of Ichthyoplankton in the Intra-Americas Sea: A Data-Assimilative Decision Support Tool for Effective Living Marine Resource Management

DRIFTCAST™

FATHOM SCIENCE

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NASA

Bonefish & Tarpon TRUST

Aaron Adams

This material is based upon work supported by NASA under award Number 80NSSC21K1471

Fathom Science

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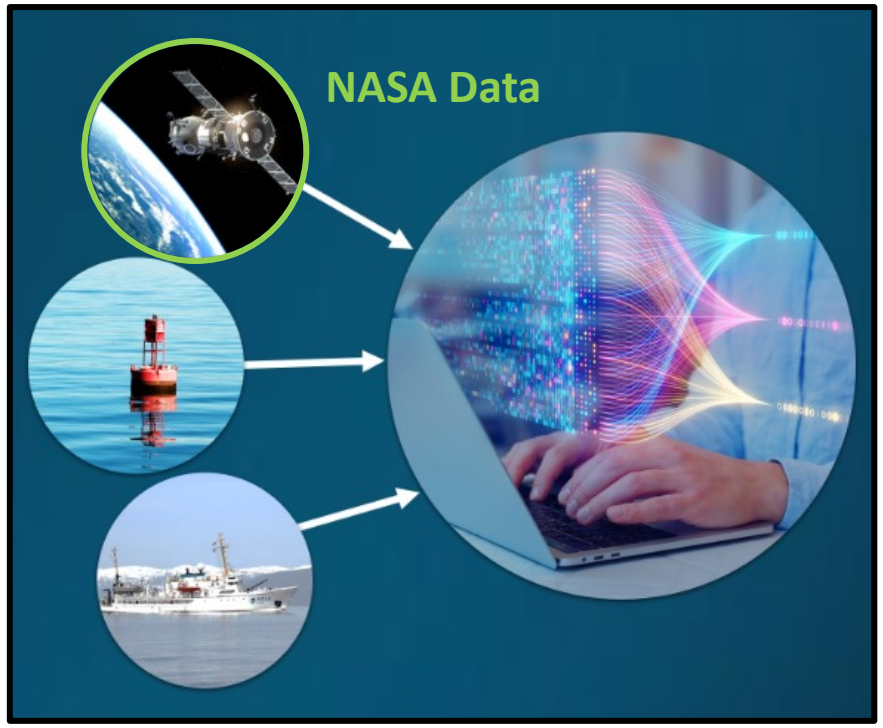
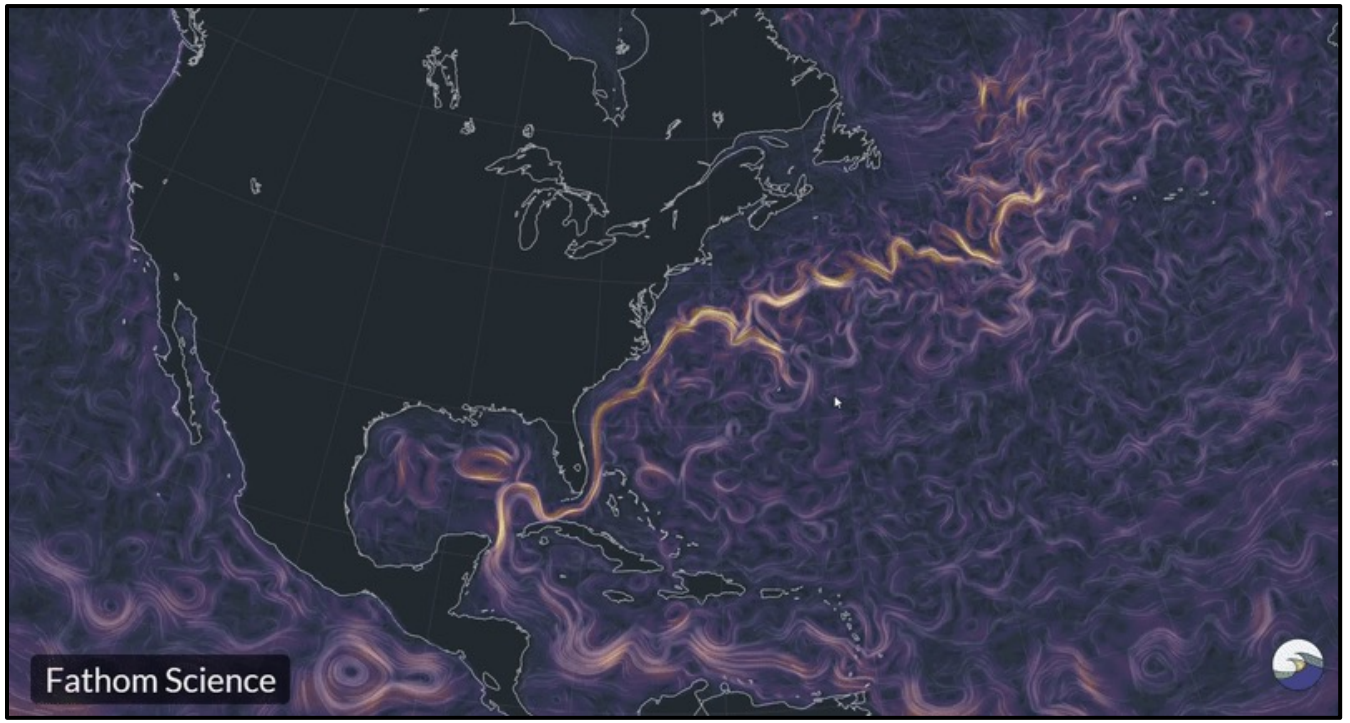
AI/ML and Data Assimilation



Global ocean data, at your fingertips



- Start up company from North Carolina State University
- Goal: Serve the Blue Economy across multiple sectors
- Providing data at a range of scales (Ports to Global)
- Using **data for good**

NC STATE UNIVERSITY

+

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Motivation

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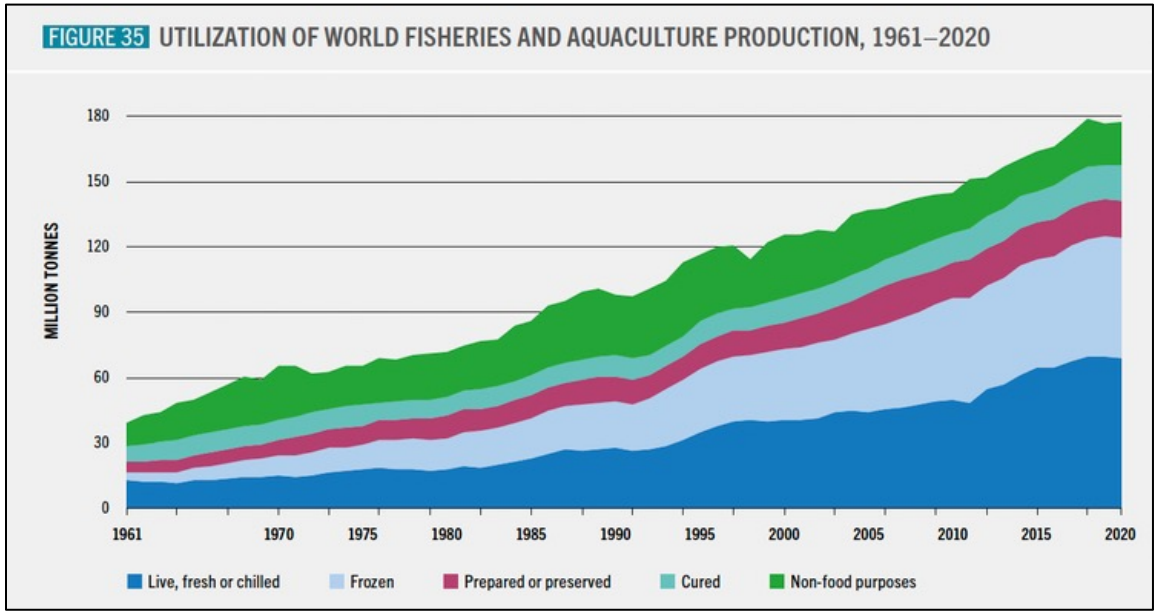
Ecosystem wide impact of seafood

Source: https://www.fao.org/in-action/globefish/market-reports/resource-detail/en/c/1109513/

Global Seafood Demand



Source: https://migration.ucdavis.edu/rmn/blog/post/?id=2803

- The issue: Seafood demands will only continue to increase
- A key requirement of sustainable fisheries management is accurately estimating **recruitment** (number of new young fish that will replace harvested fish)
- Current fisheries management relies solely on reproduction potential of females to estimate recruitment

Motivation

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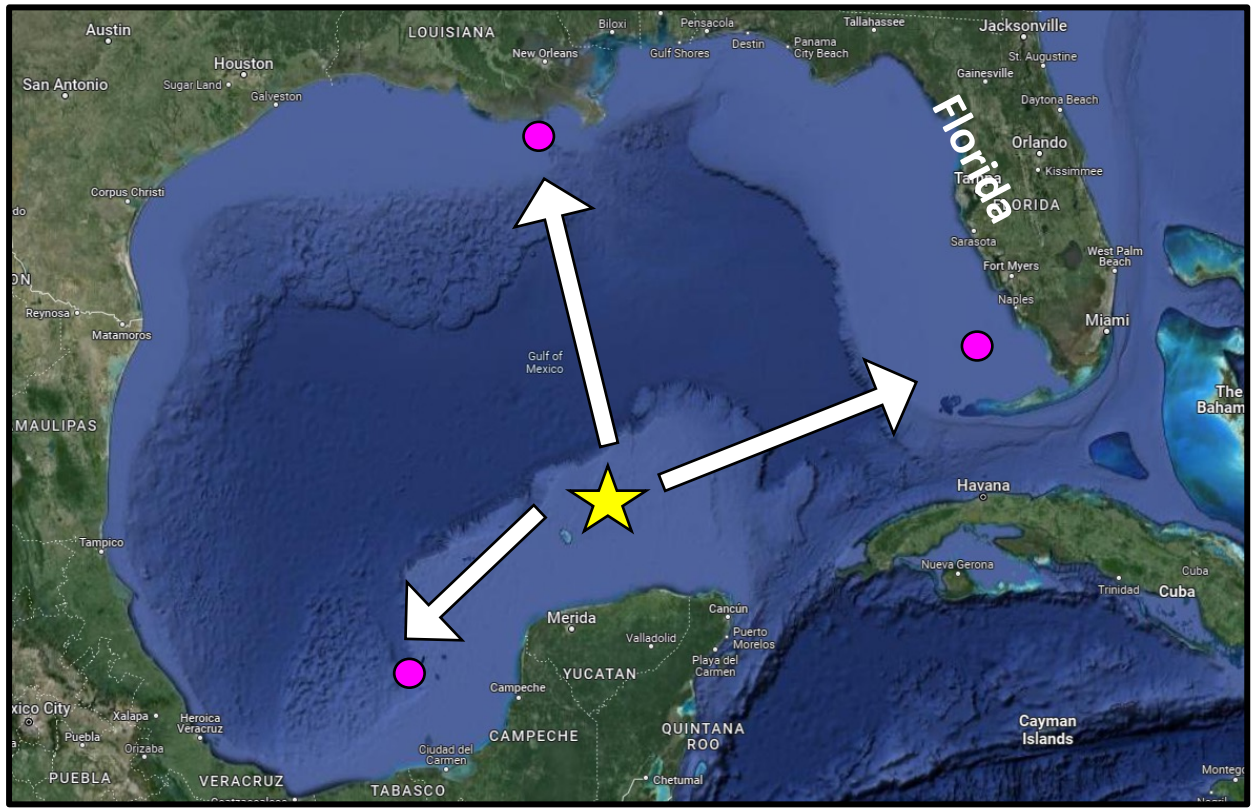
Hypothetical dispersal



- Spawning Site
- Settlement
- Yearly ocean current

- Ocean conditions ALSO strongly impact recruitment through dispersal of eggs and larvae.
- Connectivity (source and sinks) determines the magnitude of potential recruits in an area.
- Project Goal: Create a user friendly ocean modeling tool with NASA data to help federal and state **fisheries managers (end user)** better understand recruitment and connectivity.

First Application

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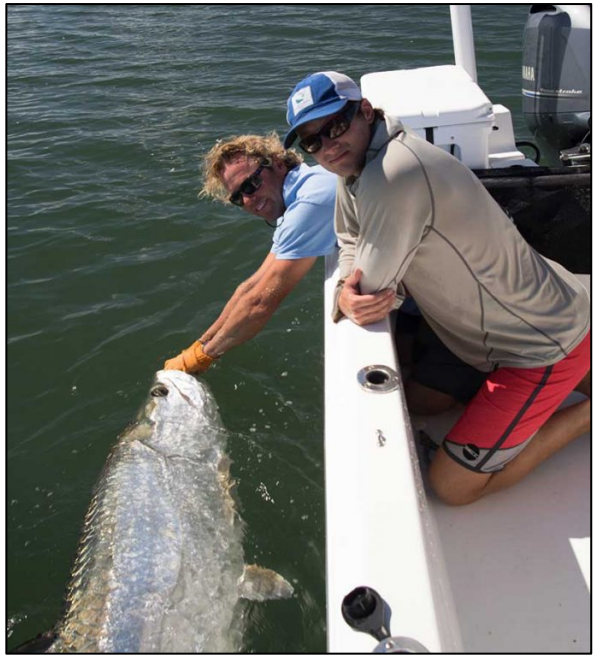
"Flats"

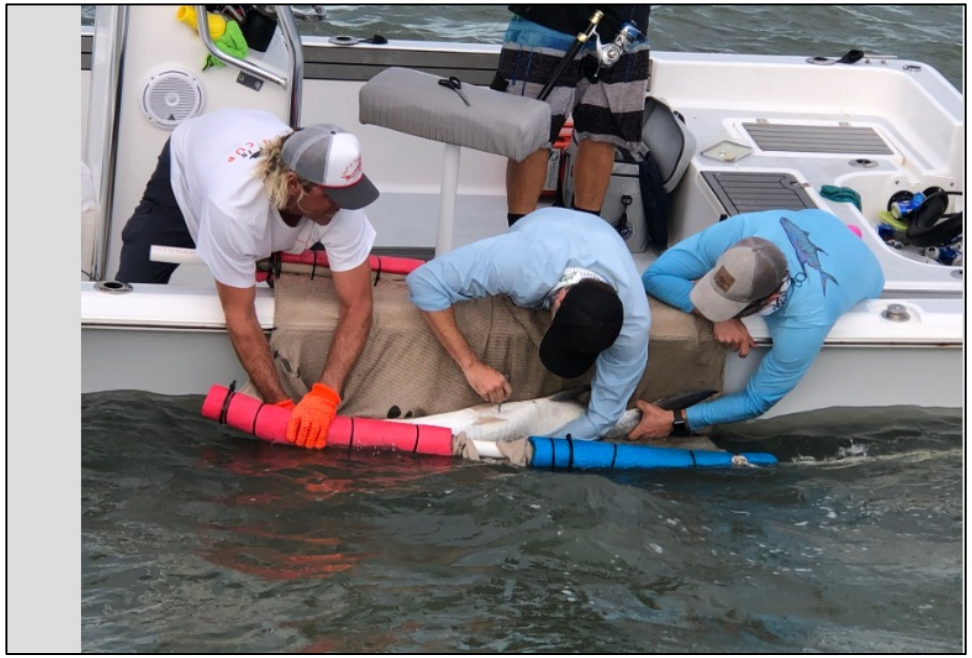
Source: https://norrik.com/

Tarpon



Source: https://www.bonefishtarpontrust.org

Tarpon Tagging



Source: https://www.bonefishtarpontrust.org

- Flats fisheries are world renown (great location, exciting species)
- Tagging efforts fill in some data gaps, but are expensive
- Partnered with **Bonefish and Tarpon Trust** to develop a fisheries management tool
    1. BTT understands the resource manager needs and limitations
    2. Provide accurate spawning information for Tarpon, Bonefish, and Permit

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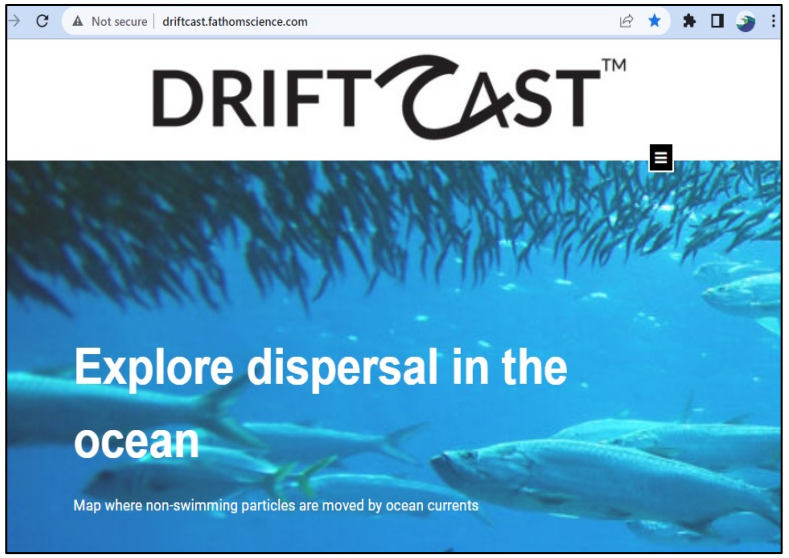

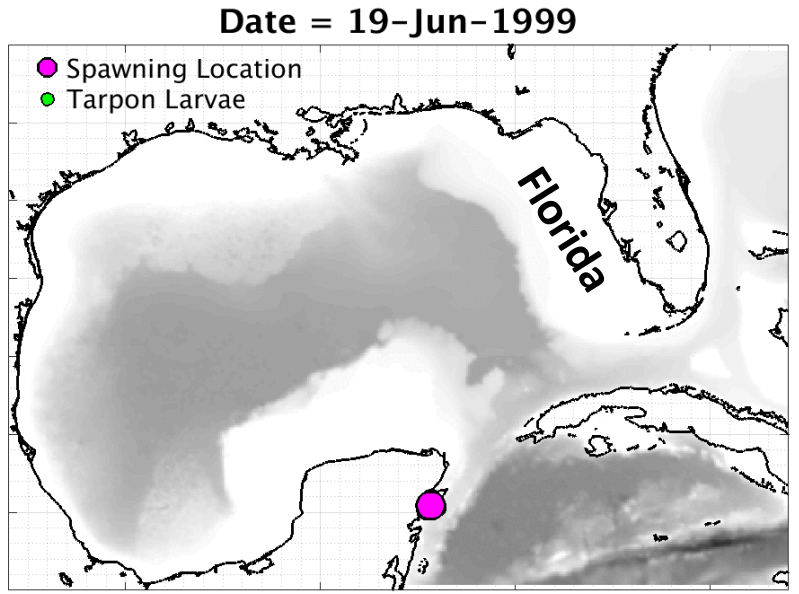

Bonefish and Tarpon Trust Symposium (2022)

End user engagement:

- Florida Fish and Wildlife
- Other Gulf states

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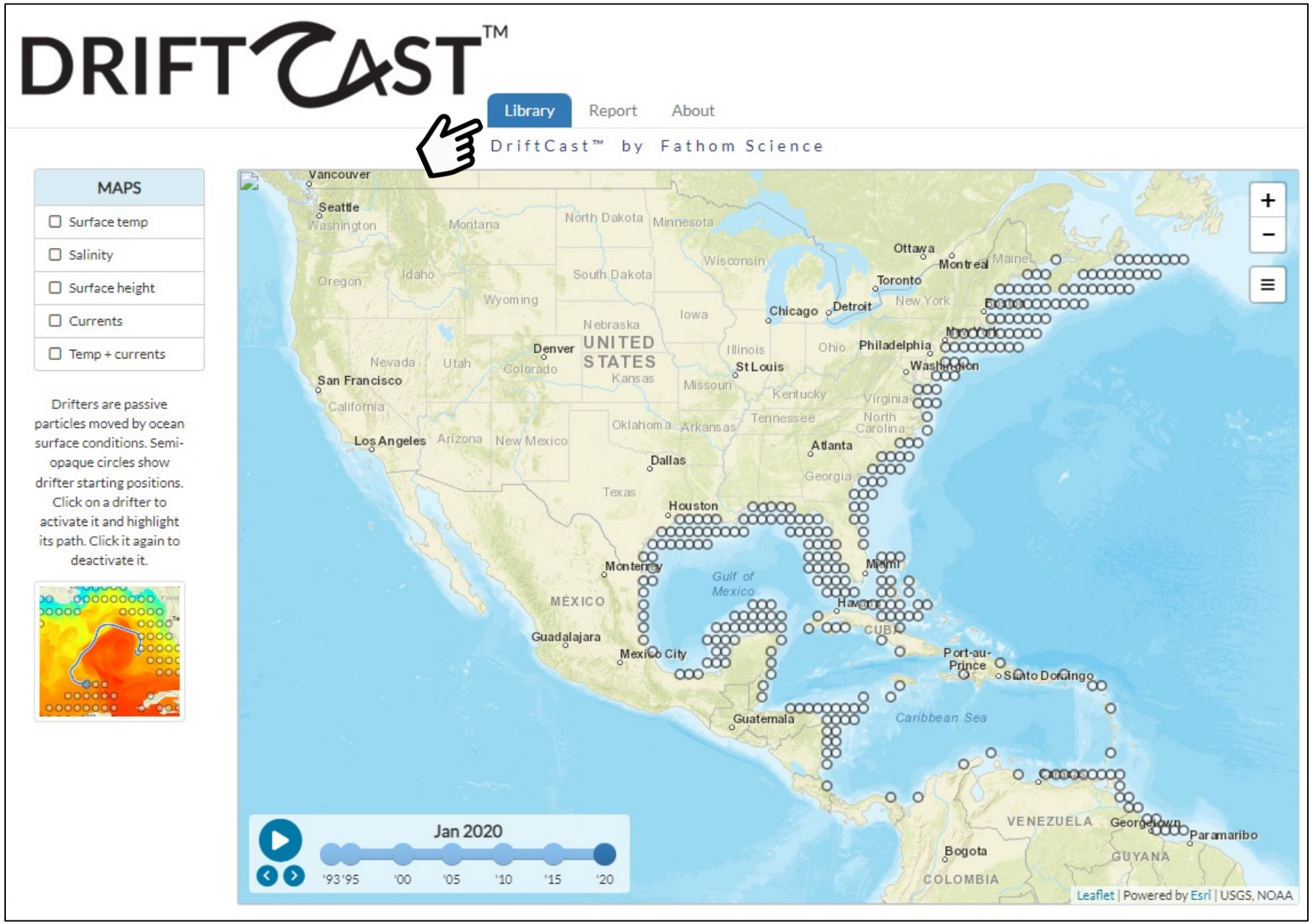
End User Requests:

1. Greater spatial coverage
2. View ocean conditions
3. More interactive



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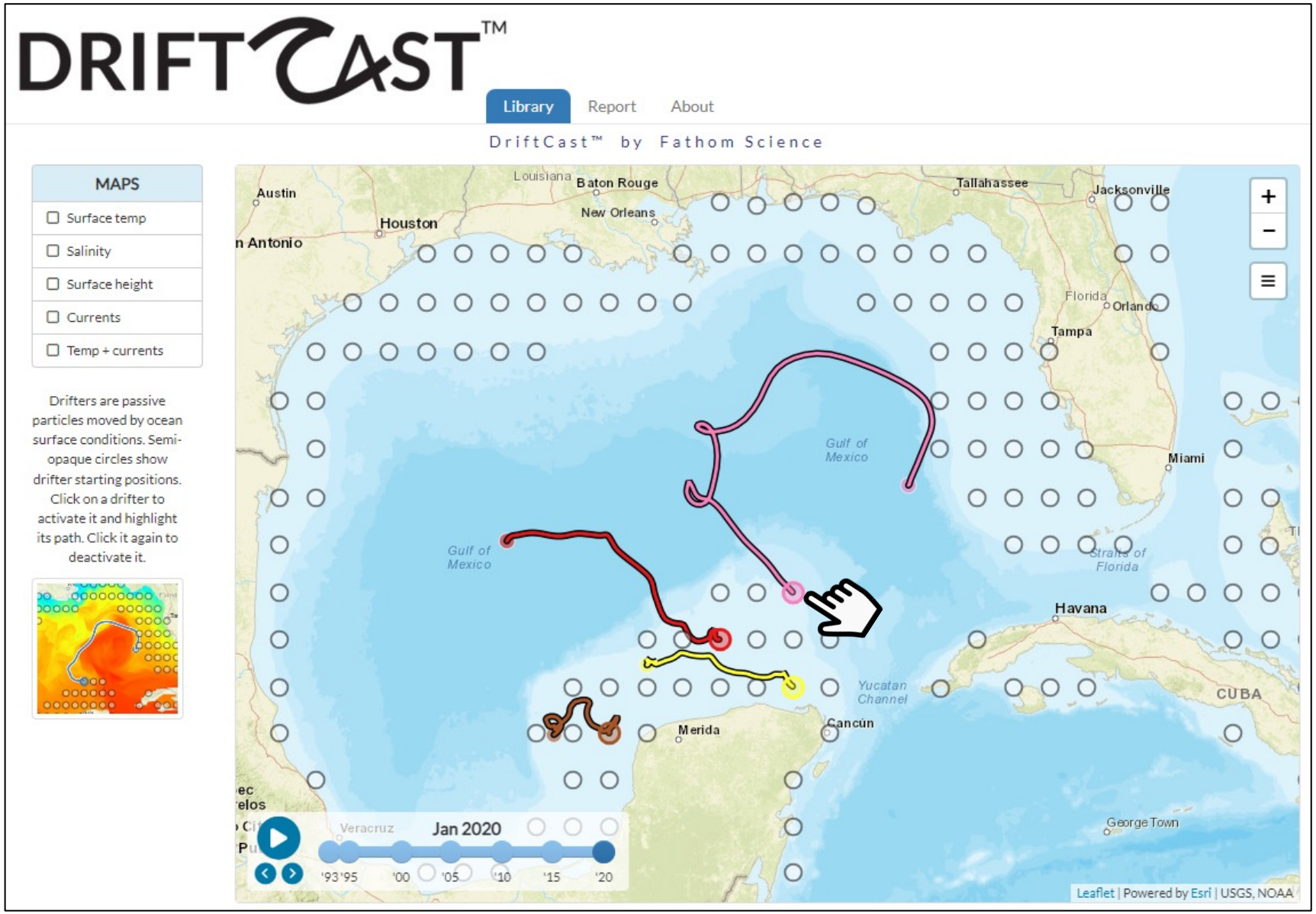
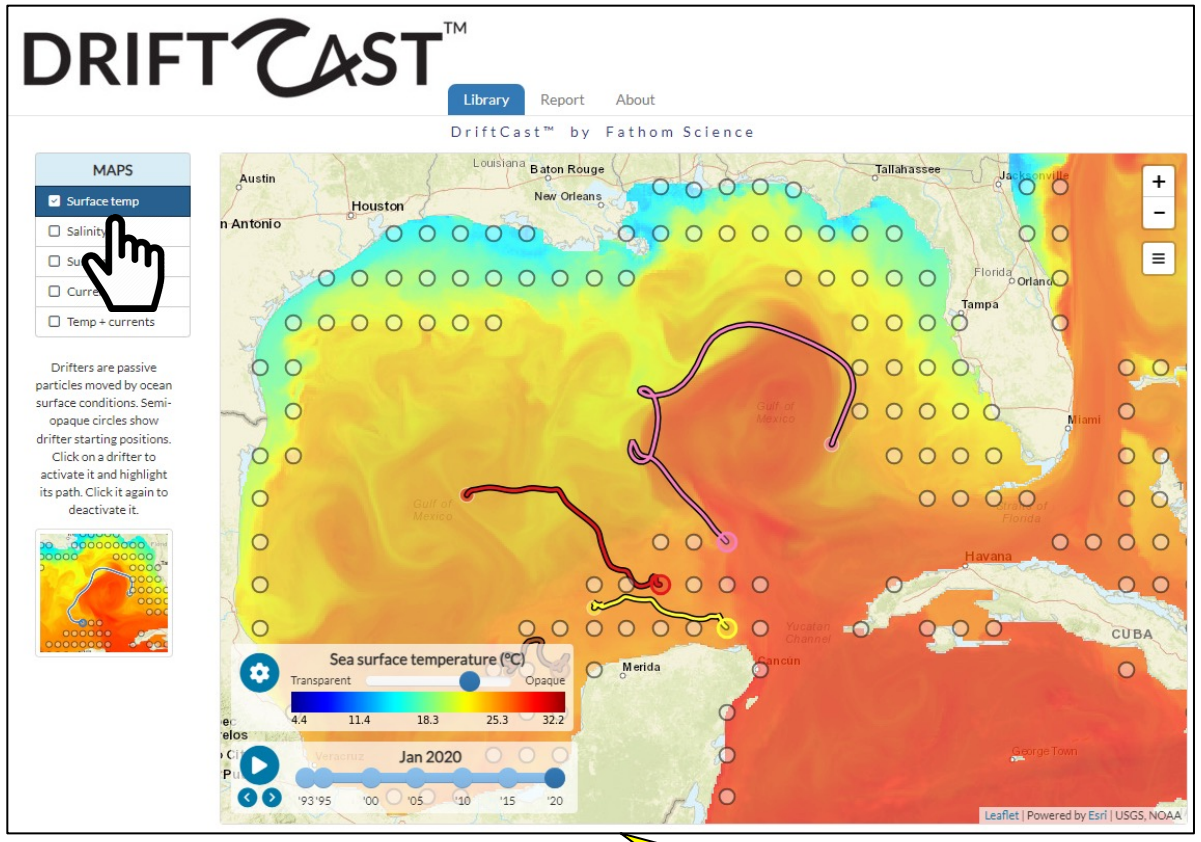
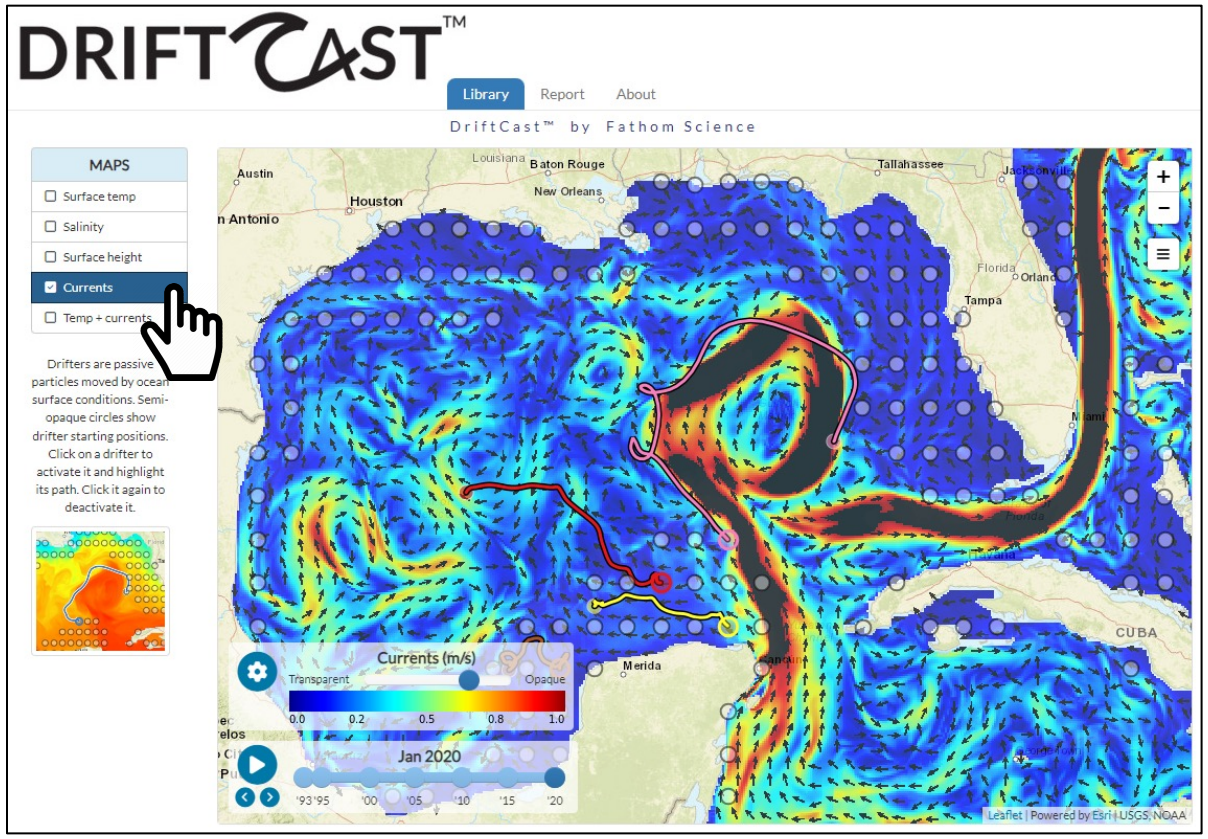
View 4-week drift from many locations



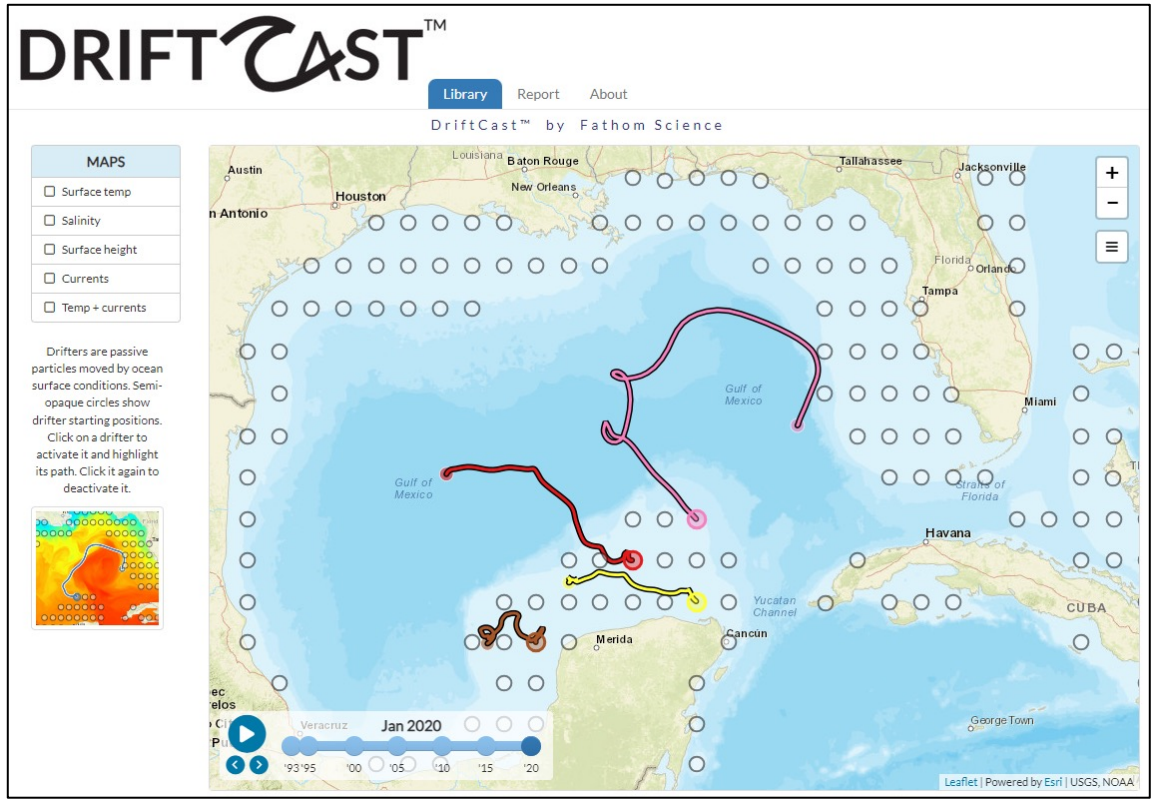
DriftCast Library

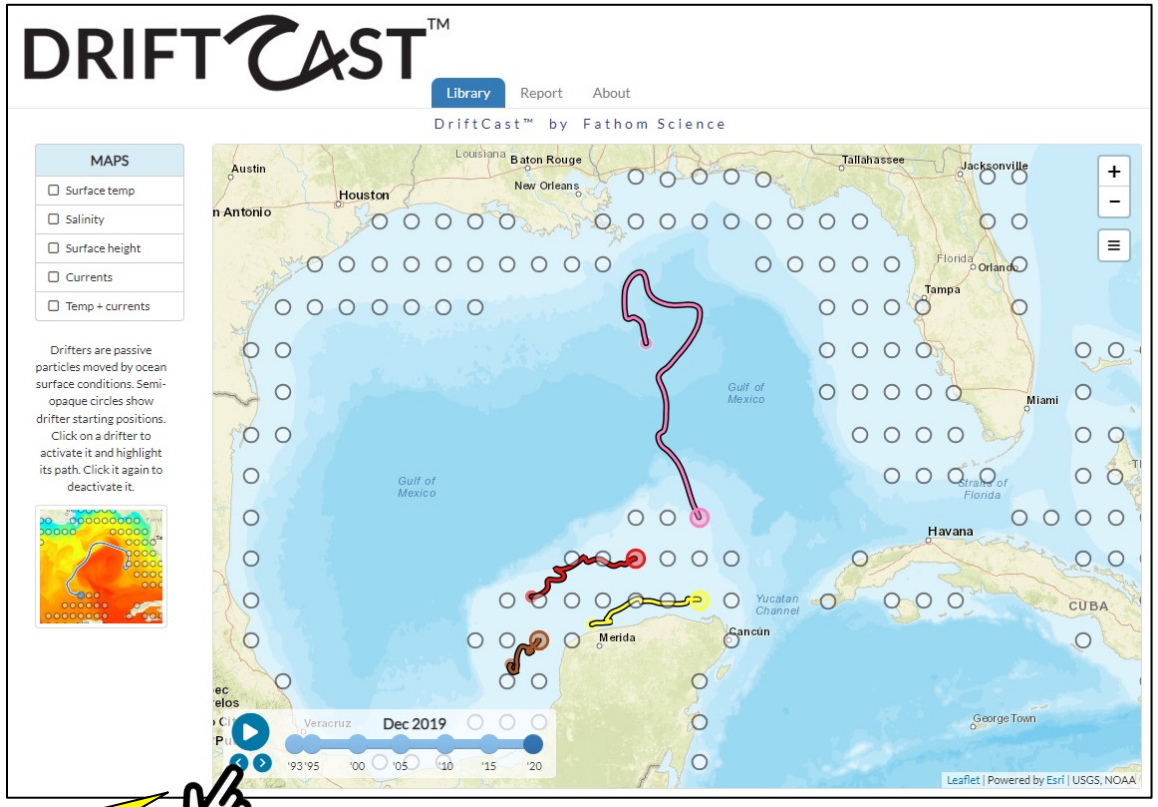




View monthly background ocean conditions

DriftCast Library





Use time slider to see how dispersal varies each month

DriftCast Report

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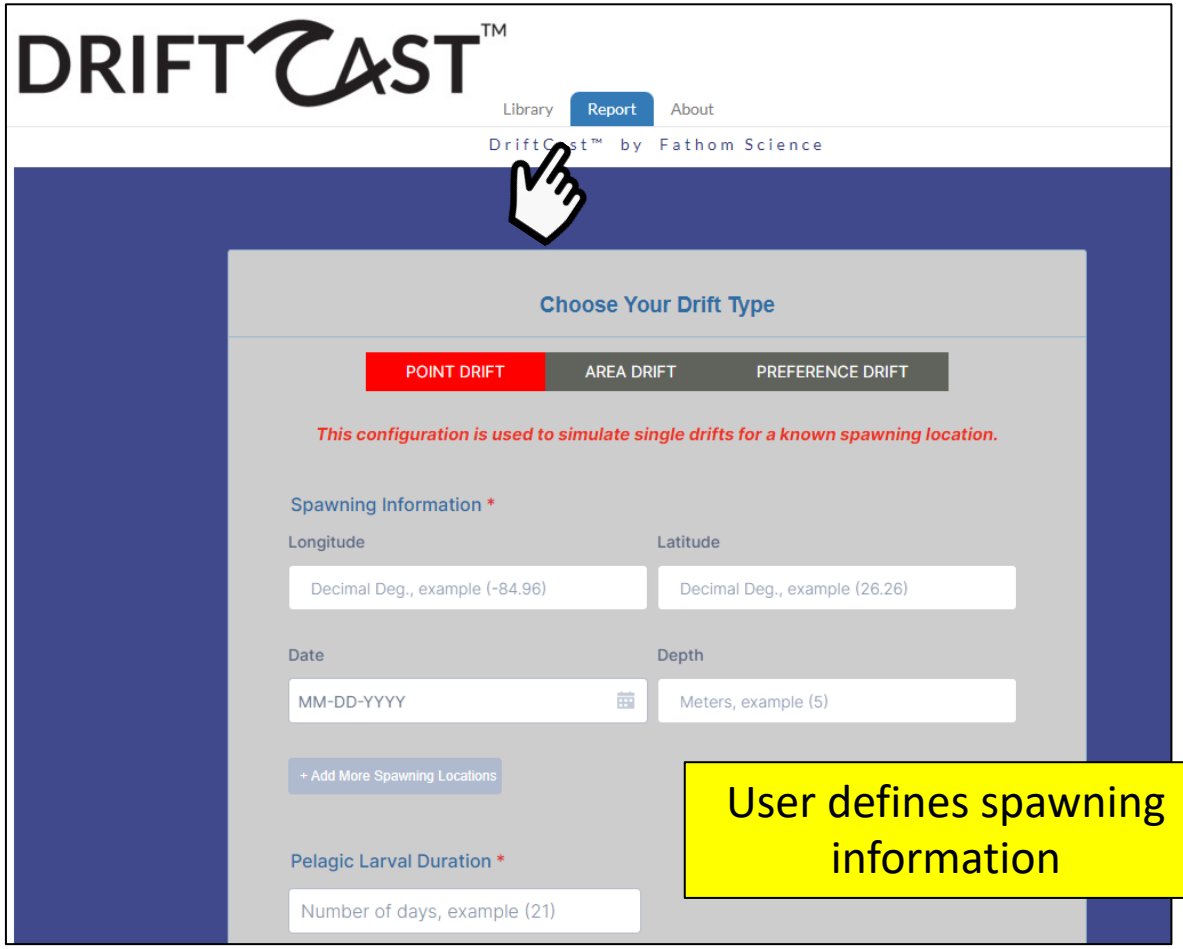
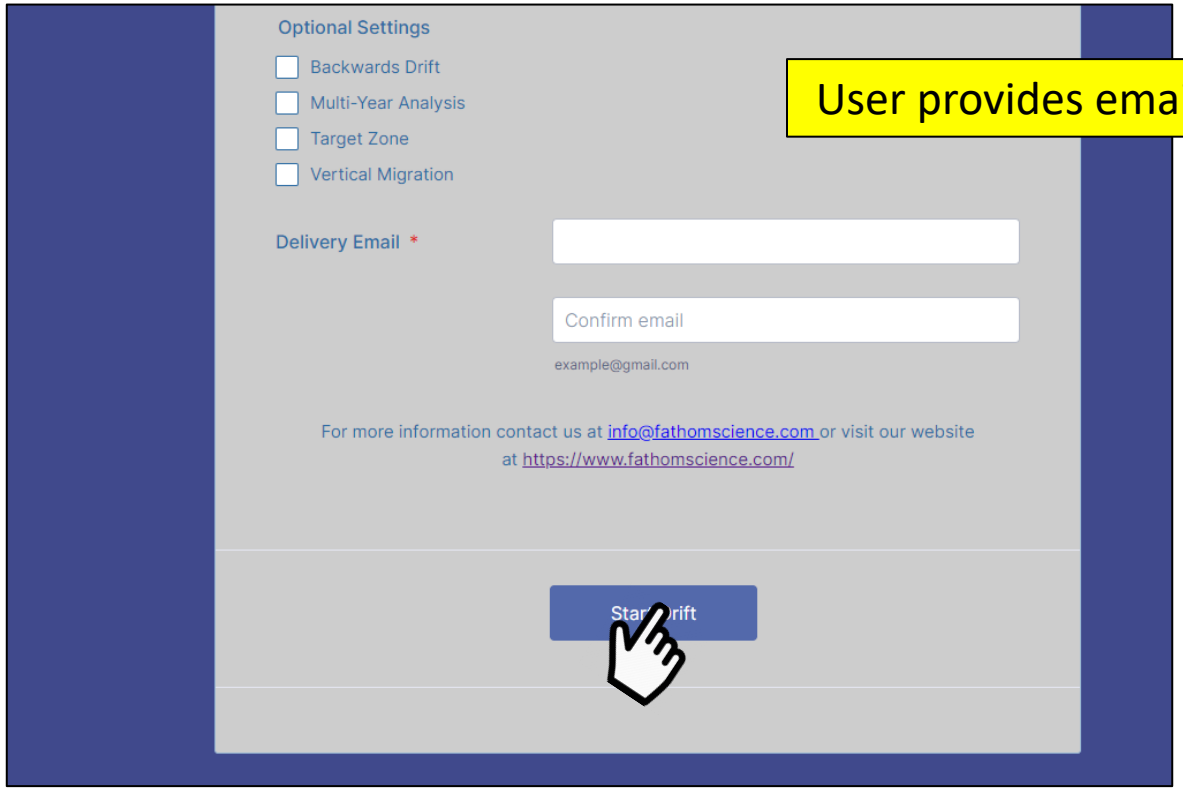


User defines spawning information



User provides email

- Spawning locations and times vary significantly between species. Hence it is important to give some users the ability to run their own simulations.
- Fisheries managers are not typically experienced with ocean modeling. DriftCast Report remove this barrier.

DriftCast Report Flow

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Your submission has been received and your Drift is now running on our servers!

We will notify you when your analysis is complete.

Results will be sent to: tshropshire@fathomscience.com

Submit another Drift

Gmail

Your Drift

Compose

Inbox 64
Starred
Snoozed
Sent
Drafts 3
More

Labels

Your Drift is Complete! [Submission ID: 000_tshropshire] External Inbox ×

t tashrops@gmail.com
to

The results of your Drift are now available in the link below:

http://18.205.105.94/driftcast/submissions/sub_000_tshropshire/

To submit another Drift simulation:

https://submit.jotform.com/232826188384163

Reply Forward

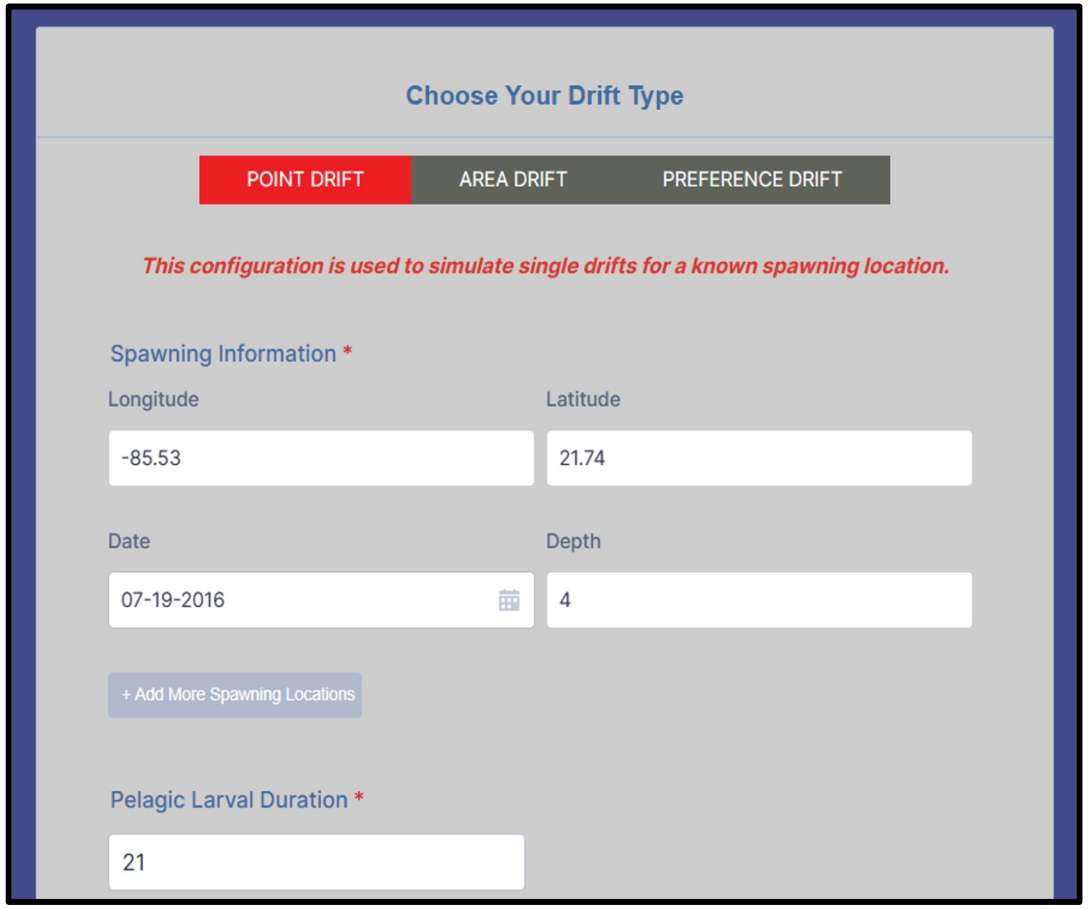
Email sent to user when simulation is complete

Index of /driftcast/submissions/sub_002_tshropshire

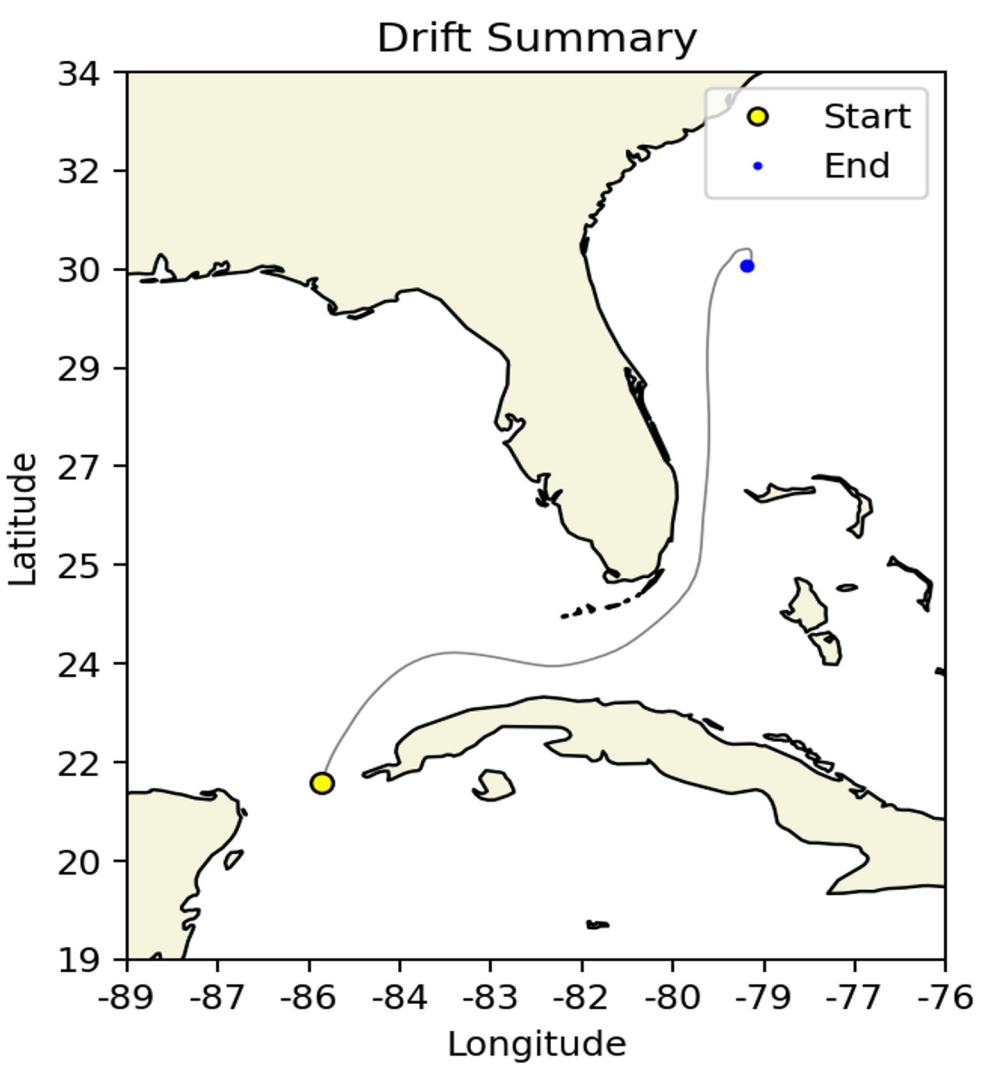
Name	Last modified	Size	Description
Parent Directory		-	
Drift_ALL.png	2023-11-14 05:12	128K	
Drift_End.png	2023-11-14 05:12	102K	
TargetZone_Bar.png	2023-11-14 05:12	24K	

Simulation images

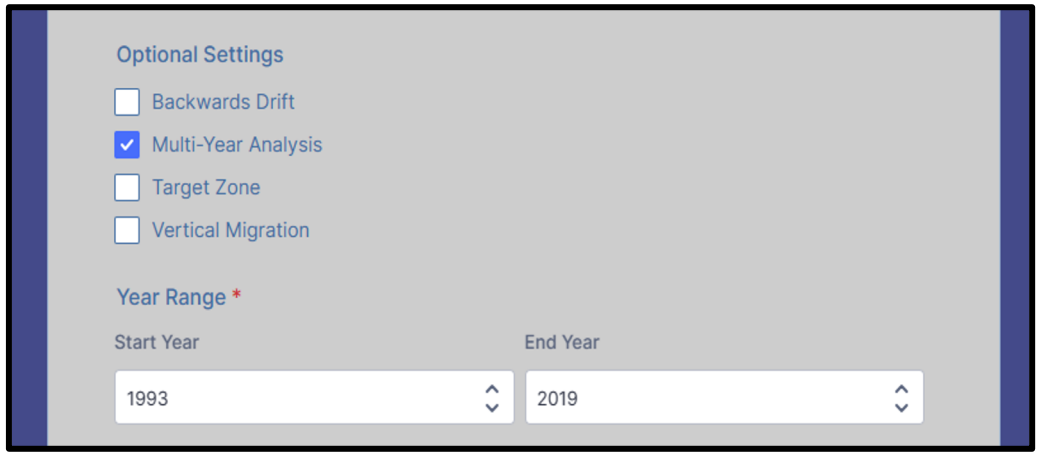
Example Simulation



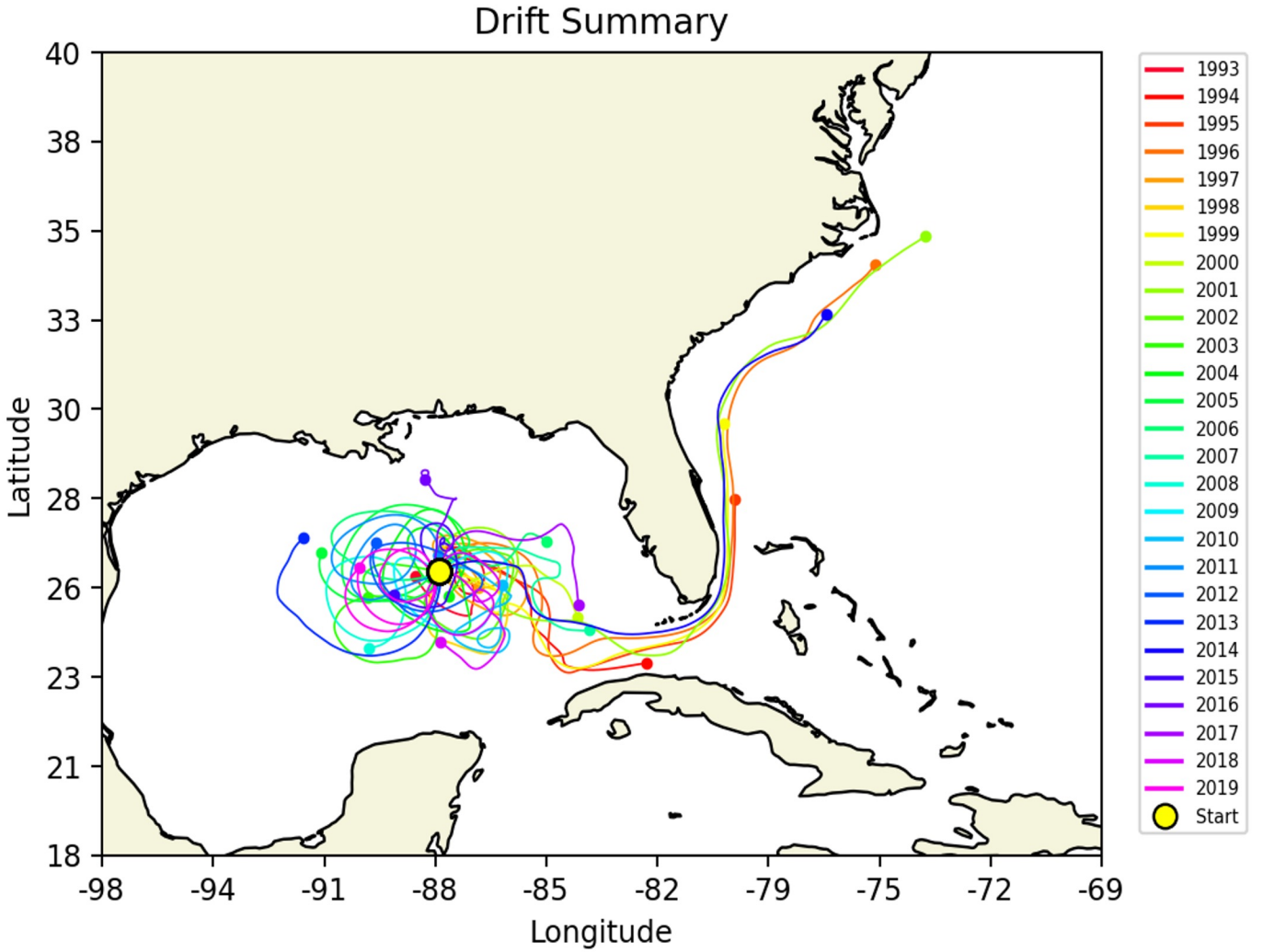
Most simplified simulation is a single point Drift



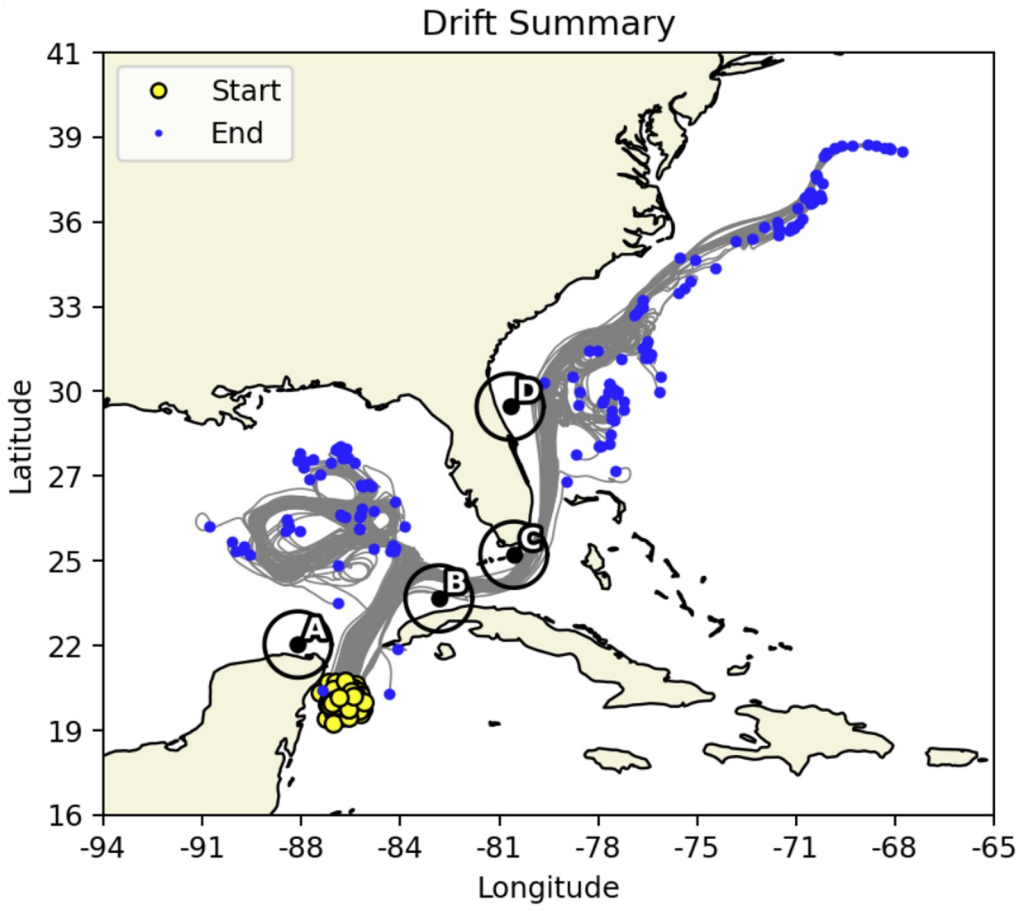
Example Simulation

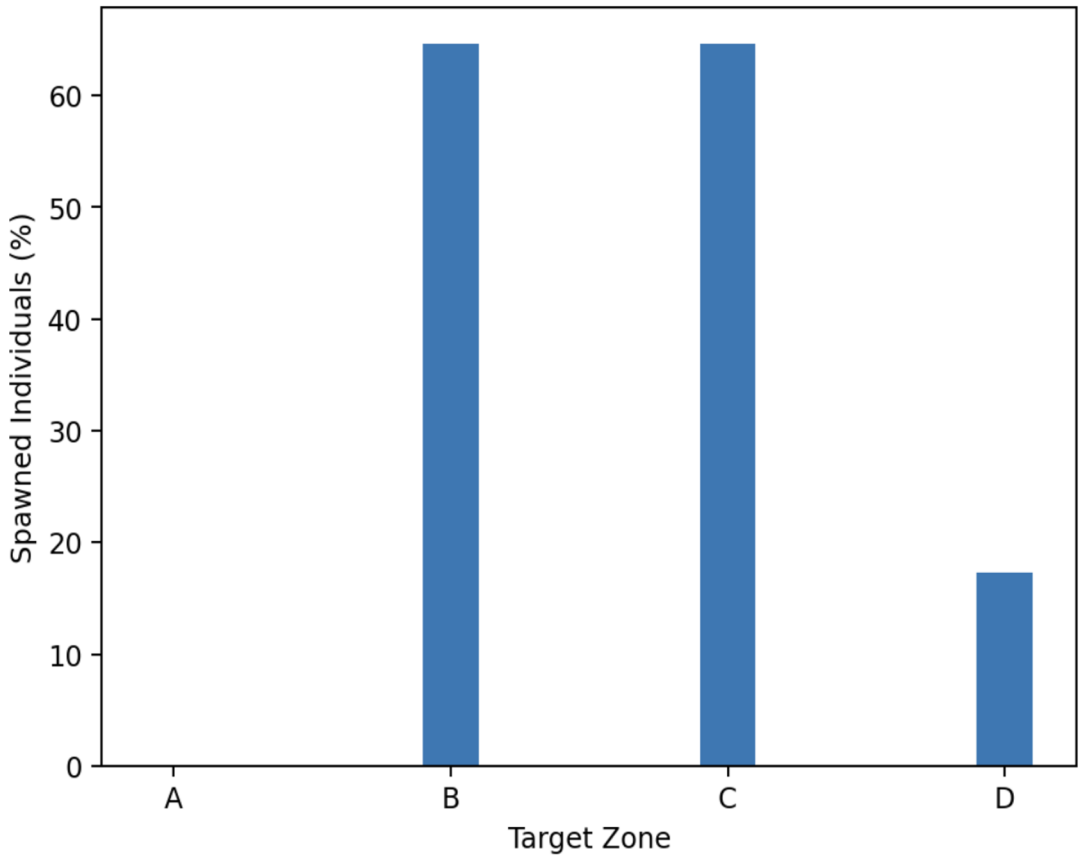


View interannual variability to help fisheries managers understand connectivity in their region



Example Simulation





DriftCast provides **actionable information** if the user defines “Target Zones”

End User Engagement

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Workshop November, 2023

Florida Fish and Wildlife Conservation Commission

South Carolina Department of Natural Resources

South Atlantic Fishery Management Council

TEXAS A&M UNIVERSITY

Sea Grant NORTH CAROLINA

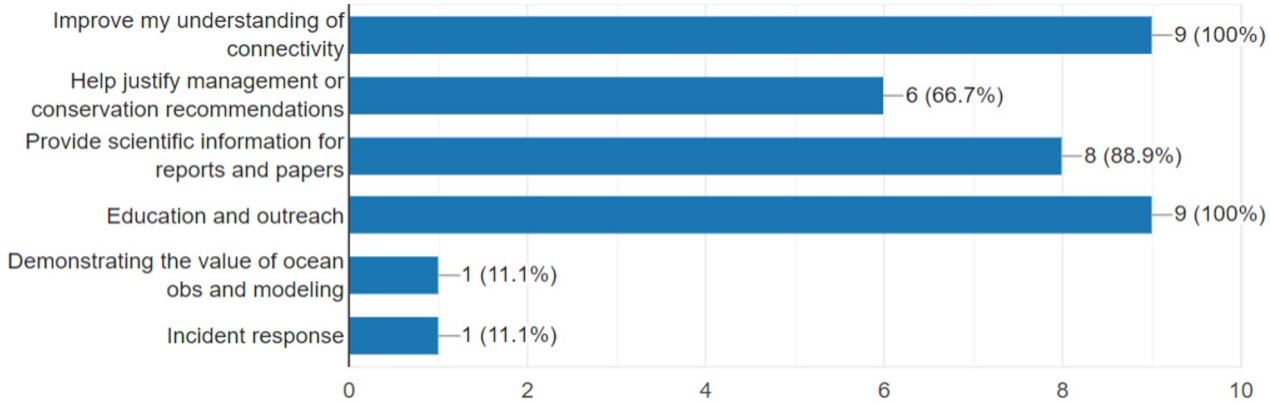
THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Environmental Defense Fund

NORTH CAROLINA Environmental Quality

SECOORA Southeast Coastal Ocean Observing Regional Association

How might DriftCast help your efforts? Please check all that apply.



Main Feedback

1. Ability to run multiple year simulations quickly
2. Interactive simulation results
3. Error Messaging
4. Further realism (offshore-inshore connection)

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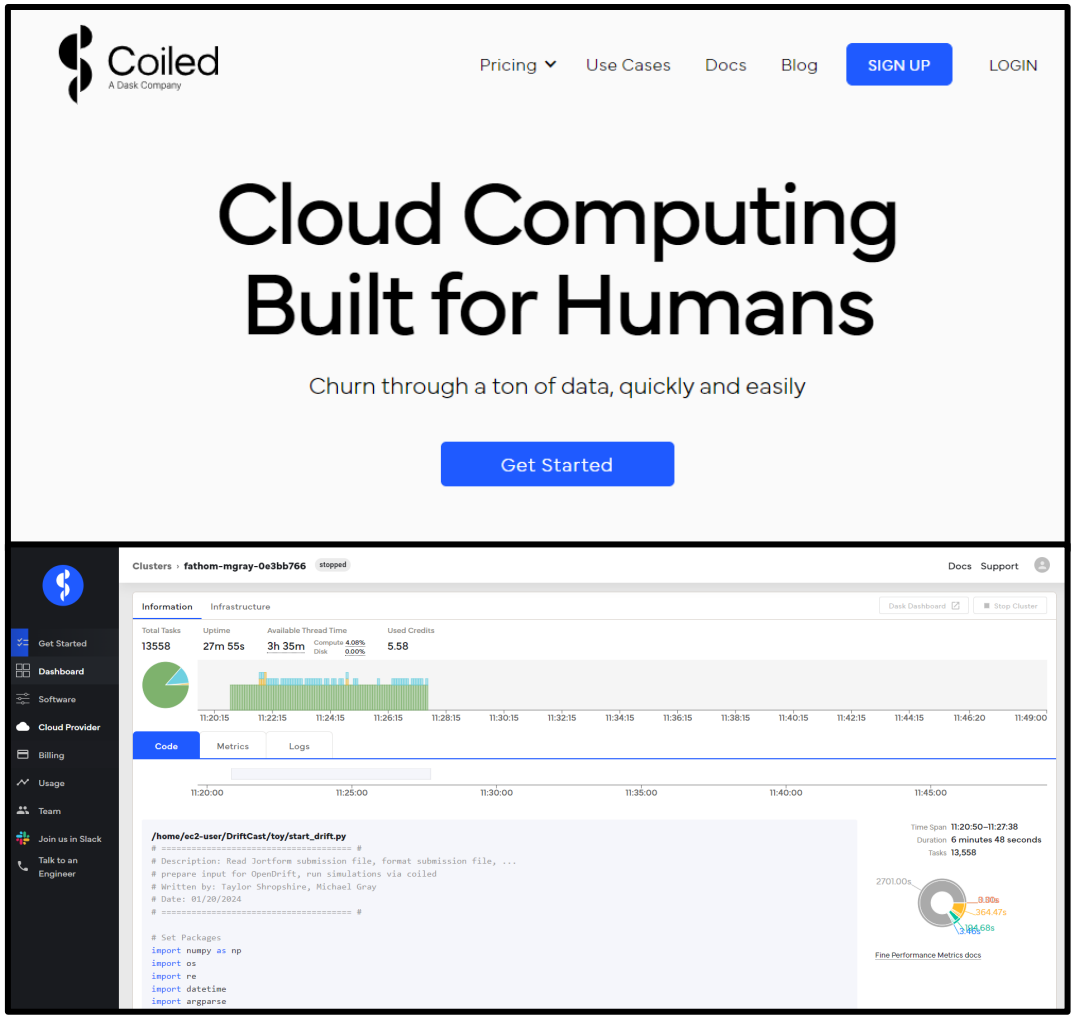
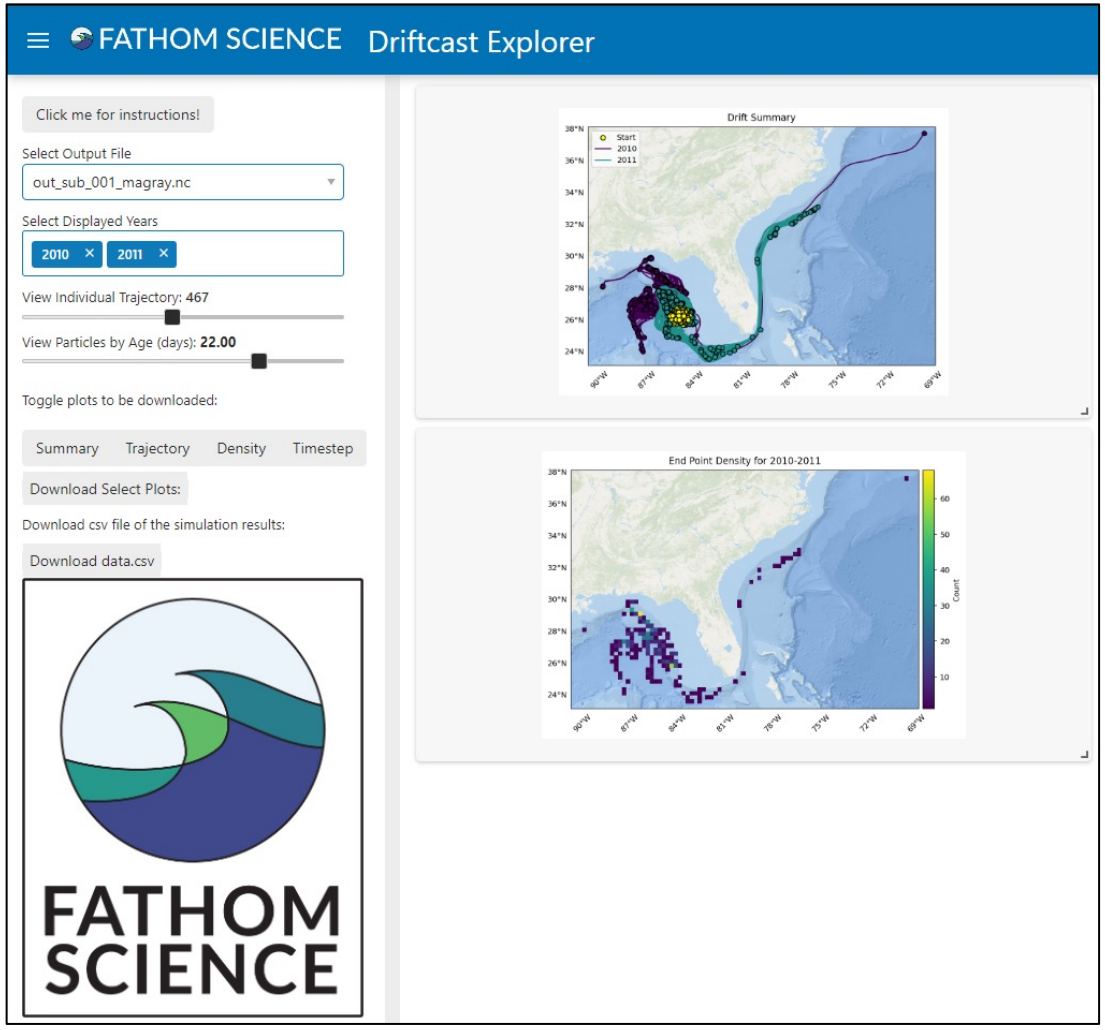
Scale users with cloud computing

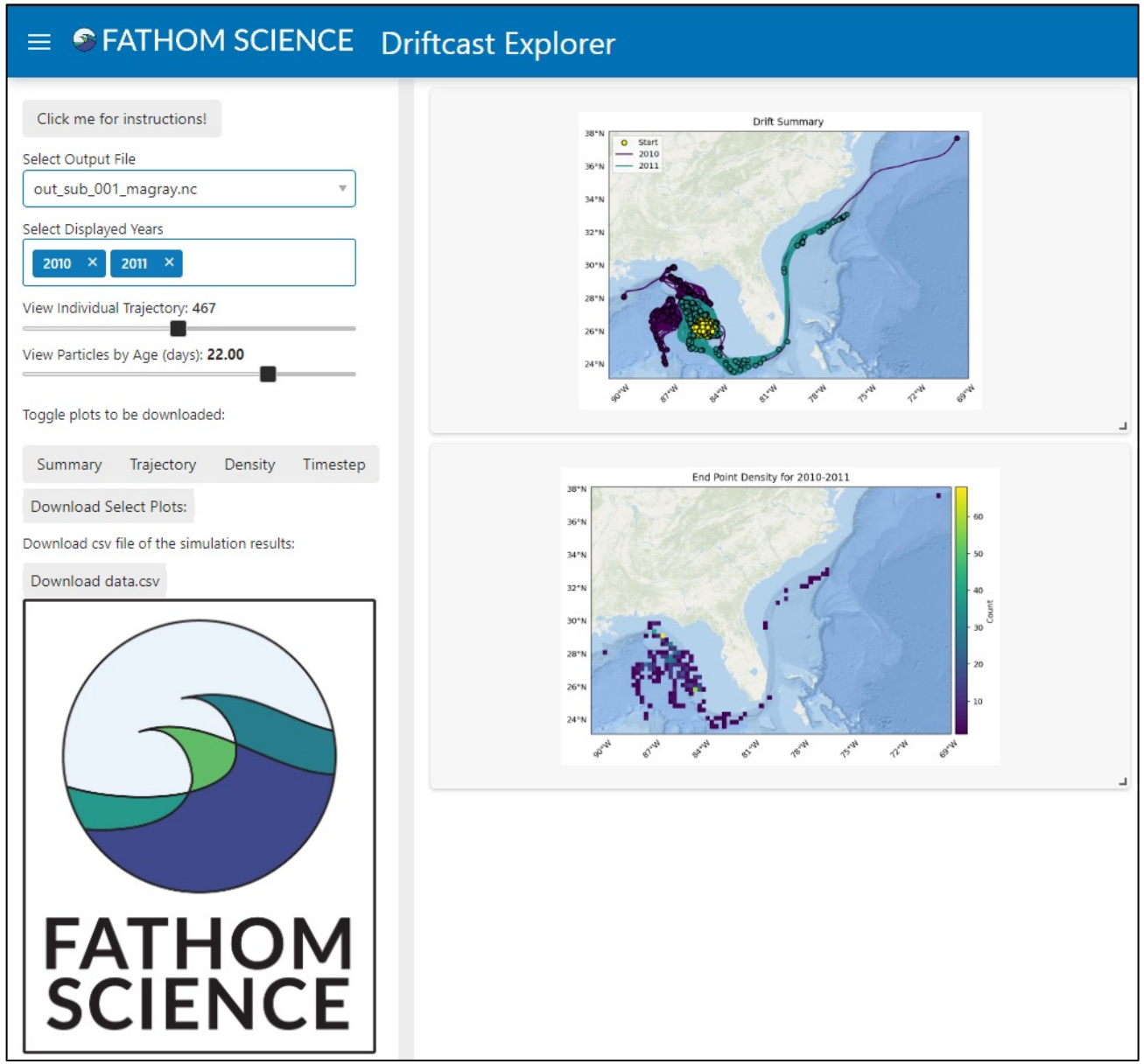


Interactive Results



Interactive Results

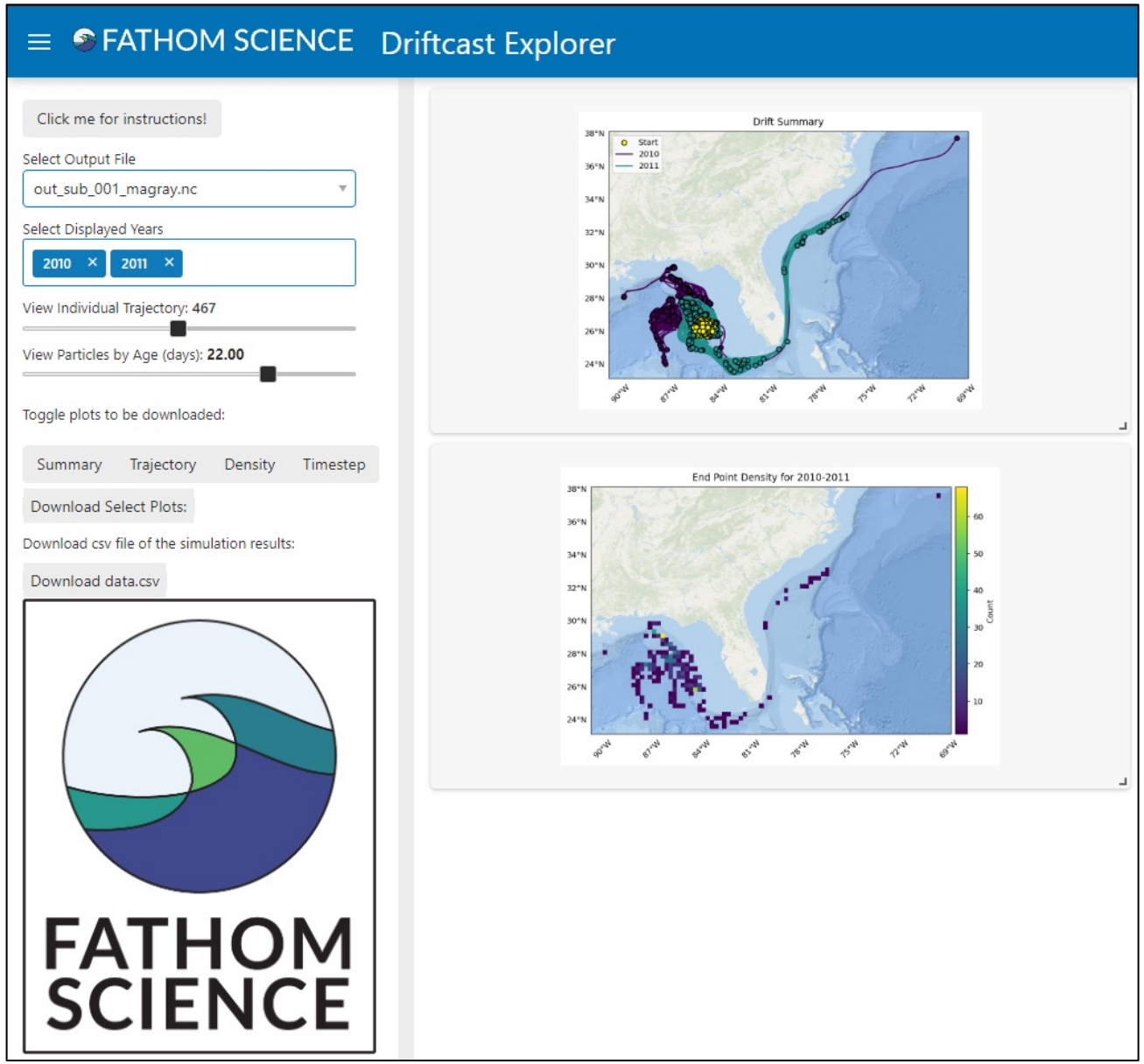
Select simulation file



Interactive Results

Select simulation file

Select years



Interactive Results

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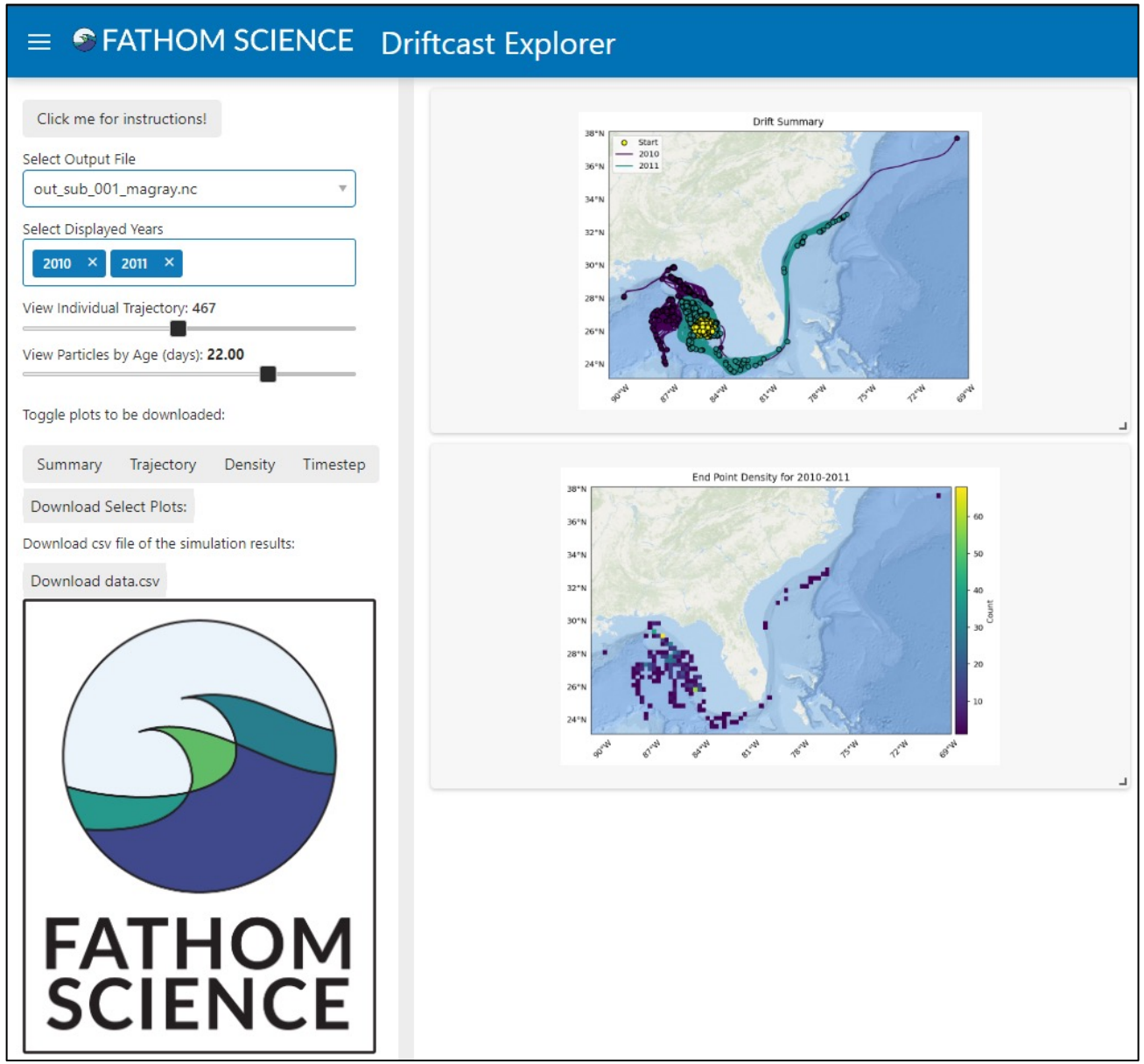
Select simulation file

Select years

Download plots



Interactive Results

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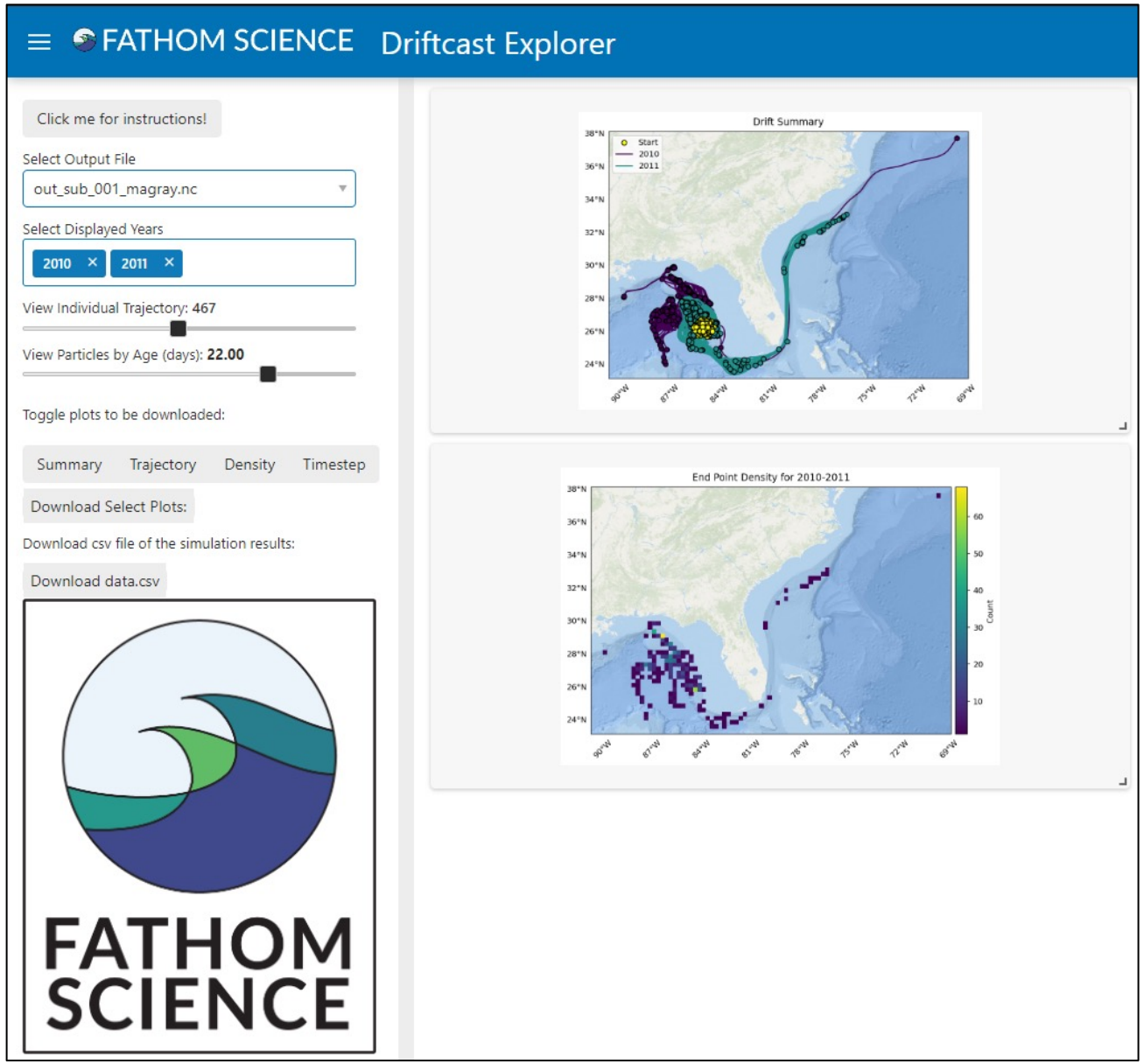
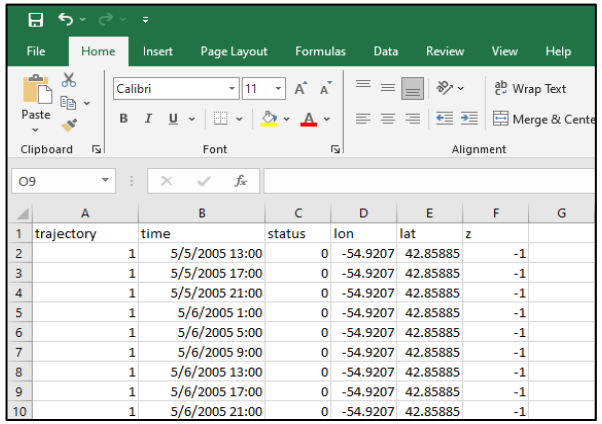
Select simulation file

Select years

Download plots

Download data



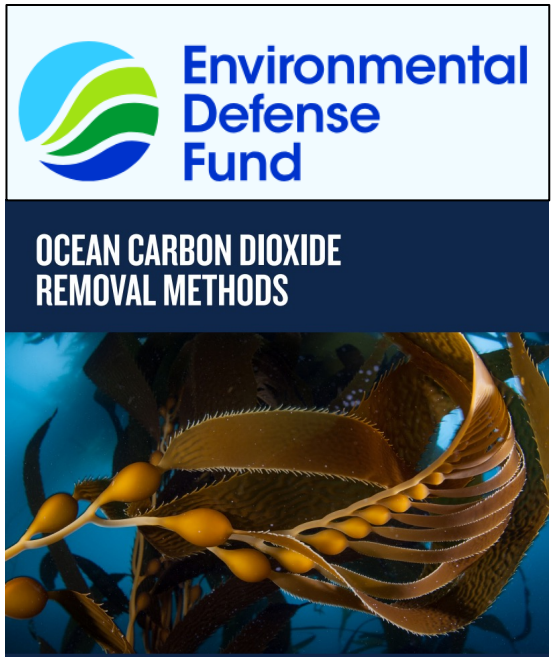


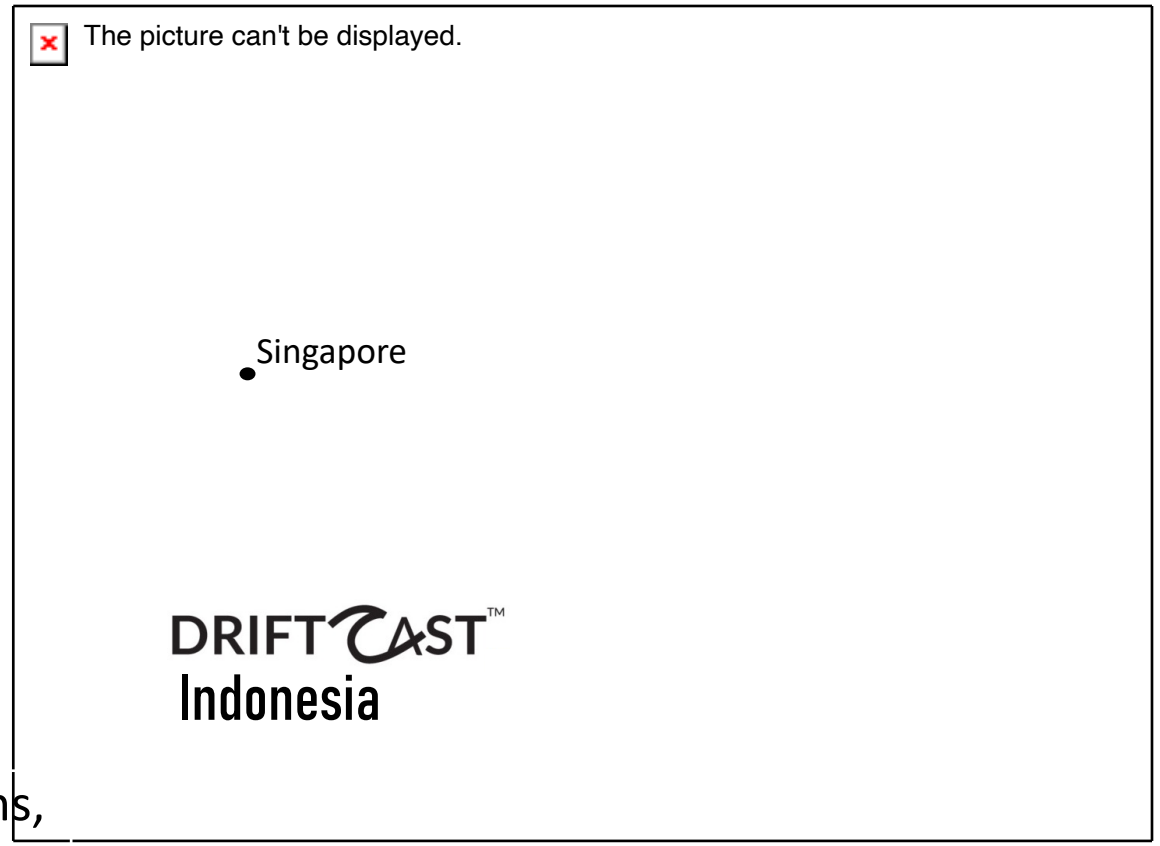
	A	B	C	D	E	F
1	trajectory	time	status	lon	lat	z
2	1	5/5/2005 13:00	0	-54.9207	42.85885	-1
3	1	5/5/2005 17:00	0	-54.9207	42.85885	-1
4	1	5/5/2005 21:00	0	-54.9207	42.85885	-1
5	1	5/6/2005 1:00	0	-54.9207	42.85885	-1
6	1	5/6/2005 5:00	0	-54.9207	42.85885	-1
7	1	5/6/2005 9:00	0	-54.9207	42.85885	-1
8	1	5/6/2005 13:00	0	-54.9207	42.85885	-1
9	1	5/6/2005 17:00	0	-54.9207	42.85885	-1
10	1	5/6/2005 21:00	0	-54.9207	42.85885	-1

Next Steps and Broader impacts

Next Steps:

- Error messaging
- Large scale promotion of DriftCast to increase adoption
- Future work to couple DriftCast with inshore models to better simulate settlement
- Expand to international regions





New applications emerging (Seaweed Farms, Sargassum, Marine Plastics)

Thank you

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For more information about
DriftCast or Fathom Science

LinkedIn

Stop by the DriftCast Poster

Hear more about end user engagement from collaborator
Aaron Adams (Thursday May 9th 9:00 am session)

Additional slides

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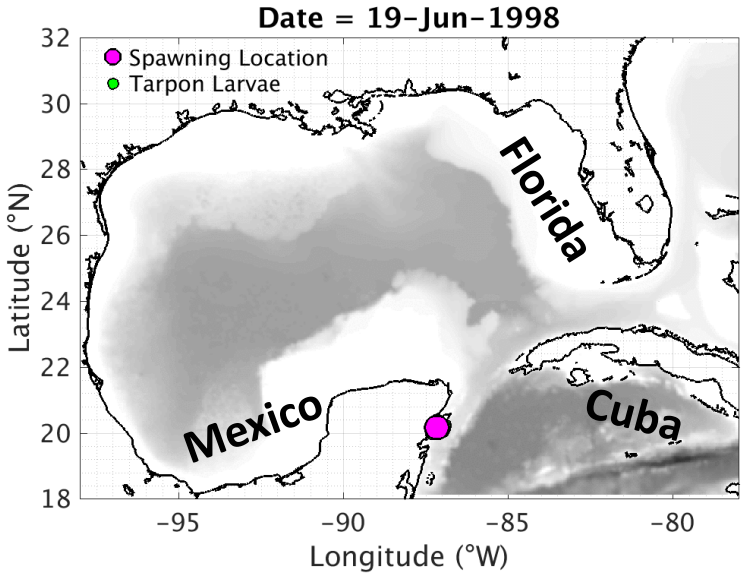

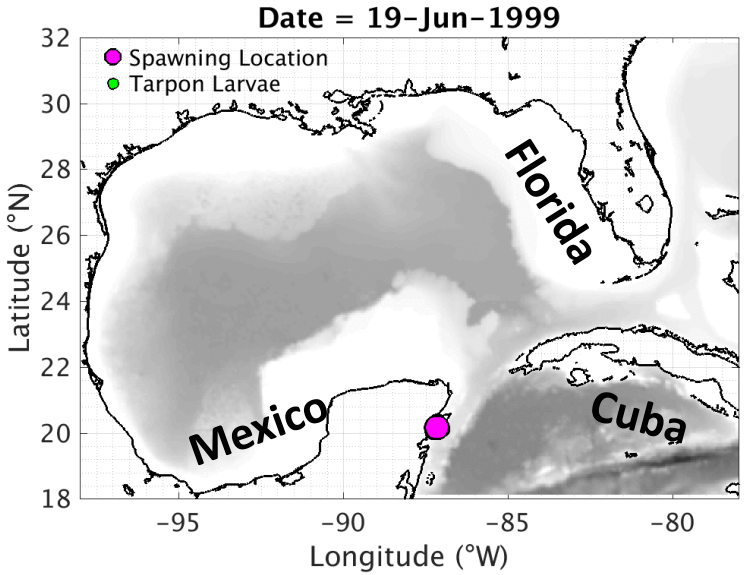

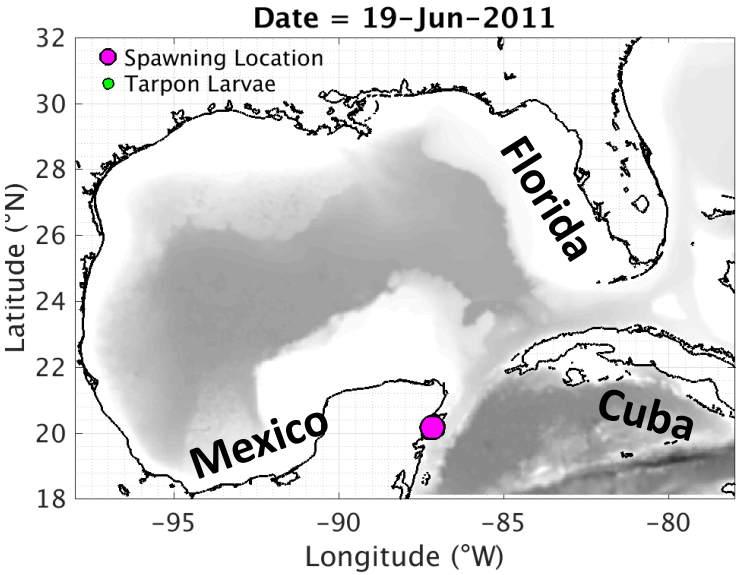

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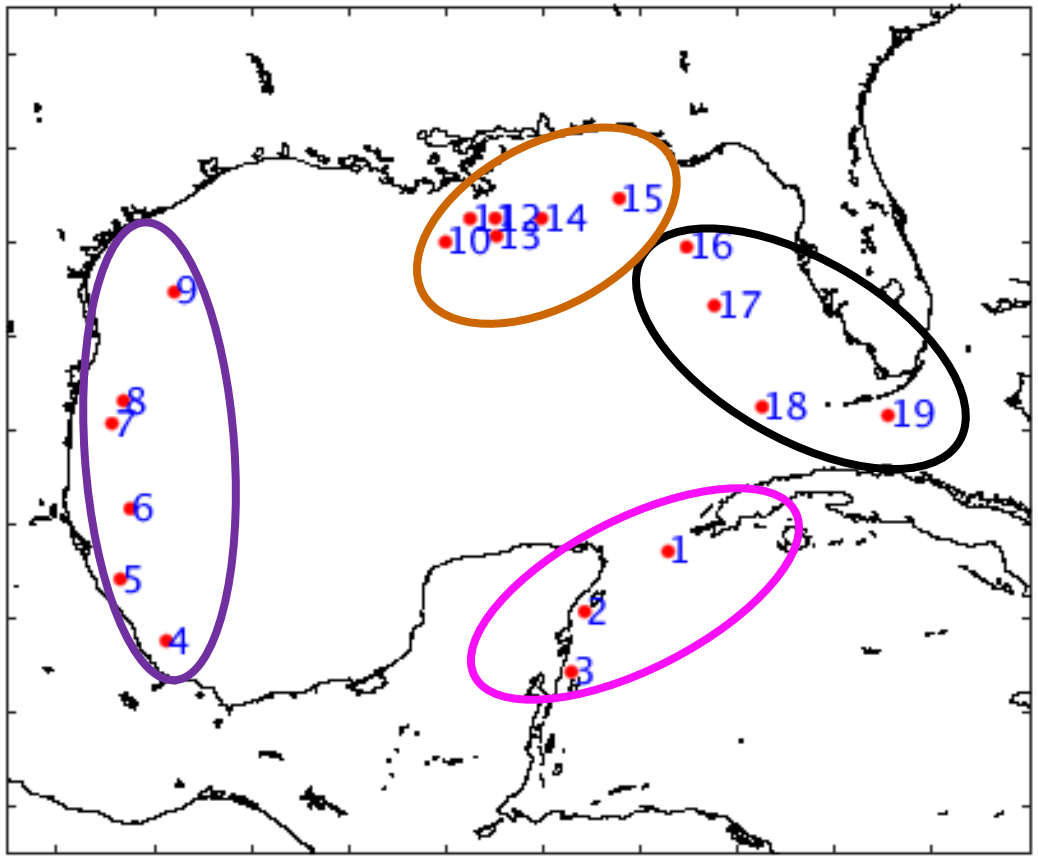
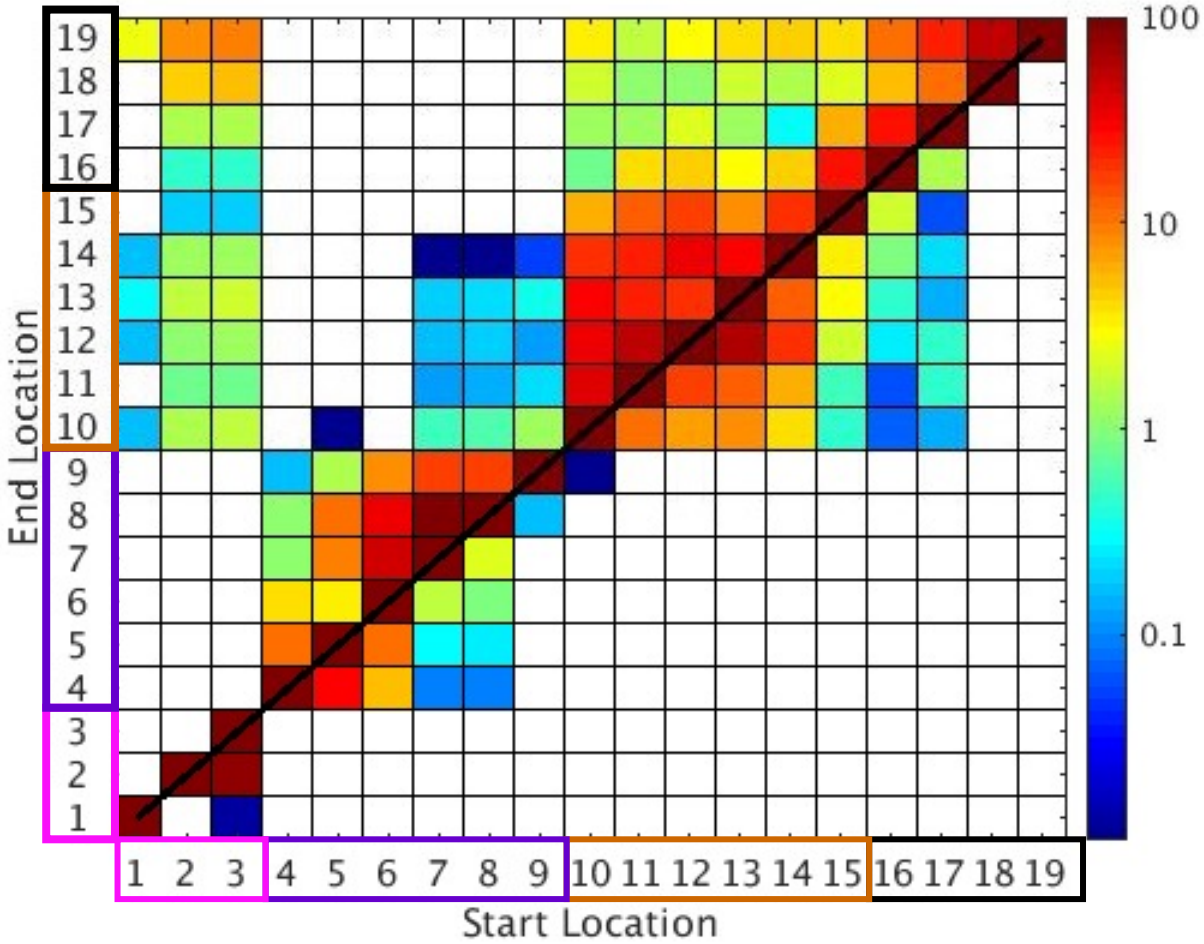
Tarpon Spawning



~ S-GOM, W-GOM, N-GOM, E-GOM

Connectivity “Pass Through”



Note: *Only using a quarter degree radius