Predicting Dispersal and Connectivity: A New Tool for Marine Resource Management

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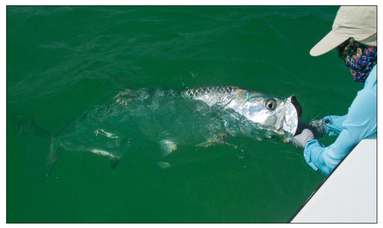
This material is based upon work supported by NASA under award Number 80NSSC21K1471

Challenge

Most marine fishes have a life cycle that decouples the adult, larval, and juvenile stages. This causes the spatial scales of marine fisheries management and the biology of the managed species to be mismatched. Thus, one of the greatest challenges for marine fisheries management is understanding the connectivity between reproduction and recruitment at appropriate spatial scales. Until now, oceanographic models have not been user friendly, and most don't incorporate managed species' biology, limiting their utility for management.

Larval Tarpon



Adult Tarpon

New Larva Tracking Tool

Here we introduce a user-friendly, interactive, web-based larva tracking tool **designed for resource managers.** The model combines ocean currents with the biology of focal species to describe **connectivity pathways**. To develop this, we are using the economically important recreational "flats" fishery species – tarpon, bonefish, & permit – in the Gulf of Mexico, southeastern US, and Caribbean Sea.

Finding: Strong Yearly Variation

To the bottom right, you can see larval transport pathways over a four week period from the same Tarpon spawning site during three years (1998, 1999, and 2011) with vastly different dispersal patterns. This dispersal variation is due to differing ocean conditions and can significantly impact the number of new fish ending up in specific areas (i.e. recruitment). In the Gulf of Mexico, variability in ocean conditions are strongly dictated by the Loop Current.

How It Works

Our cutting-edge 30-year hindcast of ocean conditions provides the setting in which "particle" drifts are modeled. Users can input specifications in a simple interface. The output is maps, data, and diagnostics of where the particles (e.g., eggs and larvae) are moved by ocean currents.

User Specifications

Choose your release type: Point, Area, or Regional

Point release:

Date	M/D/Y:		[csv upload]
Duration	Days:		[csv upload]
Depth	(m):		[csv upload]
Location	Longitude:	Latitude:	[csv upload]

Area release:

Area	Radius:	
Particles	Number:	

Regional release:

Day Preference	Min:	Max:	Mode:
Depth Preference	Min:	Max:	Mode:
Temperature Preference	Min:	Max:	Mode:
Bathymetric Preference	Min:	Max:	Mode:
Lunar Preference	Min:	Max:	Mode:

Other:

End Zone Location	Longitude	Latitude:	[csv upload]
End Zone Radius	Radius:		
Vertical Migration	Depth Min:	Depth Max:	Speed:

Start Drift

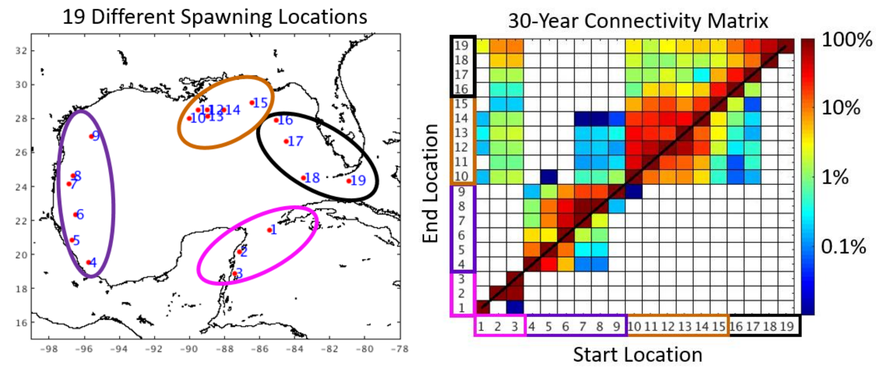
Start your drift, download data, and visual patterns

Destinations and Sources

The larval tracking tool can be run forward to map the **destinations** where larvae could end up after a spawning event, or backward to map the **sources** where settled larvae at a given site could have come from, thus exploring population connectivity.

Connectivity

Source and sink populations can be examined using a connectivity matrix, which shows what percent of eggs starting at knows spawning sites reach known populations across a wide geographic area.



What % of larvae reach South Florida (19) from the Northern Gulf (10) each year?