

# Fish Aggregations in the Florida Keys

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# Why are aggregations important?

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- Certain species have reproductive opportunities limited to only these events
- Predictable, elevated densities susceptible to overharvesting



# Fish aggregations in the Florida Keys

## Setting the Stage:

Lindeman et al. 2000 described potential spawning aggregations sites in the FL Keys based on landings and communications with commercial fishermen

Research focused on two sites that were mentioned for multiple species:

- Riley's Hump in the Dry Tortugas
- Western Dry Rocks





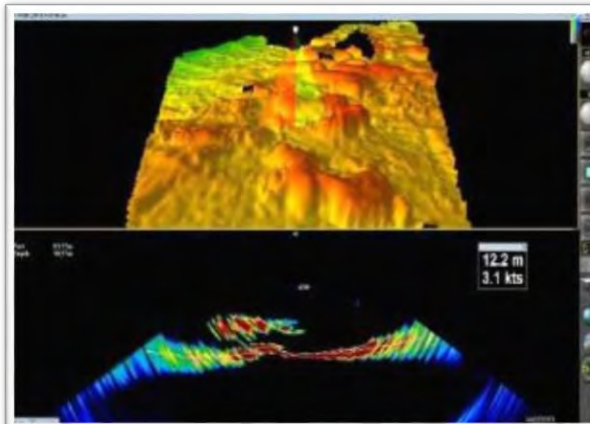
# Many different approaches are used

## Multiple Partnerships:

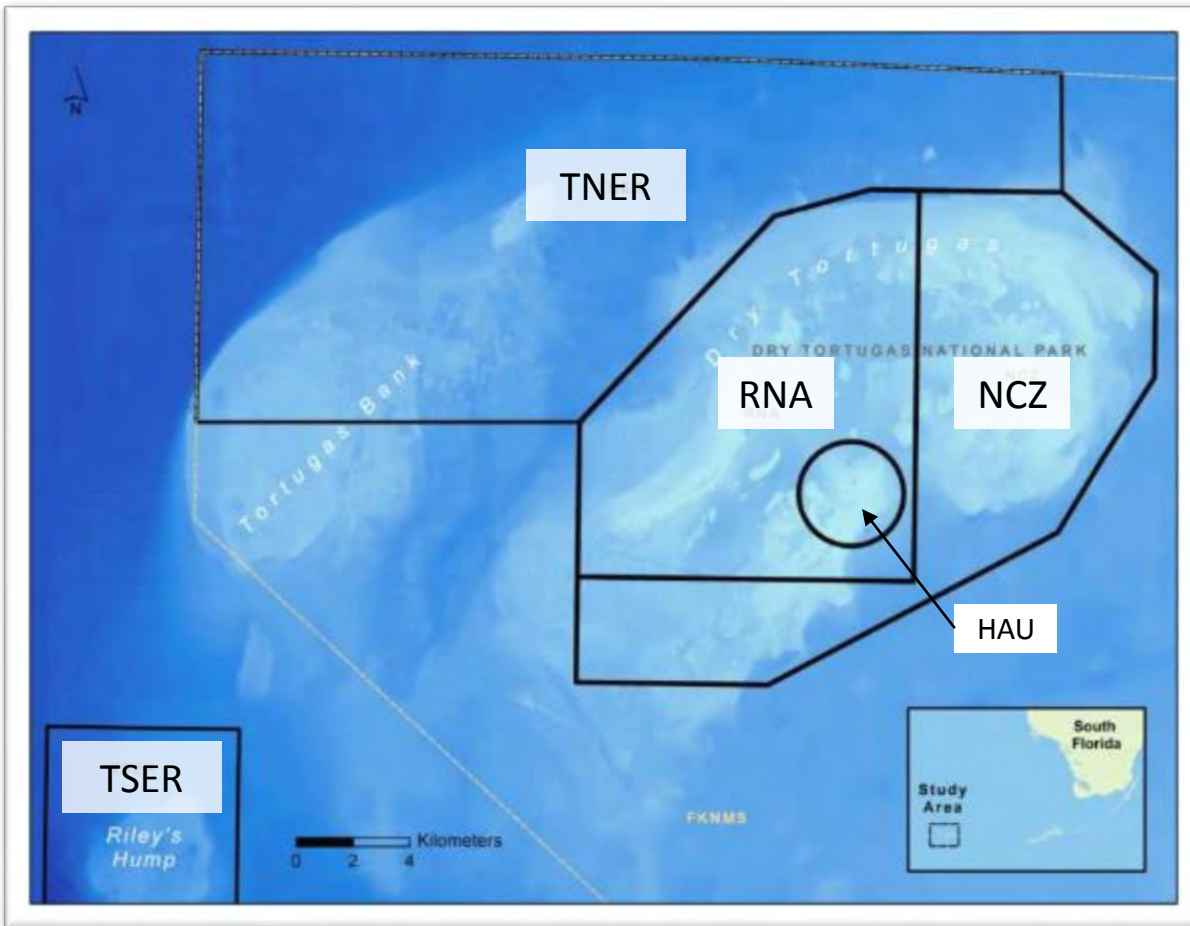


## Multiple approaches:

- Fish Acoustic Tagging
- Diver Surveys
- Multibeam data collection
- ROV Surveys
- Stereo Camera Deployments
- Passive Acoustic Hydrophone Deployments



# The Dry Tortugas



## Implemented 2001:

TSER – Tortugas South Ecological Reserve

TNER – Tortugas North Ecological Reserve

NCZ – Natural Cultural Zone

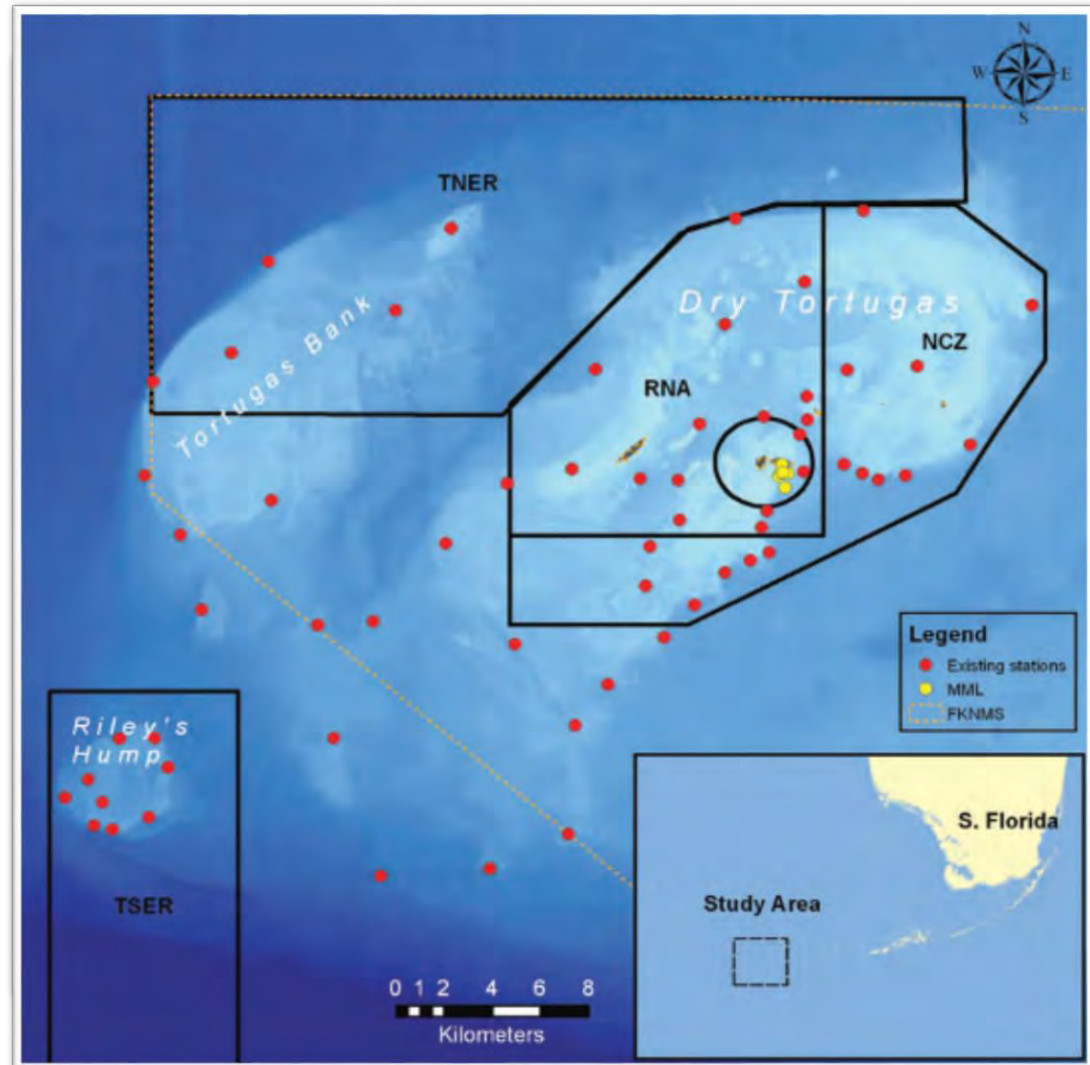
HAU – Historic Adaptive Use Zone

## Implemented 2007:

RNA – Research Natural Area

# Tagging of Mutton Snapper

- Connectivity of fishes within the Tortugas region of Florida.
  - **Riley's Hump** is a well known mutton snapper spawning aggregation site.
  - Mutton snapper were acoustically tagged within **the RNA & Riley's Hump** and tracked with a network of underwater acoustic receivers (represented by the dots on this map).

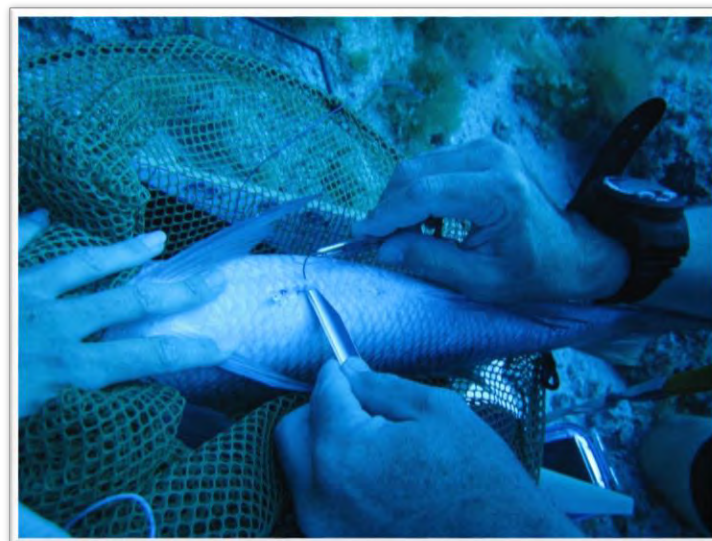


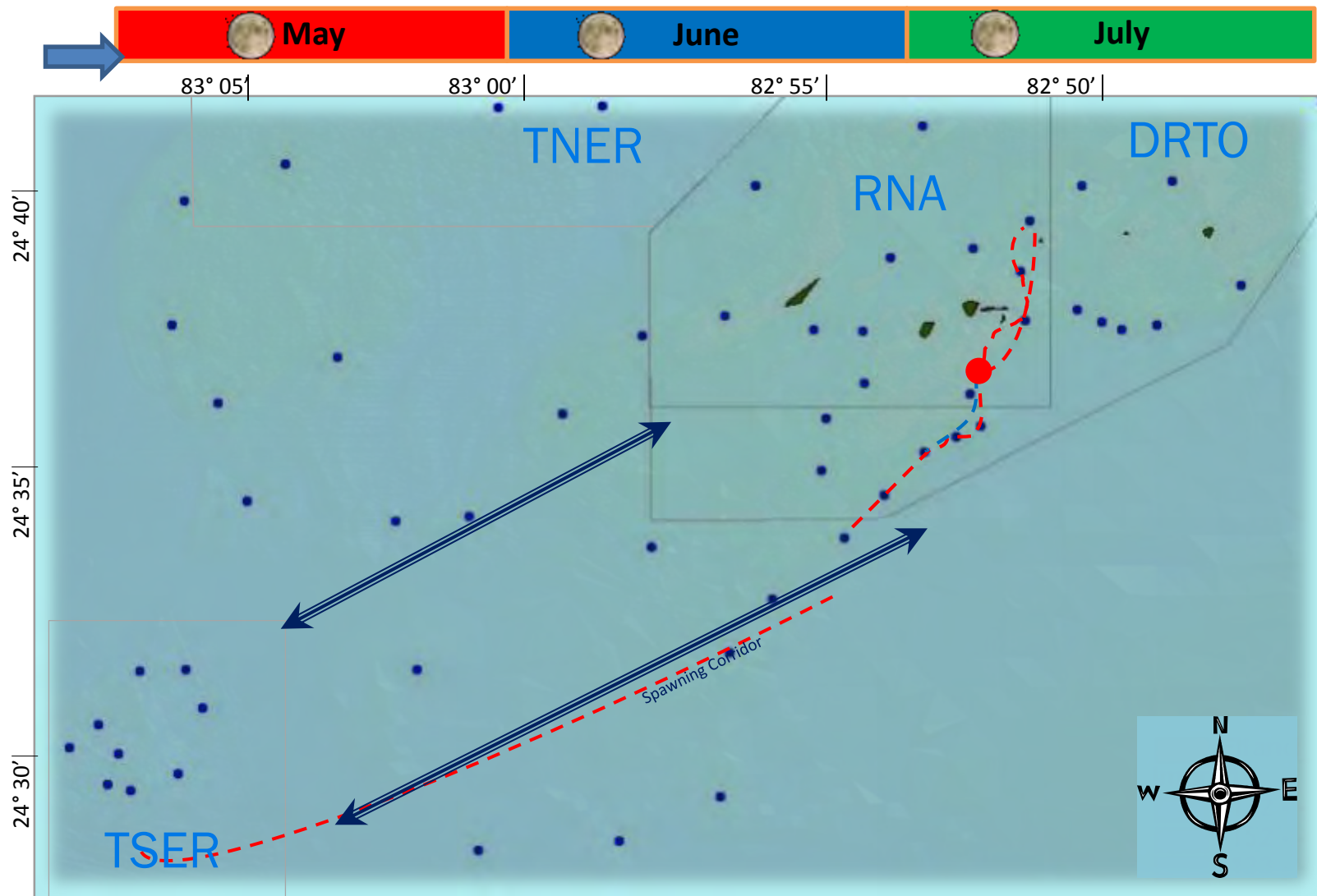


# Tagging of Mutton Snapper

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- 55 Mutton snapper were tagged
- 21 fish made multiple migratory **trips to Riley's Hump**
- 12 fish were residents of the RNA



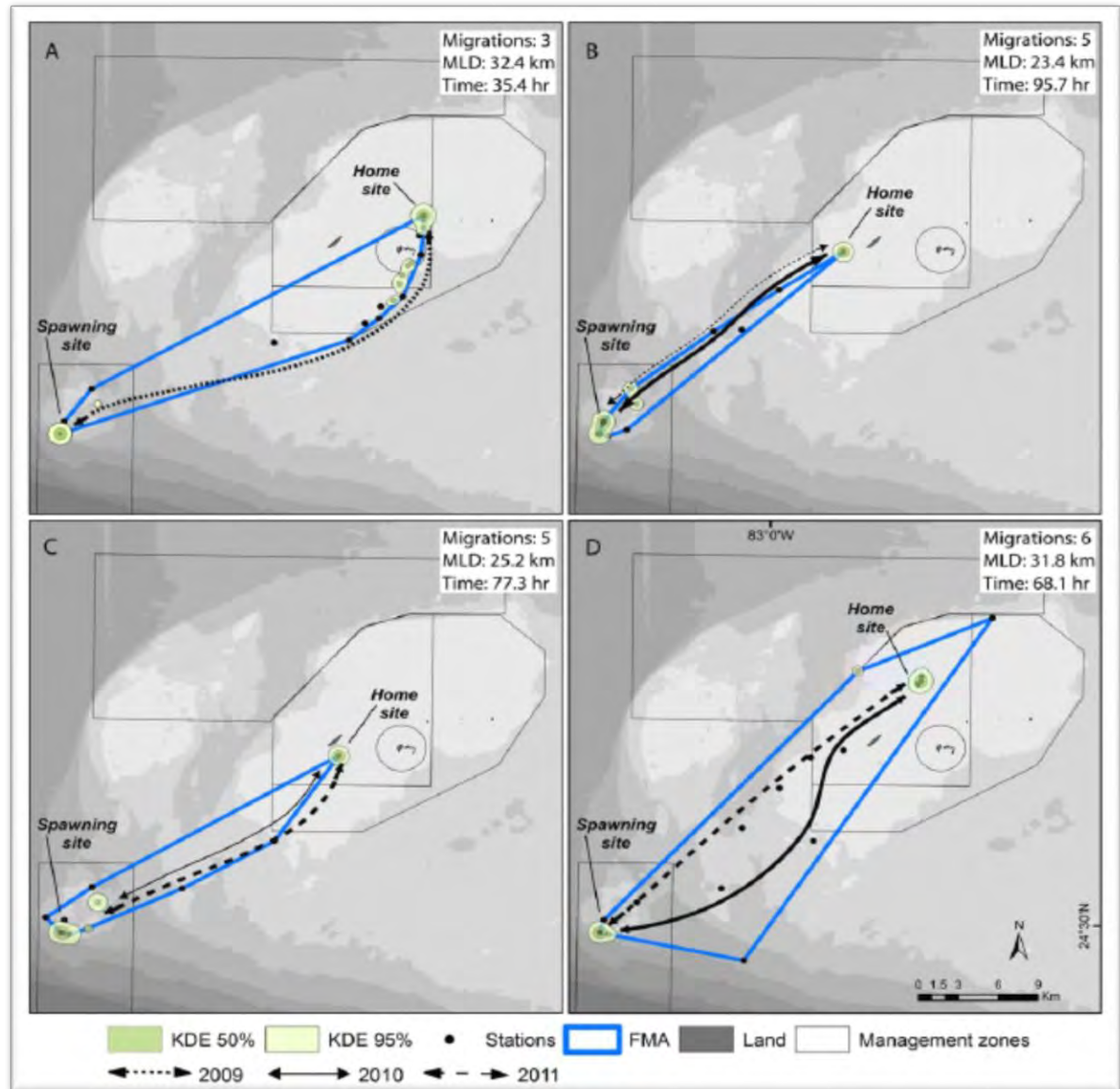


This video showed repeated movements by the same tagged mutton snapper from a home site in the RNA to the spawning site in the TSER. This movement was made three months in a row around the full moon. After spending ~7 days at the spawning site, the tagged fish would return to its home site until the next spawning movement.



# Tagging of Mutton Snapper

These movements show the complementary nature of the marine reserve network within Dry Tortugas



# Mutton Snapper Spawning at Riley's Hump

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This slide contains a video. Screen captures of the video are on the following 4 slides.

From C. Parsons (2009)

# Mutton Snapper Spawning at Riley's Hump

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2009 was the first time that mutton snapper spawning was video documented in Florida waters. A sub group of fish containing females and males are seen here after the swam up from a much larger aggregation below.



# Mutton Snapper Spawning at Riley's Hump

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The fish form a tight cluster as they swim up into the water column.

# Mutton Snapper Spawning at Riley's Hump

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At the apex of their swim, females release their eggs and males release their sperm. This release is the 'cloud' that appears in the water. The fish vigorously swish their tails around to increase the chance of the eggs being fertilized.

# Mutton Snapper Spawning at Riley's Hump

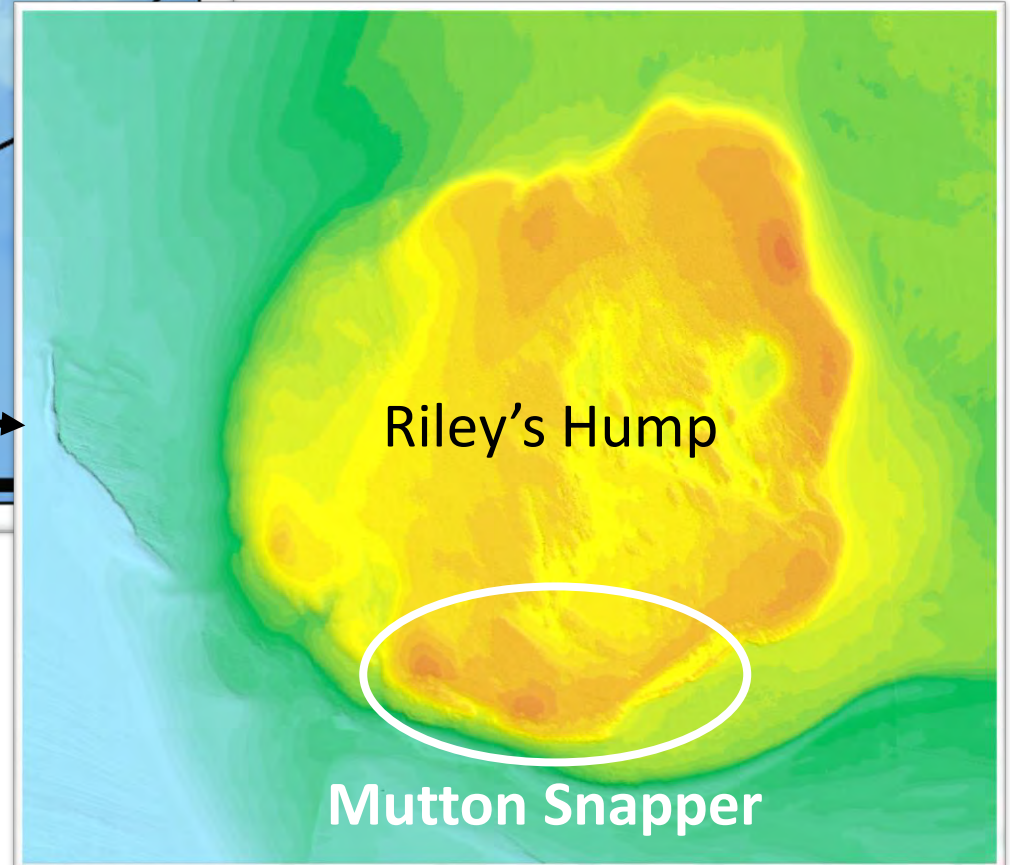
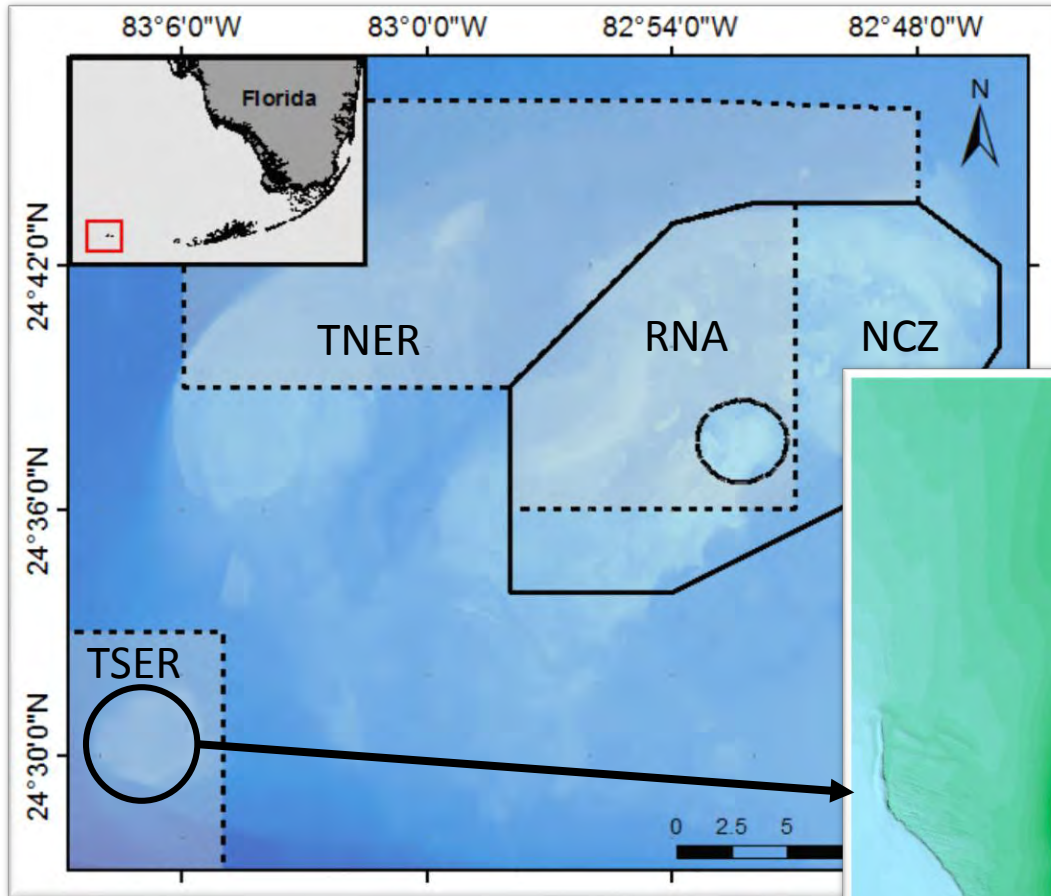
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Once the eggs and sperm have been dispersed, the subgroup of fish swim back down and rejoin the main aggregation below.



# Utilization of Riley's Hump



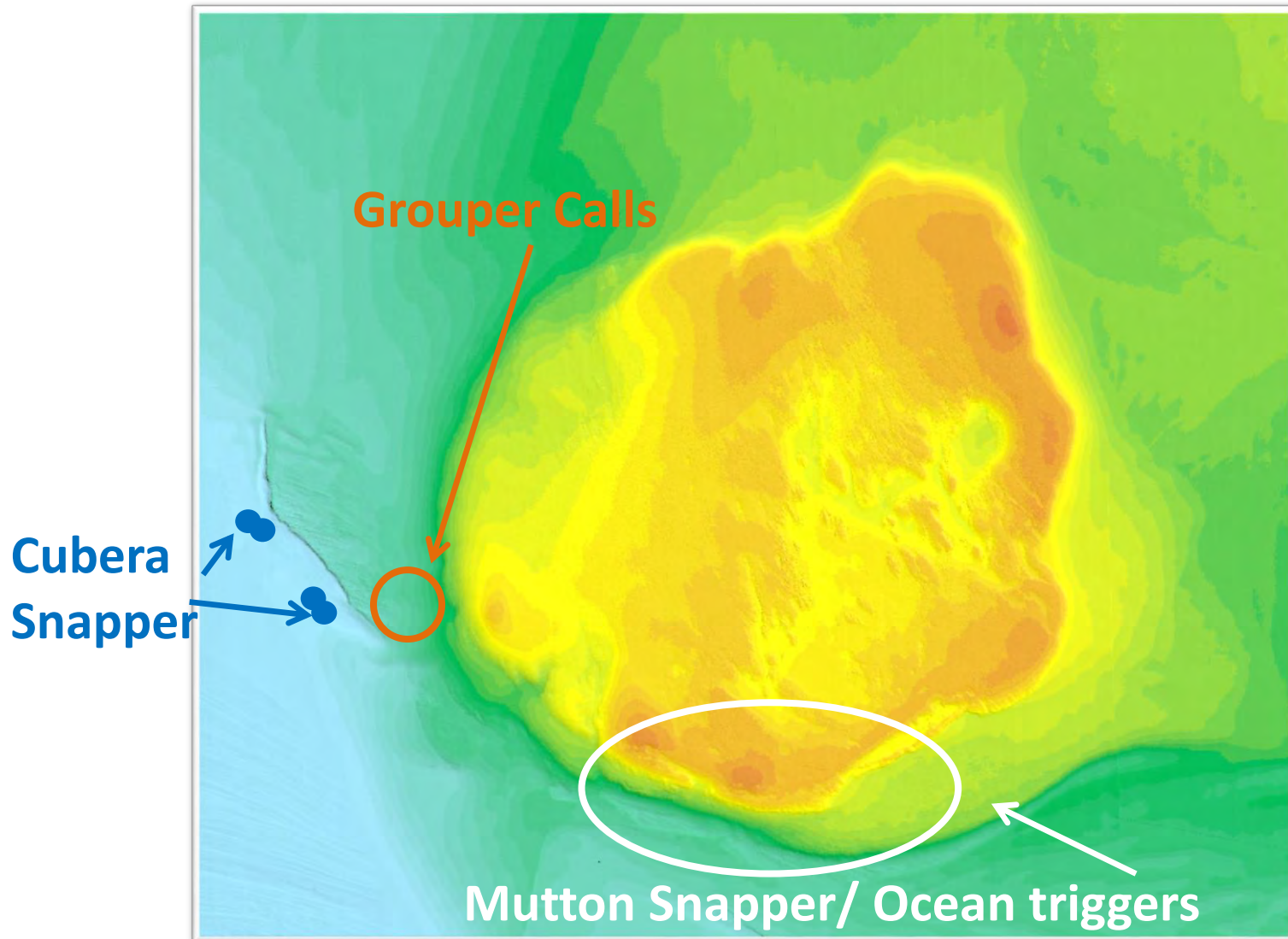
# Multispecies Aggregation Site: Triggerfish

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This slide contains a video showing high numbers of ocean triggerfish and mutton snapper swimming together in the same area of Riley's Hump. This demonstrated that Riley's Hump was also a place where ocean triggerfish came to nest.

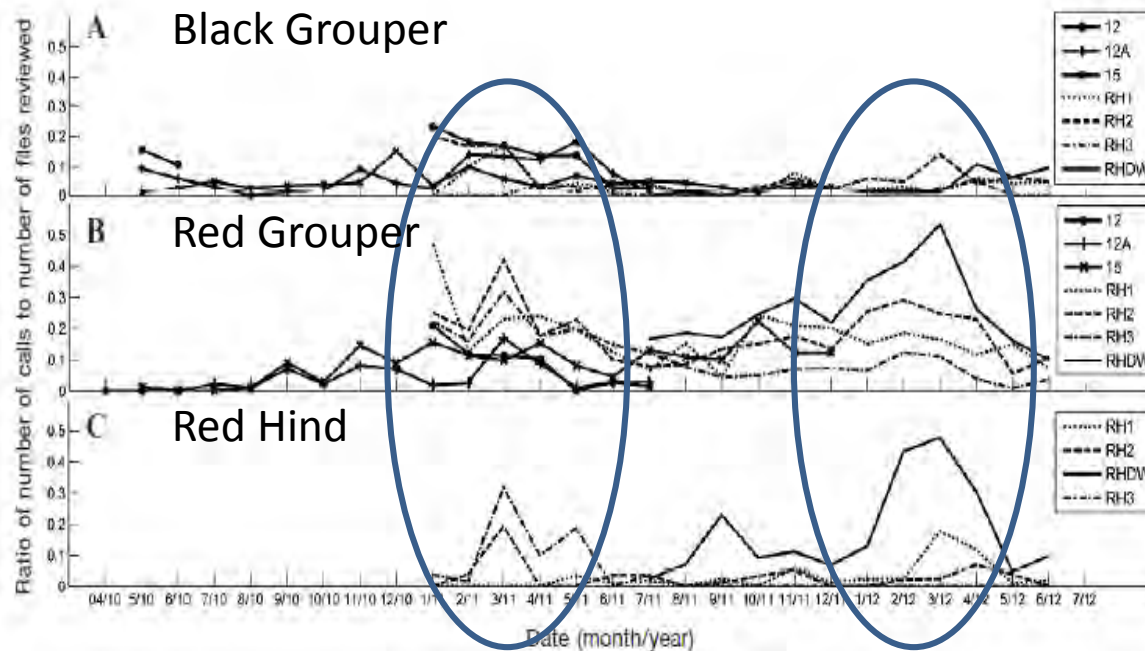
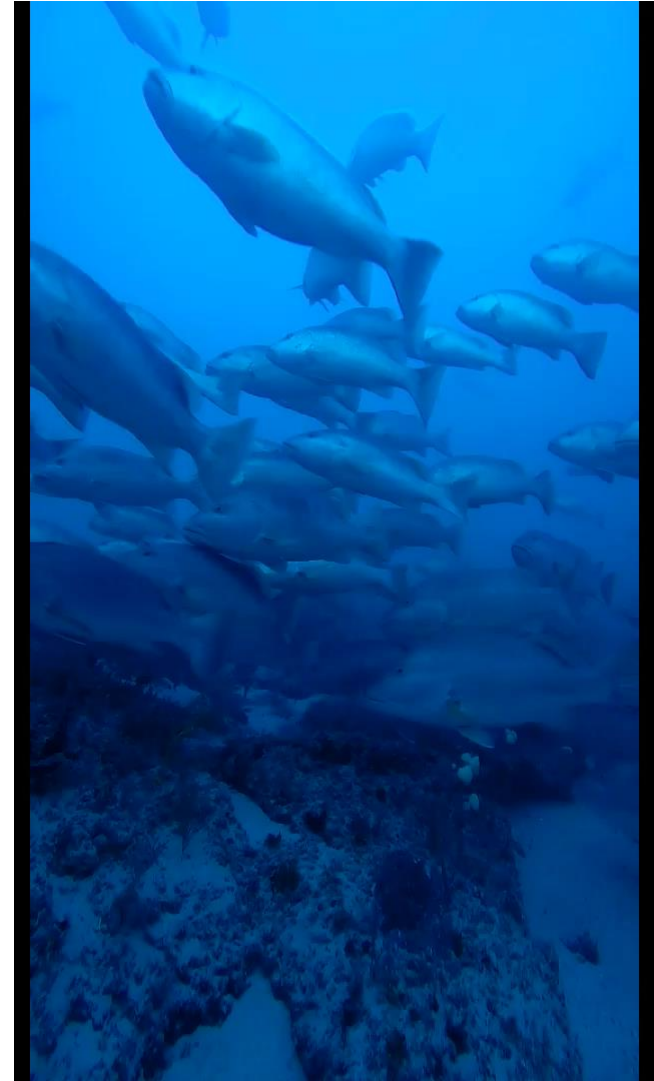
# Utilization of Riley's Hump





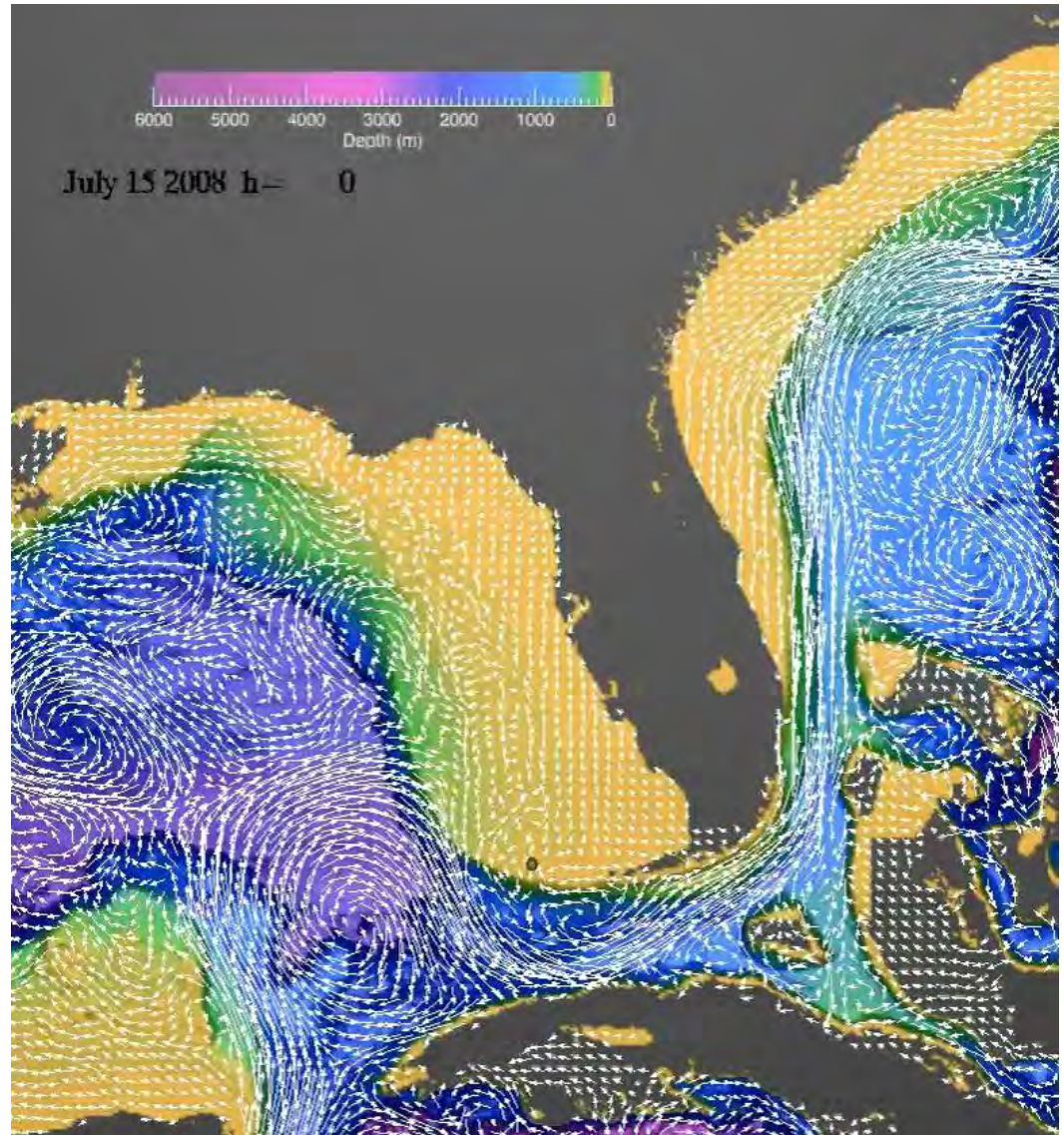
# Multispecies Aggregation Site: Cubera and Grouper

- Stereo camera deployments captured large schools of Cubera snapper
- Passive acoustic hydrophones recorded elevated numbers of grouper calls during spawning season (adapted from Locascio et al. 2016)



# Multispecies Aggregation Site: Larval Dispersal

- Red dots represent fish larvae
- These are potential drift patterns of larvae released during the summer of 2008 based on the wind and currents for that time period- adapted from University of Miami

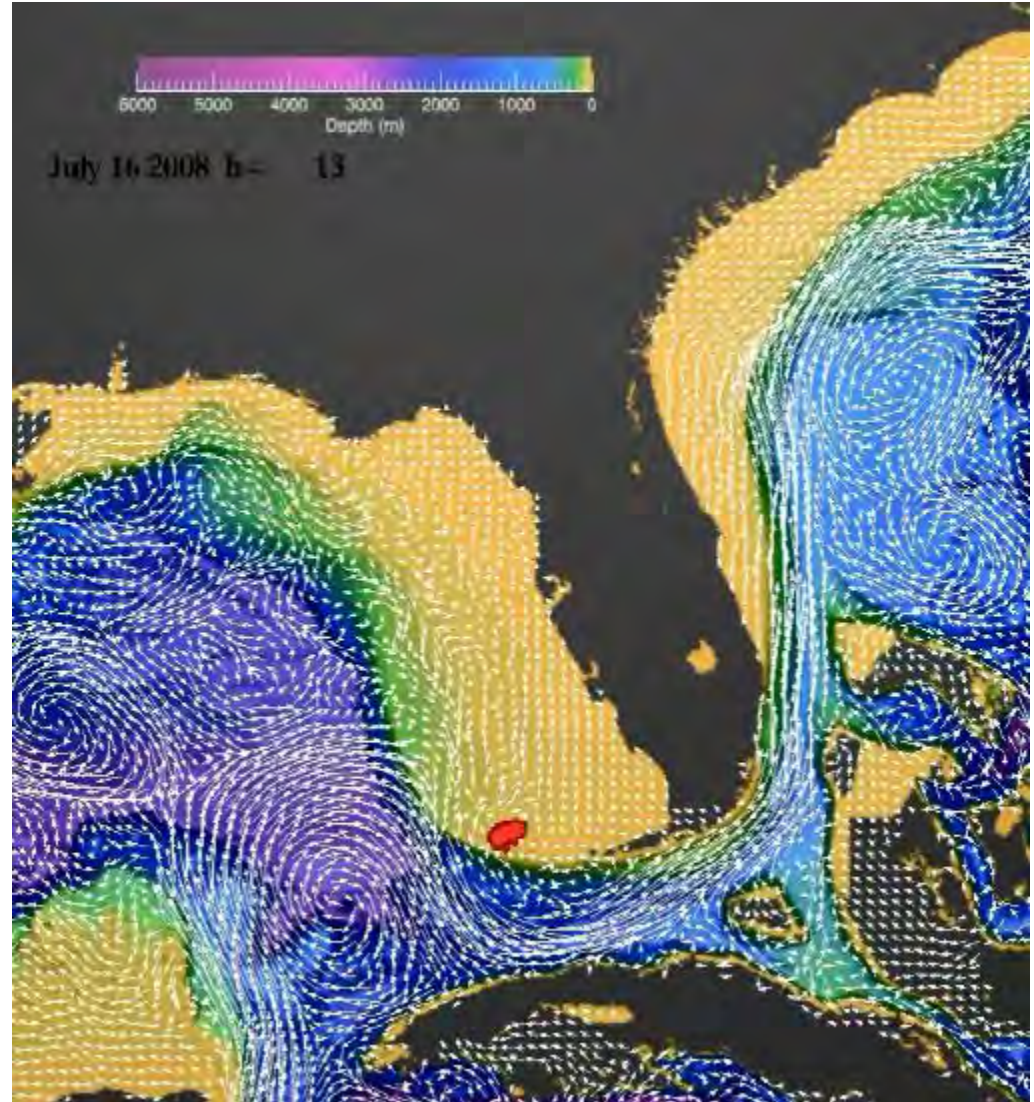


This slide contains a video showing the dispersal patterns of larvae from the Dry Tortugas. Screen captures from this video are on the following 4 slides.



# Multispecies Aggregation Site: Larval Dispersal

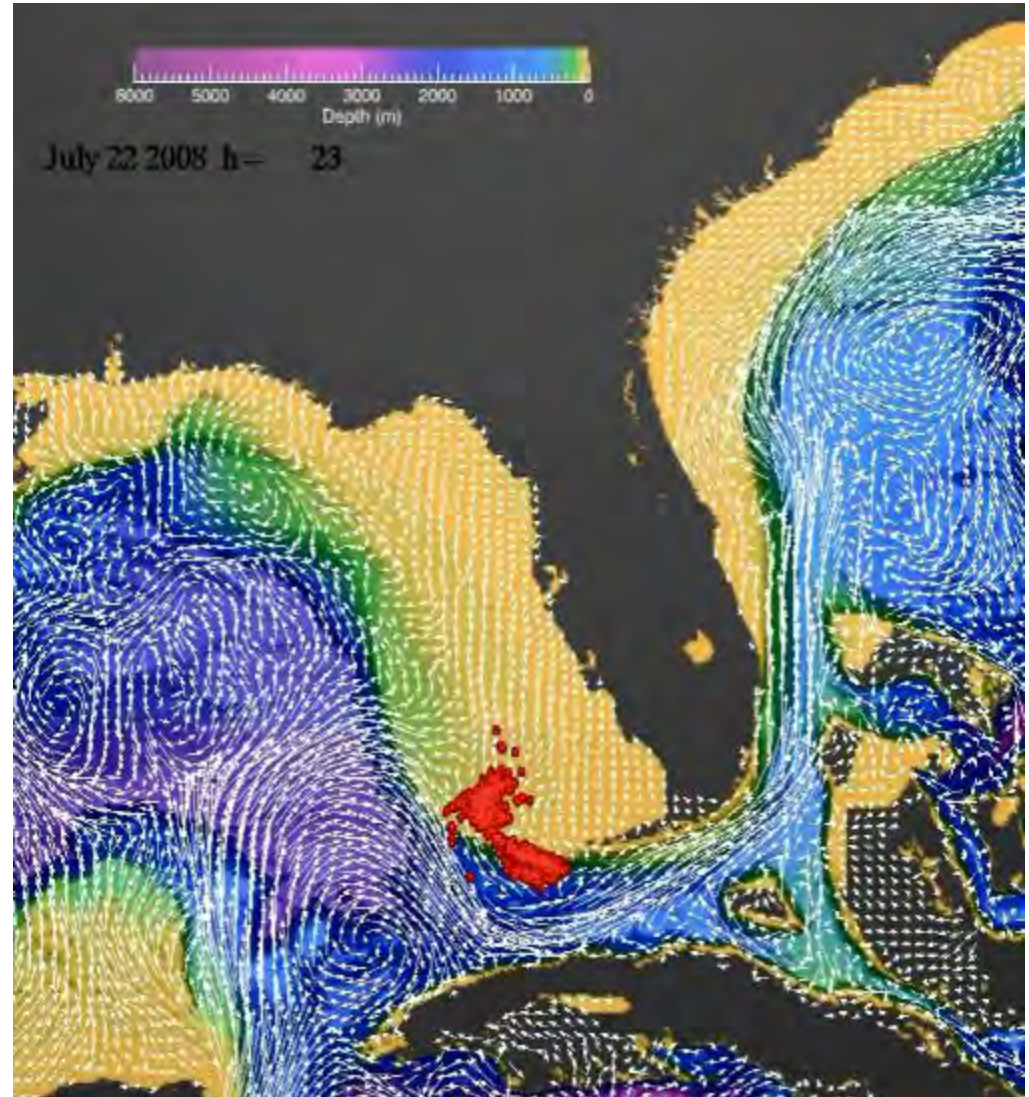
July 16<sup>th</sup> 2008 - Red dots, representing larvae, begin to leave the Dry Tortugas. This model uses specific tide, current, and wind information for the time period of July, 15<sup>th</sup> – August 13<sup>th</sup> 2008.





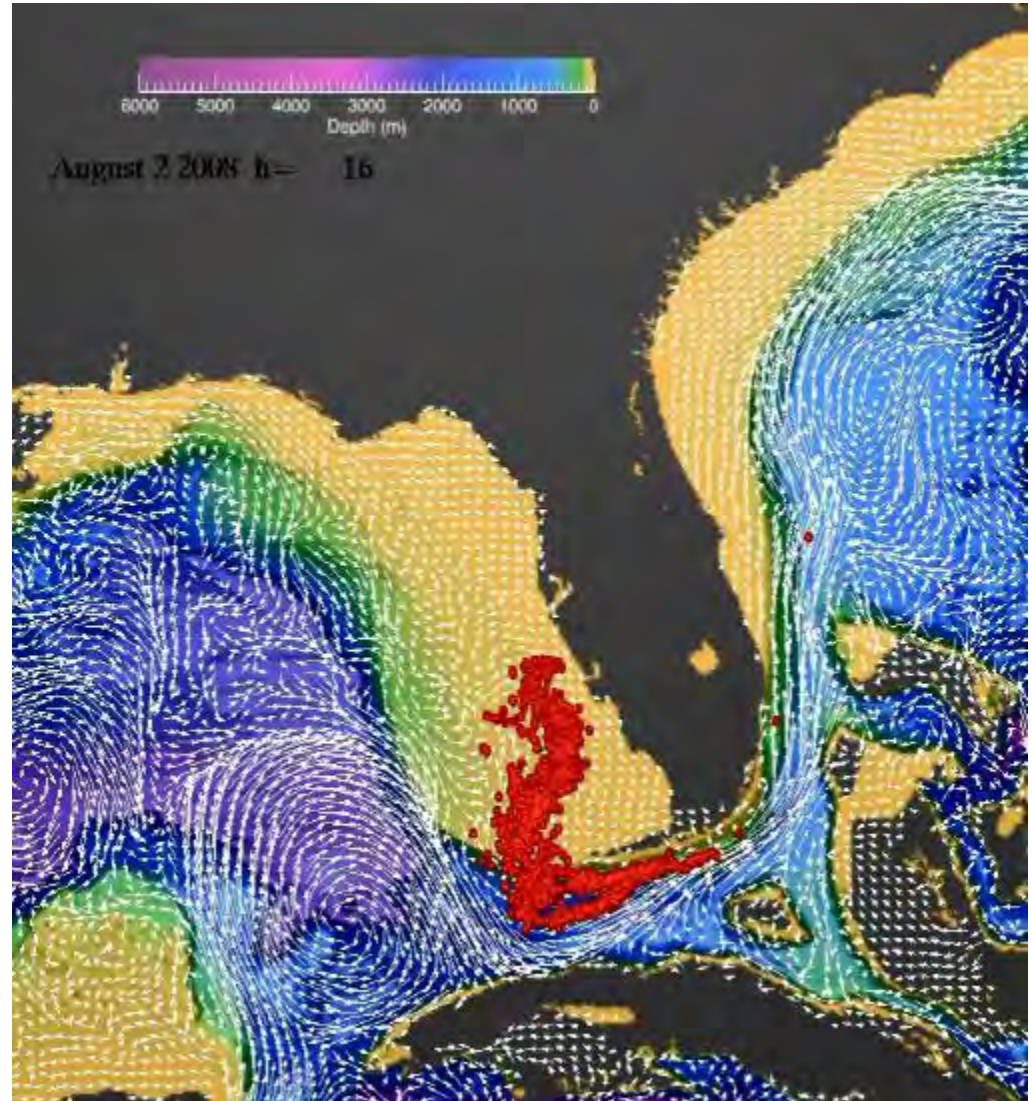
# Multispecies Aggregation Site: Larval Dispersal

July 22<sup>nd</sup> 2008 – Larvae are caught up in major oceanographic currents and begin to make more long distance movements.



# Multispecies Aggregation Site: Larval Dispersal

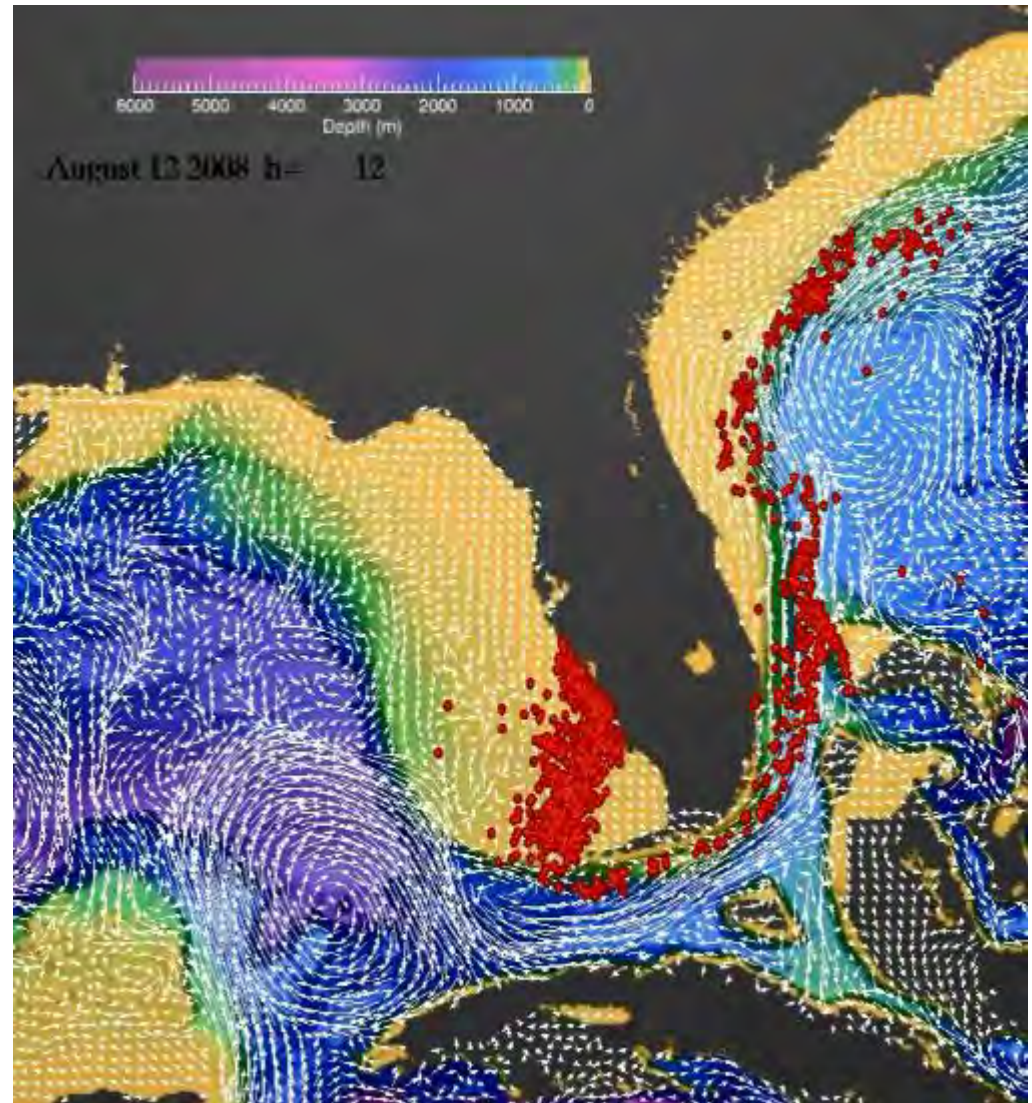
August 2<sup>nd</sup> 2008 – Larvae are moving towards the west coast of Florida and are moving up the Florida Keys.



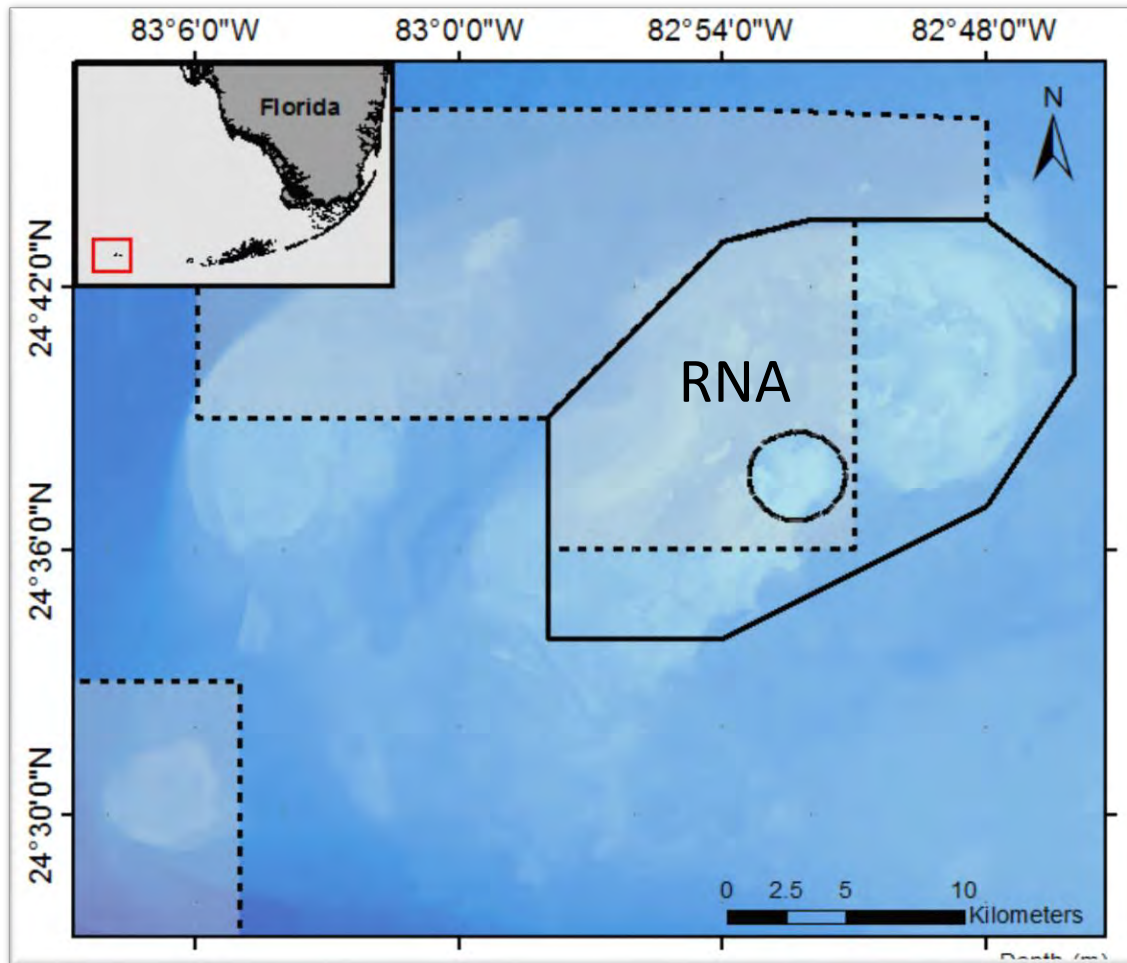


# Multispecies Aggregation Site: Larval Dispersal

This is the location of the larvae on August 13th 2008, about one month after their release in the Dry Tortugas. Larvae have moved up both the east and west coast of Florida. Approximately one month is the typical larval duration for many reef fishes.



# Results of Presenting this Research



In February 2018, FWC Commissioners agreed that the marine reserves in the Dry Tortugas region was an effective network that benefited Florida.

They voted to maintain the RNA as a part of that network for another 20 years.



# Fish aggregations in other parts of the Keys

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Rapidly discovered differences between working in a no-take marine reserve and areas open to extraction

Restricted access,  
no-take marine reserve



Open to fishing



Photo credit: Robert Glazer, FWC

# Western Dry Rocks

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## 2010 – 2015

Multi-faceted approach:

- Aerial Surveys
- Splitbeam and Multibeam Sonar
- Diver Observations



## 2014

Shifted away from direct observational approaches

Began telemetry efforts in Western Dry Rocks



# Western Dry Rocks

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2010 – 2015

Divers observed  
large numbers of:

- gray snapper
- mahogany snapper
- yellow goatfish
- spadefish
- permit



# Western Dry Rocks

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Taken May 2011 – around the full moon

~40 boats in a 0.05 km<sup>2</sup> area (0.019 miles<sup>2</sup> area)

We know this is a popular mutton fishing spot



Photo credit: Robert Glazer, FWC



# Acoustic Telemetry Stations in the Keys

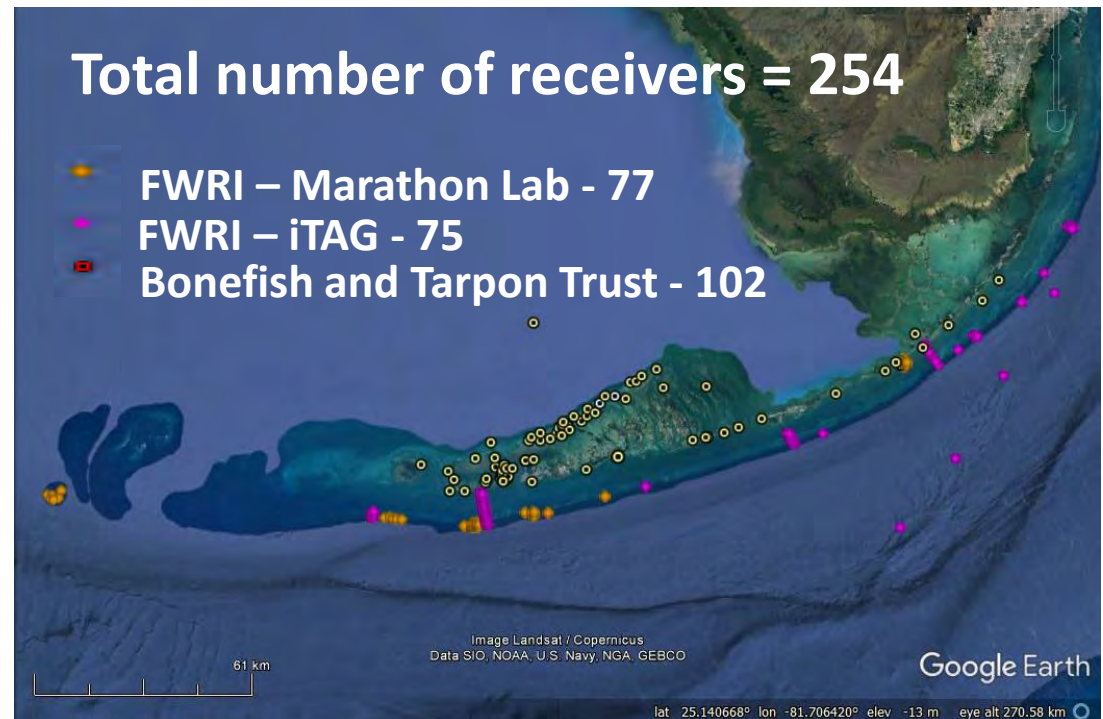
Partnerships that expand our telemetry reach:



2014

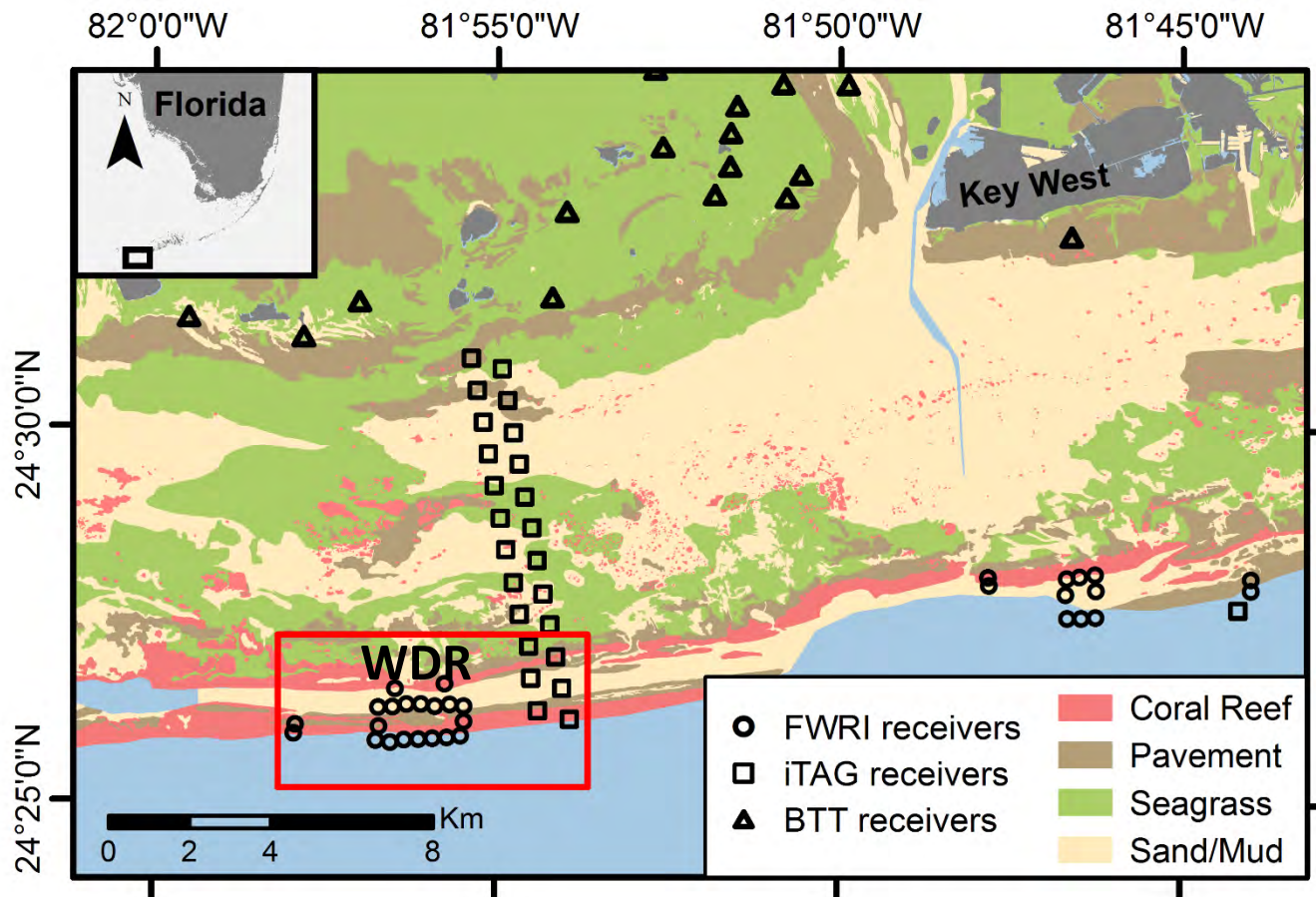
Began telemetry efforts in Western Dry Rocks

- FWRI helps to maintain a network of over 200 receivers throughout the Florida Keys



# Western Dry Rocks

Through these partnerships, 72 receivers were monitored in the region of this study with additional receivers monitored throughout south Florida

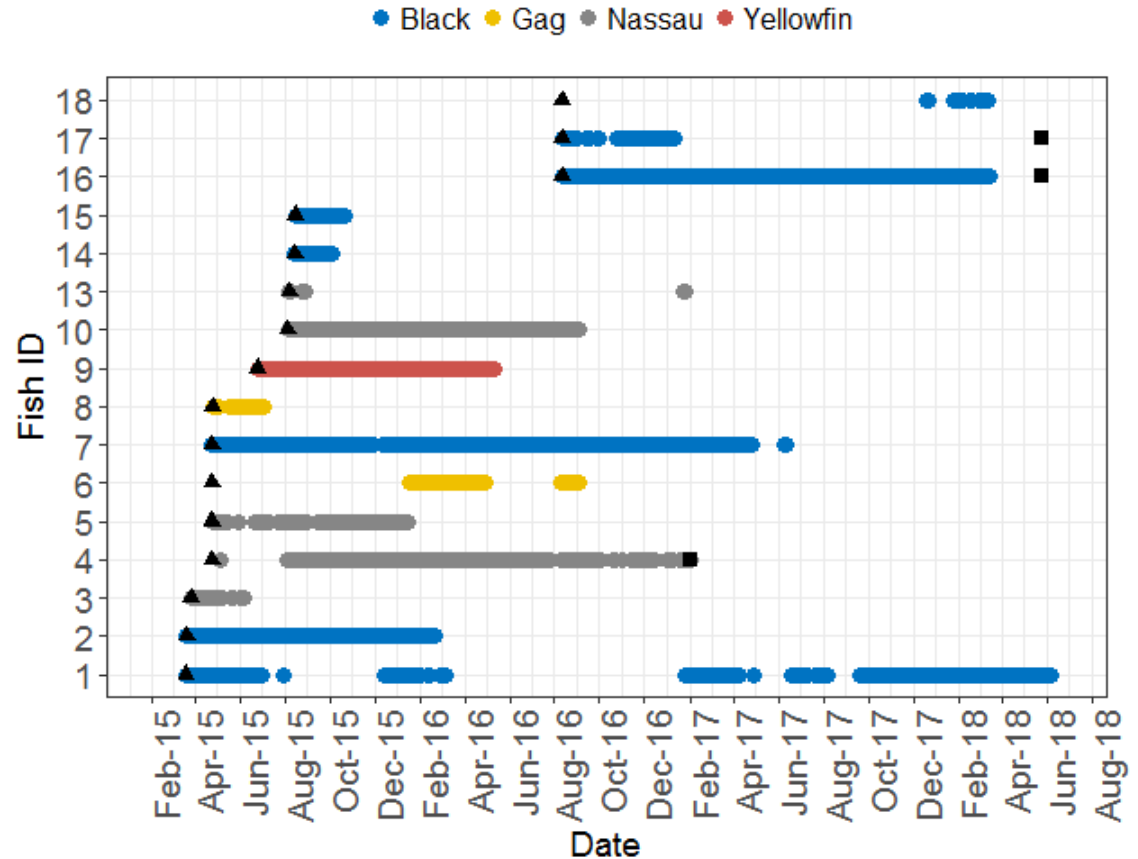


# Western Dry Rocks: Grouper

## Between 2014 - 2016

18 grouper were tagged:

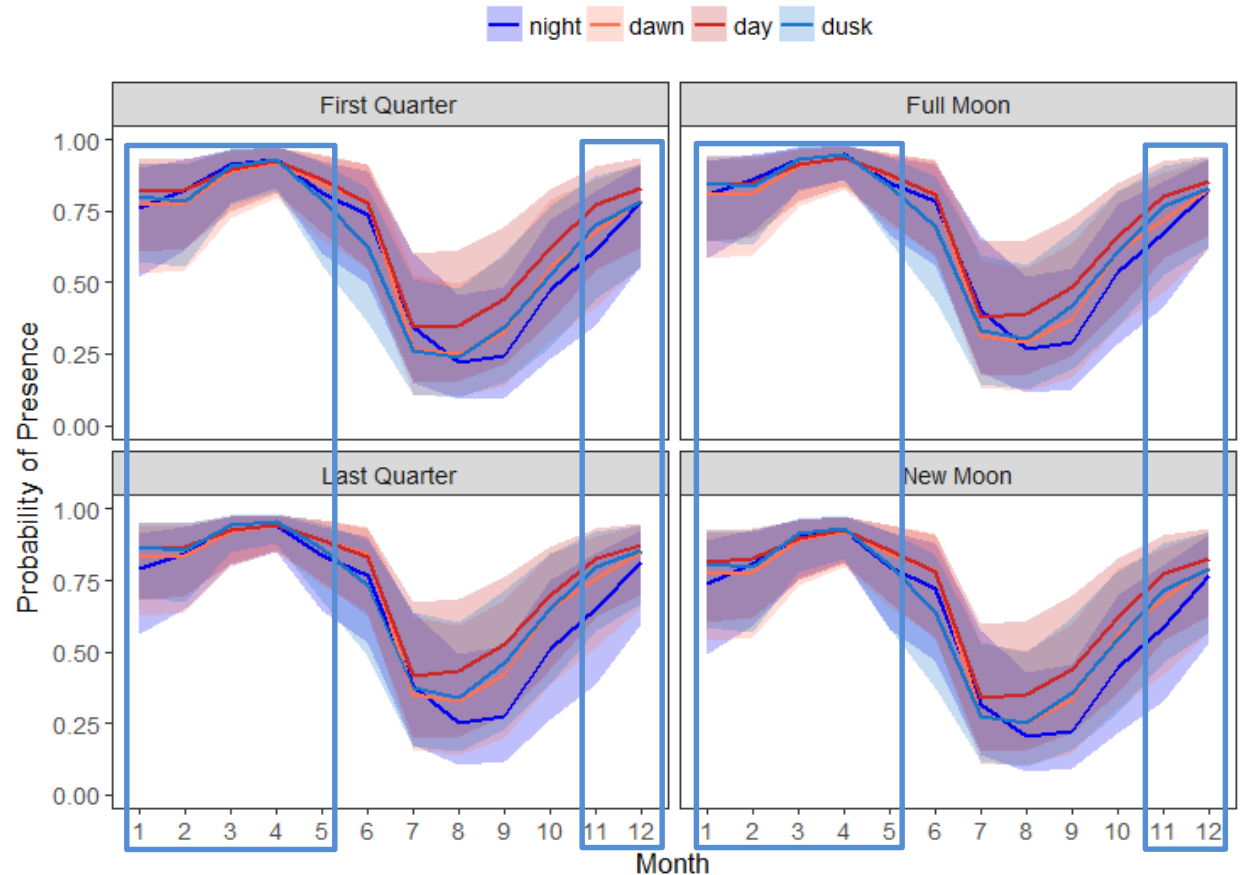
- 10 black grouper
  - 2 black grouper (fish 11 and 12) were never recorded after tagging
- 5 Nassau grouper
- 2 gag grouper
- 1 yellowfin grouper



# Western Dry Rocks: Grouper

Fish were more likely to be present in the array near Western Dry Rocks during winter spawning months

Moon phase and time of day did not influence detections as much as time of the year



Months are represented numerically with 1 being January



# Summary

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WDR likely a multispecies aggregation spot

- Divers observed large numbers of multiple species during summer spawning months
  - Grey snapper
  - Mahogany snapper
  - Yellow goatfish
  - Permit
  - Spadefish
- Aerial surveys showed it was popular during mutton snapper spawning
- Telemetry showed grouper are more likely to be present in winter months, which is their spawning season



# Any Questions?

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