

Red drum (*Sciaenops ocellatus*) understanding population dynamics of a data-poor species

JM Drymon^{1,2}, SP Powers^{3,4}

¹Mississippi State University, ²Mississippi-Alabama Sea Grant,

³University of South Alabama, Dauphin Island Sea Lab⁴





Redfish

Highly prized sportfish supporting valuable fisheries

Recreationally targeted, but federally protected

Population connectivity (Rooker et al. 2010), movement (Burnsed et al. 2020), spawning (Lowerre-Barbieri et al. 2019)...

Data-poor

SEDAR 49, 2016

DLMtool
(Carruthers & Hordky 2018)

Lane snapper
Wenchman
Yellowmouth grouper
Speckled hind
Snowy grouper
Almaco jack
Lesser amberjack



This Project

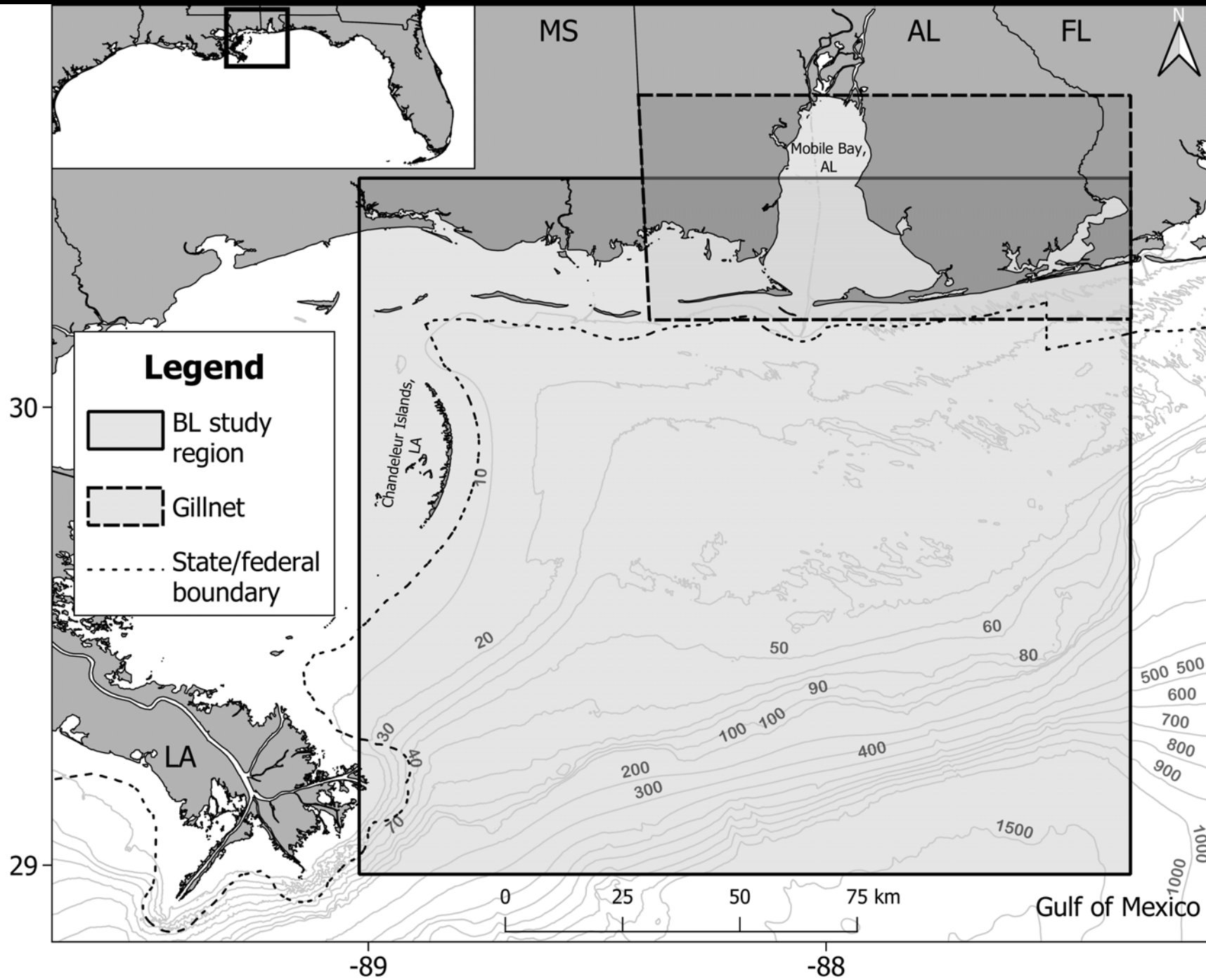
Research recommendations from SEDAR 49:

1. Expand efforts to collect age and length samples at varying sizes, seasons, months, and locations, particularly for offshore fish
2. Identify or optimize fishery-independent surveys to characterize relative abundance in federal waters
3. Explore ways to increase data collection from existing fishery-independent surveys

Our objectives: Combine data from fishery-independent surveys operating throughout the year and across the shelf to:

1. Produce up-to-date overall and sex-specific growth models
2. Update mortality estimates
3. Generate standardized indices of relative abundance
4. Provide habitat suitability predictions

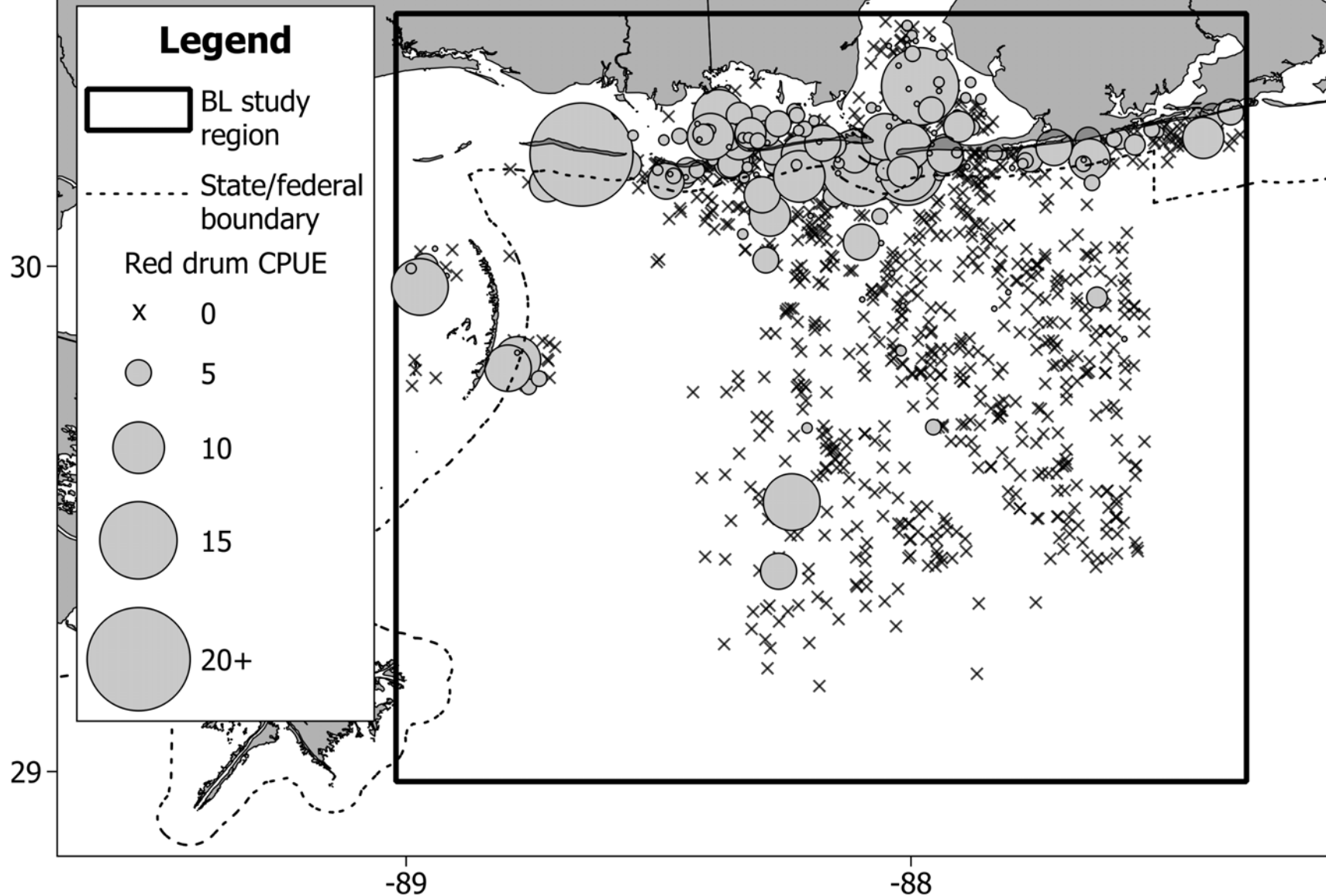
Surveys



"Identify or optimize fishery-independent surveys to characterize relative abundance in federal waters"

"Explore ways to increase data collection from existing fishery-independent surveys"

Bottom longline



"Expand efforts to collect age and length samples at varying sizes, seasons, months, locations, particularly for offshore fish"

"Identify or optimize fishery-independent surveys to characterize relative abundance in federal waters"

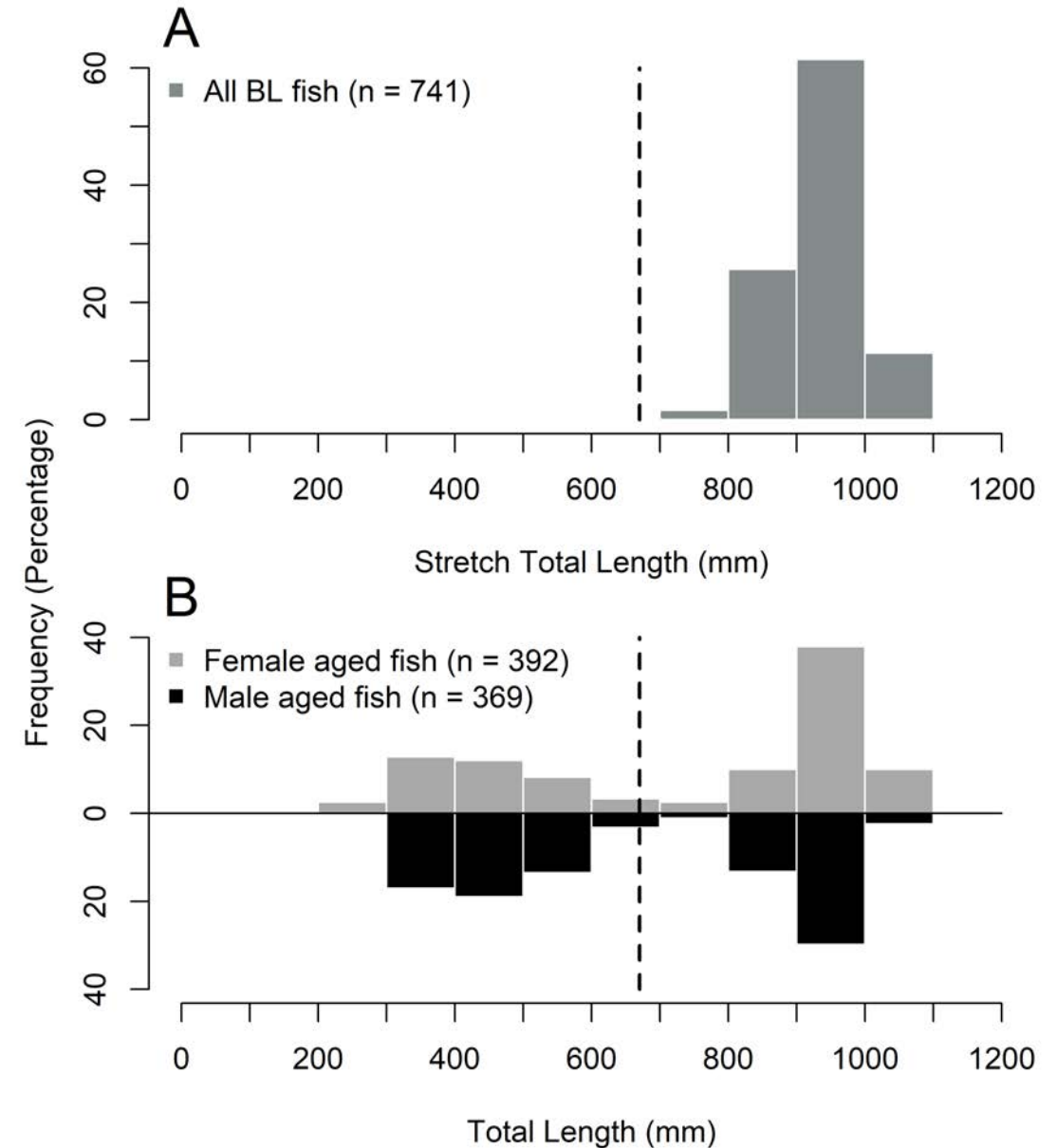
Catch Composition

May 2006 – November 2018:
1,296 sets and 815 redfish
(741 measured, 472 retained)

Exclusively larger than size at
maturity (Bennetts et al. 2019)

Supplemented with ALMRD gillnet

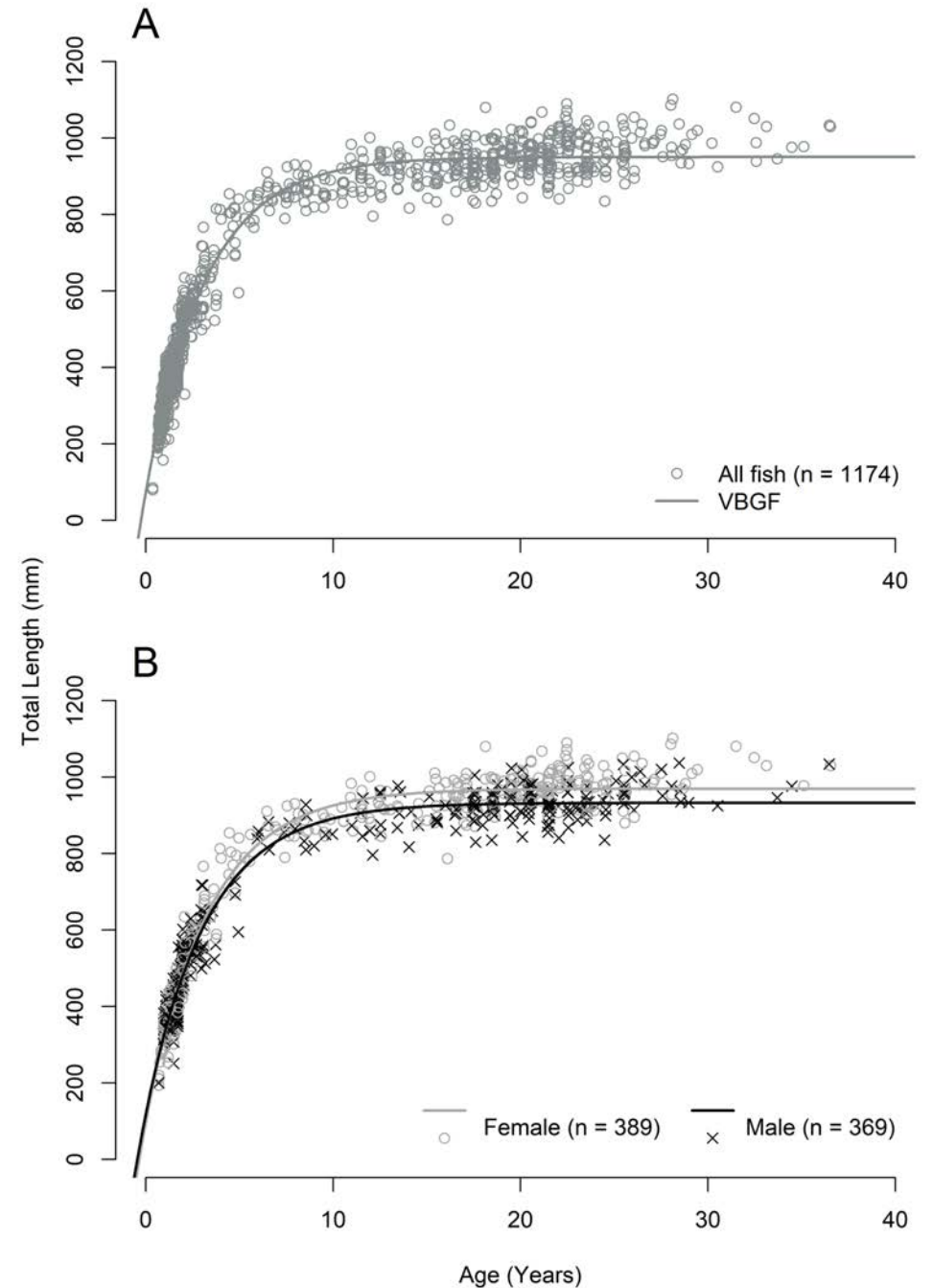
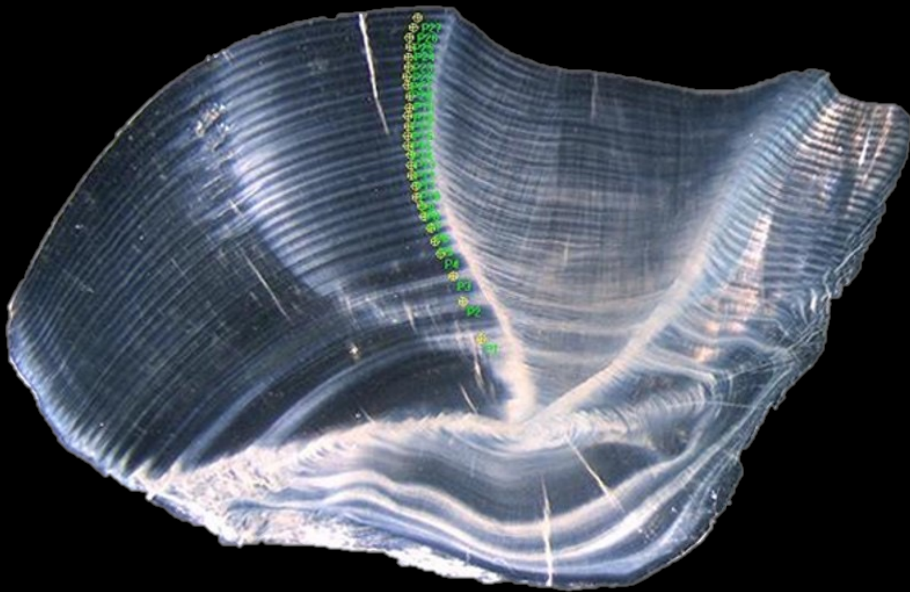
392 male, 369 female, 420 unknown



Age and Growth

Ages assigned to 1,178 redfish

0-36 years, mean age 11.7 for females,
9.9 for males



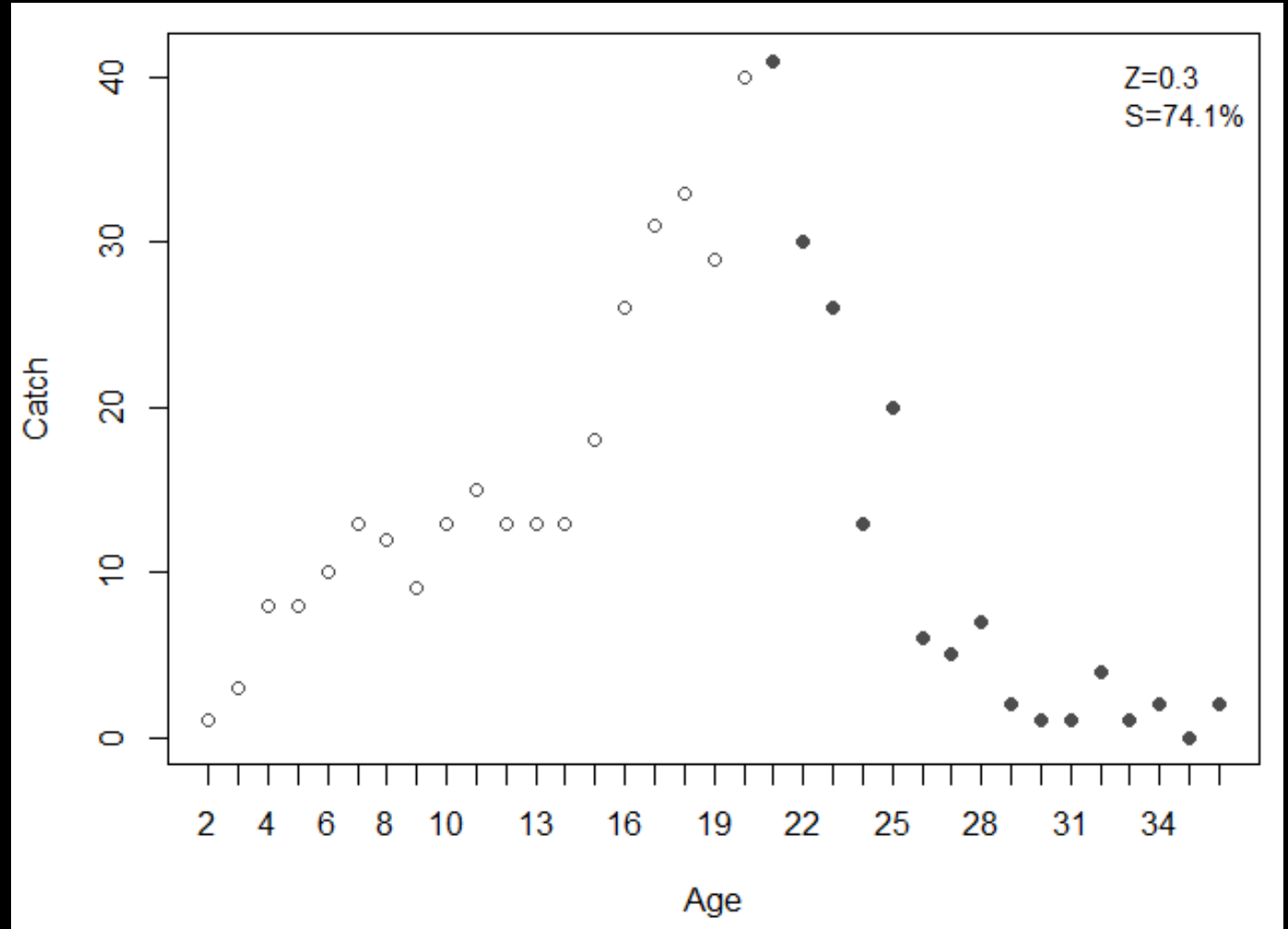
Mortality

Chapman-Robson catch curve

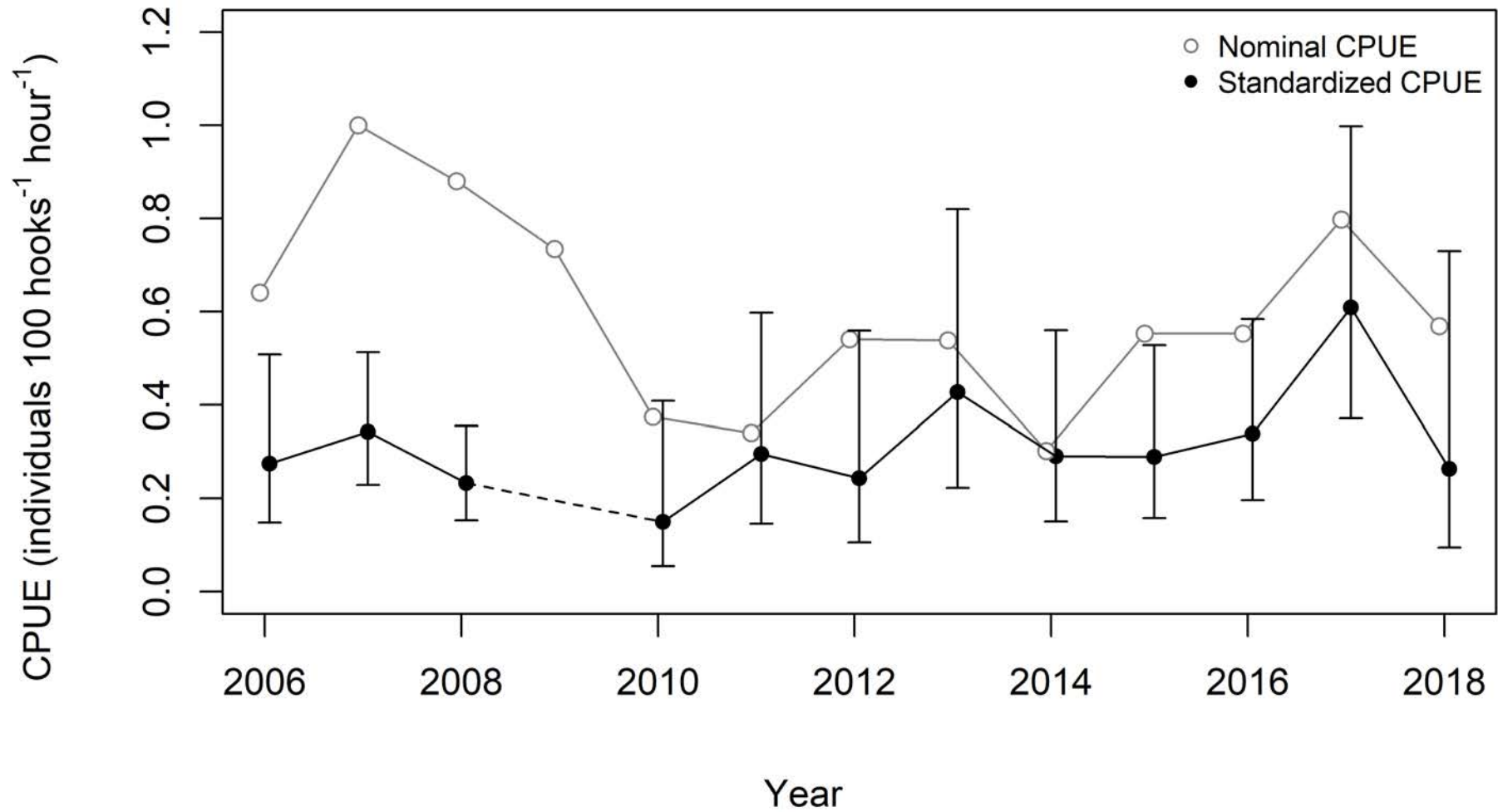
Steep ascending, gradual descending limb

Abundance of fish from the early 1990s, low harvest and high recruitment

Hoenig: 0.12 – 0.14



Relative Abundance



Boosted Regression Trees

Predictor	Source
Surface temperature (°C)	HYCOM
Bottom temperature (°C)	HYCOM
Surface salinity (psu)	HYCOM
Bottom salinity (psu)	HYCOM
Surface eastward velocity, u (m/s)	HYCOM
Bottom eastward velocity, u (m/s)	HYCOM
Surface northward velocity, v (m/s)	HYCOM
Bottom northward velocity, v (m/s)	HYCOM
Surface upward velocity, w (m/s)	HYCOM
Bottom upward velocity, w (m/s)	HYCOM
Sea surface height (m)	HYCOM
Bottom DO (mg/l)	NOAA
Depth (m)	USGS
Substrate grain size (mm)	USGS
Daylength (min)	Calculated
Distance from shore (km)	Calculated

Boosted regression trees (BRTs) allow for explanation and prediction

Complex, non-linear relationships, insensitive to multicollinearity

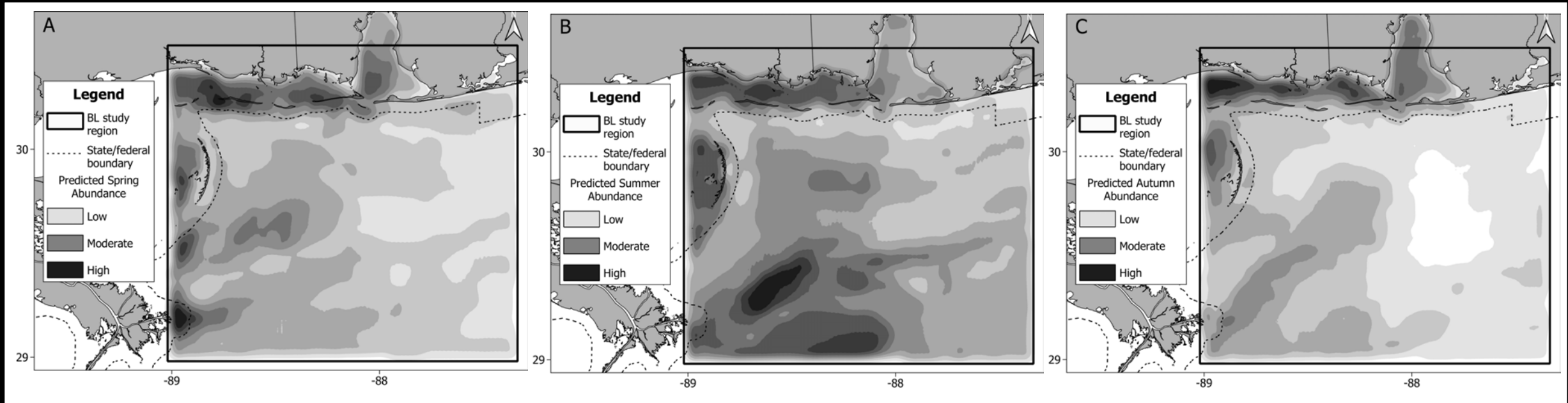
1. Habitat modeling: used to describe the relationships between CPUE and environmental variables

2. Habitat suitability: predict the distribution of suitable habitat across our survey universe

Habitat Suitability

Federal harvest moratorium since 1987. Recreational harvest permitted in all GoM state waters (3 or 9 nm).

Catch per unit effort revealed adult red drum were significantly more abundant in state waters relative to federal waters



Summary

Assessing a stock under a complete harvest moratorium presents distinct challenges

In addition to updated ages, growth models, and natural mortality estimates, our investigation reveals that the adult spawning stock is not fully protected by the federal harvest moratorium

Gulf-wide index of relative abundance from fishery-independent surveys is critical for future assessments of red drum

Hightower CL, Drymon JM, Jefferson AE, Jargowsky MB, Seubert EA, Dedman S, Mareska JF, Powers SP. In Press. Population dynamics, relative abundance, and habitat suitability of adult red drum (*Sciaenops ocellatus*) indicate vulnerability to harvest in nearshore waters of the north central Gulf of Mexico. Fishery Bulletin.

Acknowledgements



Funding for this work was provided by the Gulf of Mexico Fishery Management Council, as well as NOAA MARFIN, NOAA SEAMAP and the Alabama Department of Conservation and Natural Resources, Marine Resources Division through the National Fish and Wildlife Foundation, Gulf Environmental Benefits Fund

We thank Crystal Hightower for her enthusiastic pursuit of red drum. We thank Dauphin Island Sea Lab captains Tom Guoba, Jonathan Wittmann, Diana Marchant, Rodney Collier, Willie Johnston, and Russell Wilson for keeping us safe on the vessels. Additional thanks to the numerous graduate students, technicians, and interns who assisted with field work.