

State Reef Fish Survey in Florida



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Outline

- State Reef Fish Survey
 - Development and design
 - Results from pilot testing in Gulf
- How the survey has helped improve management of Gulf Red Snapper
 - Setting seasons
 - Quota monitoring
- Validation
- Lessons learned in the Gulf



State Reef Fish Fishery in Florida

- Focused on improving data for the private boat segment of the recreational reef fish fishery
 - Accounts for majority of recreational landings
- Most difficult segment to monitor and manage with quotas
 - High effort, dispersed, open access
 - Small sub-set of overall recreational fishery
 - Not frequently encountered in MRIP



Survey Development

- Three Gulf regional workshops 2013-2014
 - Need for more timely and precise data to manage Red Snapper
- Florida's Gulf Reef Fish Survey
 - Implemented in 2015
 - Peer review and NOAA certification in 2018
 - Runs concurrent with MRIP
- Expanded statewide in July, 2020
 - Renamed State Reef Fish Survey



State Reef Fish Angler Designation

- Florida saltwater fishing license
 - No way to distinguish offshore anglers
- State Reef Fish Angler designation
 - Required to harvest reef fish from a private boat
 - Narrows sample universe for specialized survey
- Similar requirement in other Gulf states
- Defining universe of offshore anglers for use in surveys endorsed by MAFAC

Mae B. Outdoors
CID: 987654321 1980-01-01 W/M 321654987/FL

Item:	Since:	Renew By:
Freshwater Fishing	07/01/2020	06/30/2021
Lobster	07/01/2020	06/30/2021
State Reef Fish Angler	07/01/2020	06/30/2021
Hunting	07/01/2020	06/30/2021
Management Area Permit	07/01/2020	06/30/2021
Saltwater Fishing	07/01/2020	06/30/2021

 By use of this license I agree to comply with all applicable state laws and rules of the commission. If hunting under the mentoring exemption (deferral), the license holder must hunt under the supervision of, and in the presence of, a person 21 years of age or older who is licensed to hunt or is exempt from licensing requirements. To report fish or wildlife violations, call Wildlife Alert at 1-888-404-3922.

Provides a directory of participants in the reef fish recreational fishery



Do you fish for any of these species?

As a reef fish angler or spear fisher, you may be asked periodically to participate in voluntary mail and dockside surveys. These surveys provide important information needed to monitor the fishery and provide optimum recreational fishing opportunities in Florida.

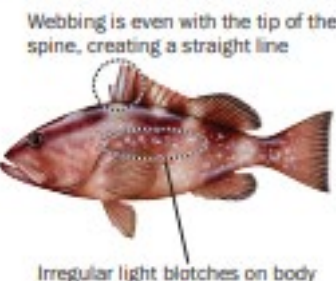
Beginning July 1, 2020, anglers 16 years of age and older are required to sign up as a State Reef Fish Angler if they fish from a private recreational boat for any of the 13 species described in this brochure. Signing up helps FWC reach out directly to people who fish for reef fish species and collect better data.

With your help, we can improve scientific data and management of these important recreational fisheries. To learn more about how to sign up as a State Reef Fish Angler, visit MyFWC.com/SRFS.

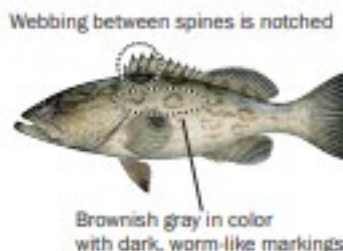
Black Grouper
Mycteroperca bonaci



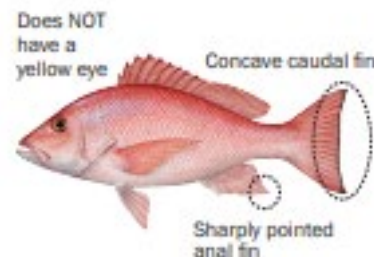
Red Grouper
Epinephelus morio



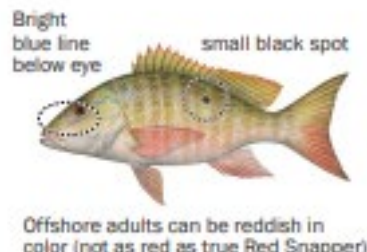
Gag Grouper
Mycteroperca microlepis



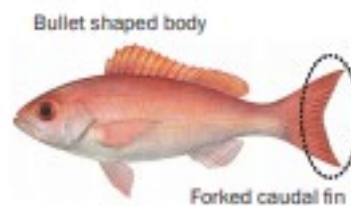
Red Snapper
Lutjanus campechanus



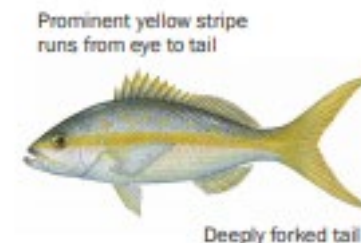
Mutton Snapper
Lutjanus analis



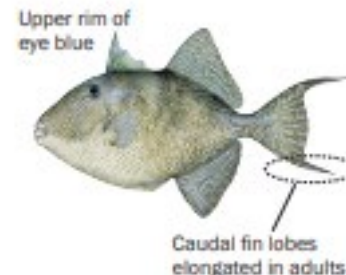
Vermilion Snapper
Rhombopiles aurorubens



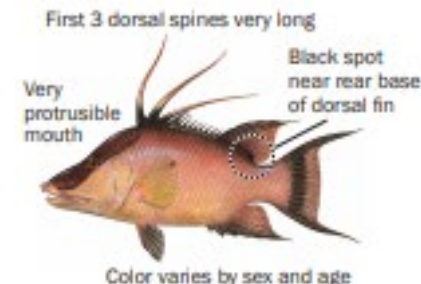
Yellowtail Snapper
Ocyurus chrysurus



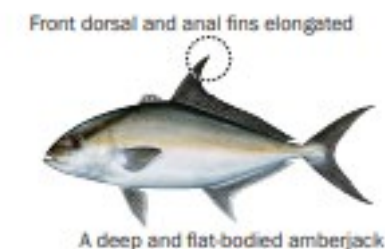
Gray Triggerfish
Balistes capricornis



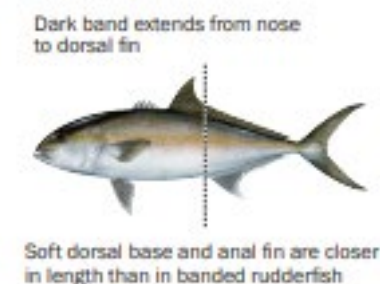
Hogfish
Lachnolaimus maximus



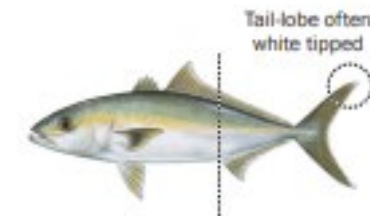
Almaco Jack
Seriola rivoliana



Amberjacks
(Greater, Lesser)



Banded Rudderfish
Seriola zonata



Design Overview

- Complementary methods
 - Mail survey of fishing effort
 - Angler intercept survey for catch-per-unit-effort
 - Year-round, monthly estimates
 - Effort, harvest, discards
- Peer-review
 - Approach studied extensively
 - Similar to Large Pelagic Survey conducted by NOAA Fisheries
 - Methods sound and appropriate for estimating recreational catch



The FWC's

State Reef Fish Survey

There are two components to the State Reef Fish Survey:



MAIL

If selected, we will ask:

- How often you fish
- Where you fish
- Types of fish you target



DOCKSIDE

If interviewed, we will ask:

- Types of fish you caught
- How many reef fish you released and harvested
- If we can sample your fish

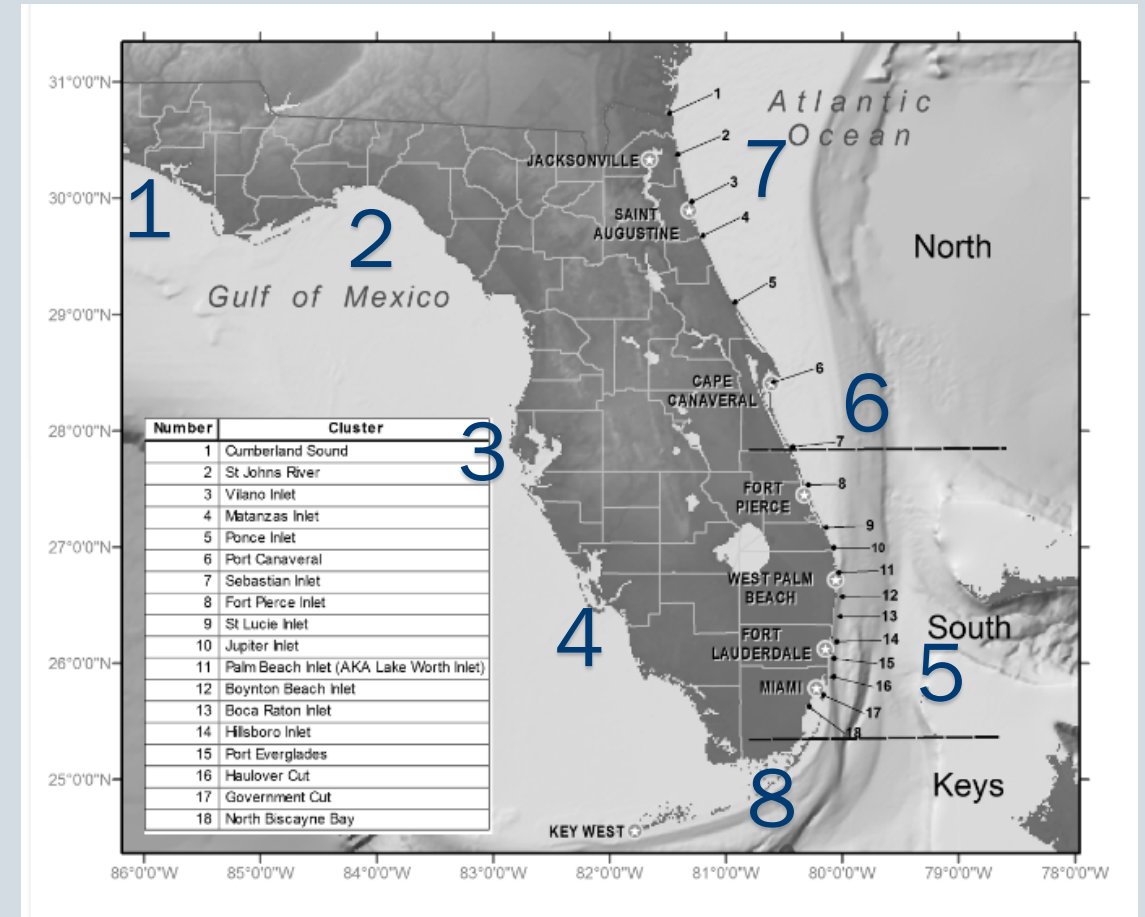


Together, these surveys tell us:

How many recreational reef fish trips are taken each month, and the total number of fish that are harvested and released.

Integrated Approach

- Improve reef fish intercepts in MRIP's Access Point Intercept Survey (APAIS)
 - Distribute sample among smaller regions
 - New offshore accessible site group
- State Reef Fish Survey
 - Effort survey directly estimates private boat angler trips for reef fishes
 - Supplement APAIS with specialized reef fish intercept survey



Intercept survey stratification in Florida



Intercept Survey Data

- Catch estimates from SRFS include data from:
 - MRIP Access Point Angler Intercept Survey (APAIS)
 - Supplemental assignments at offshore access sites
- Compatible sample weights
 - Supplemental reef fish assignments drawn at same time as APAIS in FL

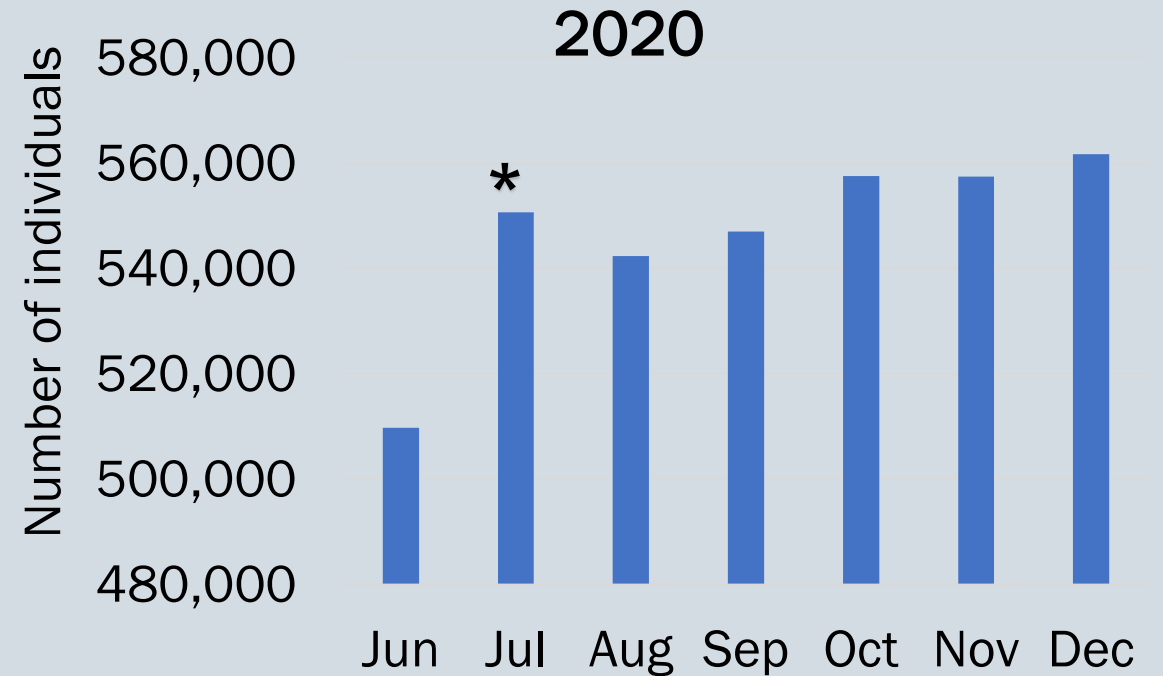


***Increased intercepts
from reef fish trips***



>560,000 State Reef Fish Angler Designations

- 22% out-of-state residents
 - 26% live in AL or GA
- 78% state residents
 - 46% live on Gulf coast
 - 32% live on Atlantic coast
 - <2% live in Keys
 - 20% live inland
- 20% of state residents live in household with a boat



*first month of statewide expansion



Effort Survey

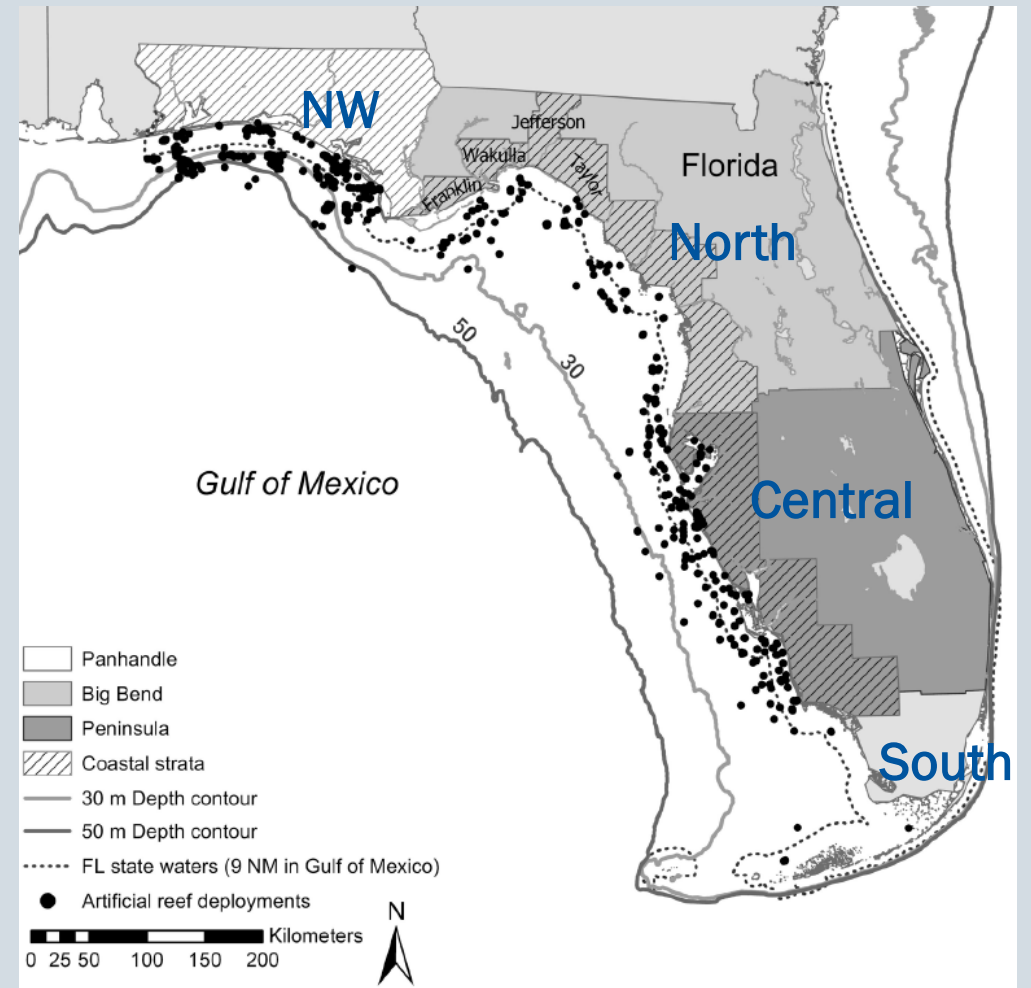
- Mail survey stratification

- Non-residents

- Georgia/Alabama
 - All other states

- Florida residents

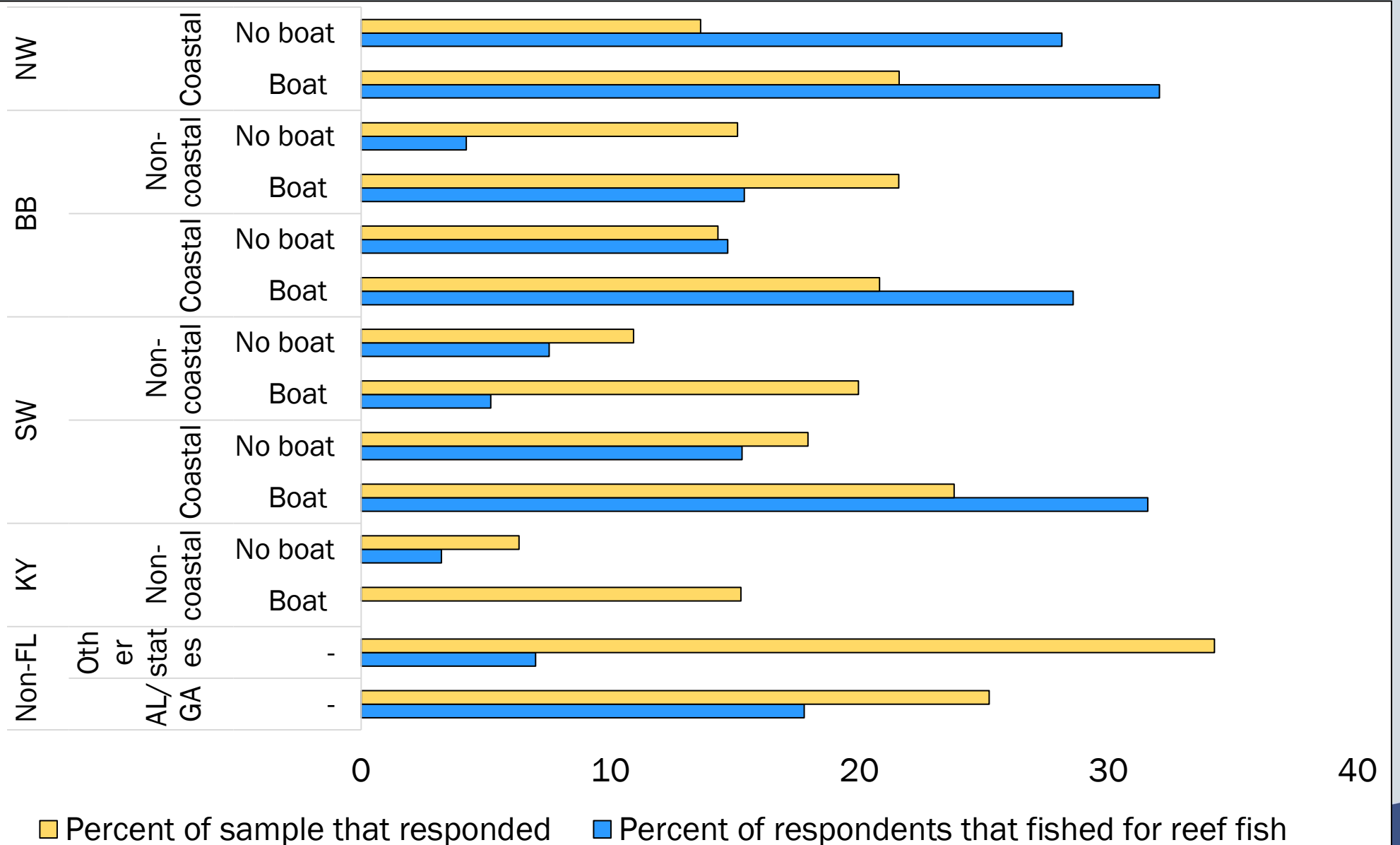
- Northwest, North, Central, and South Florida
 - Gulf, Atlantic, inland counties
 - Whether address matches a state boat registration



Accounts for varied response rates and avidities among different types of anglers



Results from Pilot Testing in Gulf



Sample Size and Response Rates

- 7,000 selected for mail survey each month
 - Allocated across strata to minimize variance
- ~1,400 responses each month
 - Overall response rate 20%



Effort Questionnaire

Reduced recall period and potential recall error

Respondents asked to recall whether they fished from a private boat in FL over past month.

Use calendar for most recent month to mark each day they recall taking a trip.



Florida Saltwater Recreational Fishing Survey

SRFS
STATE REEF FISH SURVEY

This survey should be completed by **FIRST NAME LASTNAME** only.
Return this form even if you did not participate in saltwater recreational fishing.

For the purpose of this questionnaire:

- A **private boat** is defined as any boat that did not have a state or federal license to conduct professional for-hire recreational fishing trips. Do not report any trips taken from a licensed charter or large party boat.
- Please report only those trips where the boat launched from Florida and recreational fishing occurred in saltwater, even if no fish were caught.
- Use only a black ink pen to "X" the response boxes. Please **do not** use blue ink.
- Please report trips only for the month specified.

Q1. During the month of NOVEMBER, did you personally participate in a recreational fishing trip on a private boat that launched from Florida? (Check the box that corresponds to your answer)

☐ NO, I DID NOT FISH → THANK YOU - That is all the information we need. Please return the questionnaire in the enclosed postage-paid envelope.

☐ YES, I FISHED (Continue to Q2.)

☐ NOT SURE, DO NOT RECALL

Q2. On the NOVEMBER calendar below, please "X" the box for each date that you personally participated in a recreational fishing trip on a private boat that launched from Florida.

NOVEMBER						
Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
8 ☐	9 ☐	10 ☐	11 ☐	12 ☐	13 ☐	14 ☐
15 ☐	16 ☐	17 ☐	18 ☐	19 ☐	20 ☐	21 ☐
22 ☐	23 ☐	24 ☐	25 ☐	26 ☐	27 ☐	28 ☐
29 ☐	30 ☐					

Q3. When you went recreational fishing in NOVEMBER, which of the following locations did the boat (or boats) that you fished on launch from:

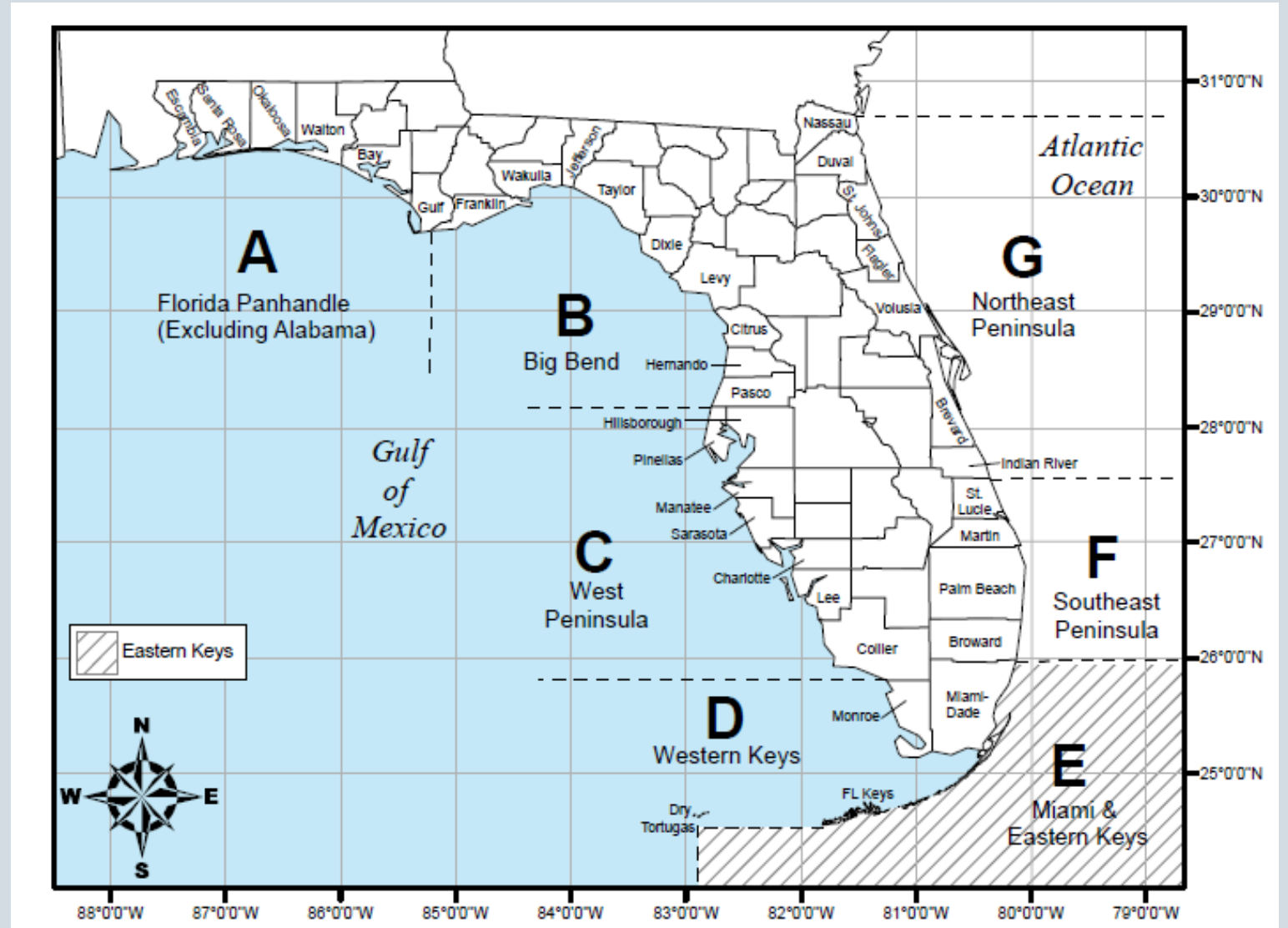
SELECT ALL THAT APPLY:

1 a residential boat slip (waterfront home, vacation rental, condominium or apartment complex)? ☐

2 other facilities for launching boats (public boat ramp, municipal marina, dry storage)? ☐

Please turn the page and tell us about your trips.

*Fishing area map
provided with
questionnaire*



Trip Level Reporting

Trip date

Region fished in
Gulf or Atlantic

% time, if any,
fished in EEZ

Species caught
or targeted

TRIP 1 Please write in the day the boat departed: 0 9 / D D / 2 0 2 0 Did you fish on an artificial reef during this trip? <table><tr><td>Yes</td><td>No</td><td>Not Sure</td></tr><tr><td>☐</td><td>☐</td><td>☐</td></tr></table>	Yes	No	Not Sure	☐	☐	☐	Select ONE region the boat spent the majority of time fishing: <i>See enclosed map</i> <table><tr><td rowspan="4">West FL</td><td>☐ A</td><td>Florida panhandle</td></tr><tr><td>☐ B</td><td>Big Bend</td></tr><tr><td>☐ C</td><td>West Peninsula</td></tr><tr><td>☐ D</td><td>Western Keys</td></tr><tr><td rowspan="3">East FL</td><td>☐ E</td><td>Miami & Eastern Keys</td></tr><tr><td>☐ F</td><td>Southeast Peninsula</td></tr><tr><td>☐ G</td><td>Northeast Peninsula</td></tr></table>	West FL	☐ A	Florida panhandle	☐ B	Big Bend	☐ C	West Peninsula	☐ D	Western Keys	East FL	☐ E	Miami & Eastern Keys	☐ F	Southeast Peninsula	☐ G	Northeast Peninsula	What percent of your time, if any, was spent fishing offshore in federal waters (select one): more than 10 miles from shore? <table><tr><td> 0% </td><td> 10% </td><td> 20% </td><td> 30% </td><td> 40% </td><td> 50% </td></tr><tr><td> 60% </td><td> 70% </td><td> 80% </td><td> 90% </td><td> 100% </td><td></td></tr></table> more than 3 miles from shore? <table><tr><td> 0% </td><td> 10% </td><td> 20% </td><td> 30% </td><td> 40% </td><td> 50% </td></tr><tr><td> 60% </td><td> 70% </td><td> 80% </td><td> 90% </td><td> 100% </td><td></td></tr></table>	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%		Did anyone on the boat keep, release, or try to catch any of the following species? <i>See Species Guide</i> <table><tr><td><u>Snappers & Groupers:</u></td><td><u>Other reef fish:</u></td><td><u>Inshore species:</u></td></tr><tr><td>☐ Red snapper</td><td>☐ Gray triggerfish</td><td>☐ Snook</td></tr><tr><td>☐ Vermilion snapper</td><td>☐ Hogfish</td><td>☐ Red drum</td></tr><tr><td>☐ Mutton snapper</td><td>☐ Amberjack</td><td>☐ Seatrout</td></tr><tr><td>☐ Yellowtail snapper</td><td>☐ Almaco jack</td><td>☐ Bay Scallops</td></tr><tr><td>☐ Gag, black or red grouper</td><td>☐ Banded rudderfish</td><td><u>Other species:</u></td></tr><tr><td>☐ Other snappers, groupers</td><td>☐ Other jacks</td><td>☐ Some other species</td></tr></table>	<u>Snappers & Groupers:</u>	<u>Other reef fish:</u>	<u>Inshore species:</u>	☐ Red snapper	☐ Gray triggerfish	☐ Snook	☐ Vermilion snapper	☐ Hogfish	☐ Red drum	☐ Mutton snapper	☐ Amberjack	☐ Seatrout	☐ Yellowtail snapper	☐ Almaco jack	☐ Bay Scallops	☐ Gag, black or red grouper	☐ Banded rudderfish	<u>Other species:</u>	☐ Other snappers, groupers	☐ Other jacks	☐ Some other species
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Artificial reef use

Allows for direct estimation of reef fish effort by region and area fished



Reef fish ID guide included with questionnaire



During each trip, did you either catch or try to catch any of the following species?

Black Grouper
Mycteroperca bonaci

Box-like patches on body



Copper spots on face and body

Red Snapper
Lutjanus campechanus

Does NOT
have a
yellow eye



Concave caudal fin

Sharply pointed
anal fin

Yellowtail Snapper
Ocyurus chrysurus

Prominent yellow stripe
runs from eye to tail



Deeply forked tail

Almaco Jack
Seriola rivoliana

Front dorsal and anal fins elongated



A deep and flat-bodied amberjack

Red Grouper
Epinephelus morio

Webbing is even with the tip of the
spine, creating a straight line



Irregular light blotches on body

Mutton Snapper
Lutjanus analis

Bright
blue line
below eye



small black spot

Offshore adults can be reddish in
color (not as red as true Red Snapper)

Gray Triggerfish
Balistes caprisus

Upper rim of
eye blue



Caudal fin lobes
elongated in adults

**Amberjacks
(Greater, Lesser)**

Lesser Amberjack not
pictured here. Lesser
Amberjack grow up to
32 inches in length.

Dark band extends from nose
to dorsal fin



Soft dorsal base and anal fin are closer
in length than in banded rudderfish

Gag Grouper
Mycteroperca microlepis

Webbing between spines is notched



Brownish gray in color
with dark, worm-like markings

Vermilion Snapper
Rhomboplites aurorubens

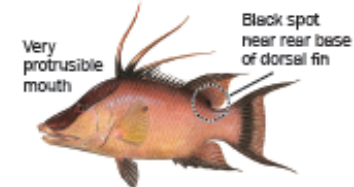
Bullet shaped body



Forked caudal fin

Hogfish
Lachnolaimus maximus

First 3 dorsal spines very long



Very
protrusible
mouth

Black spot
near rear base
of dorsal fin

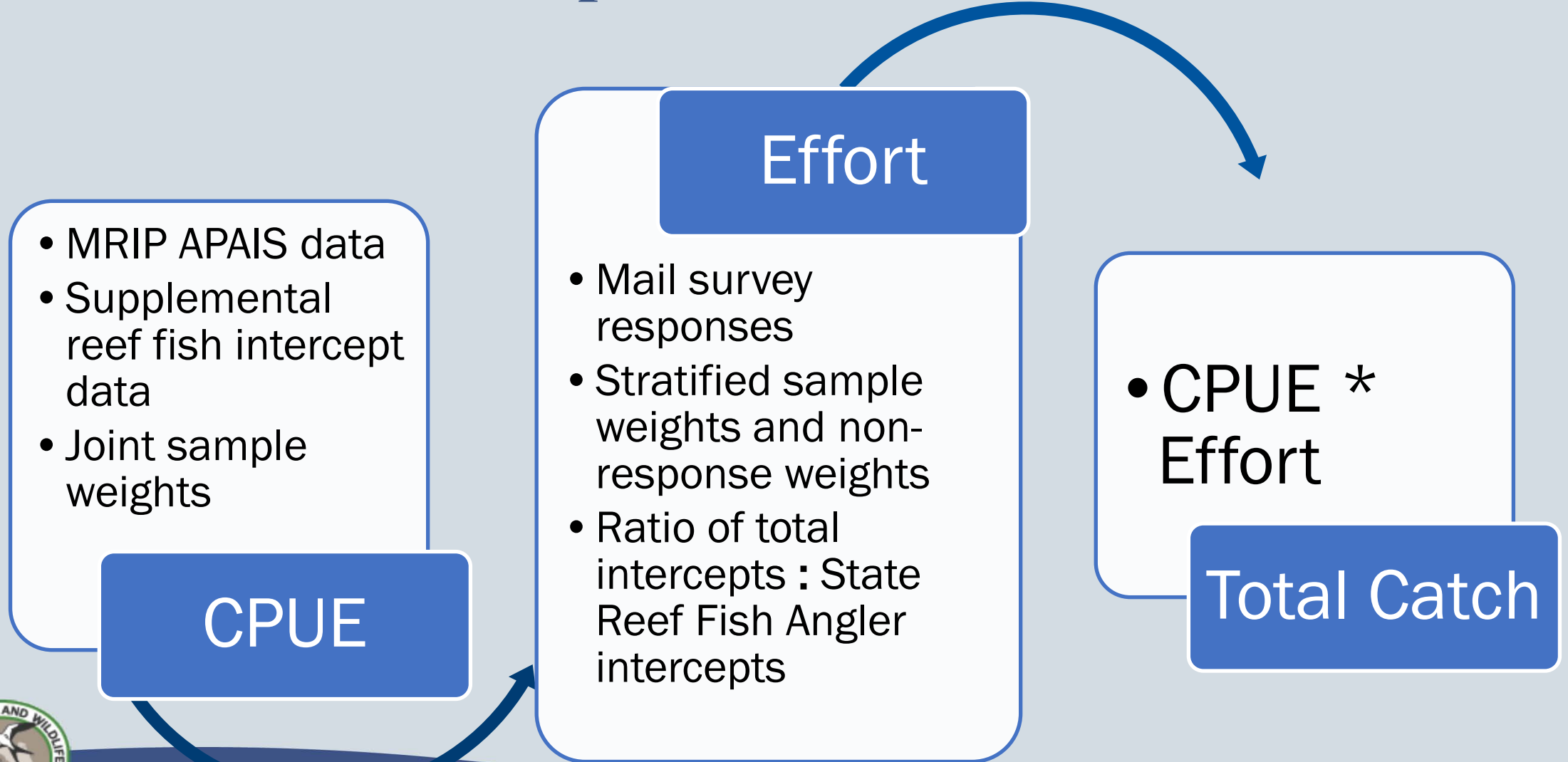
Color varies by sex and age

Banded Rudderfish
Seriola zonata

Tail-lobe often
white tipped

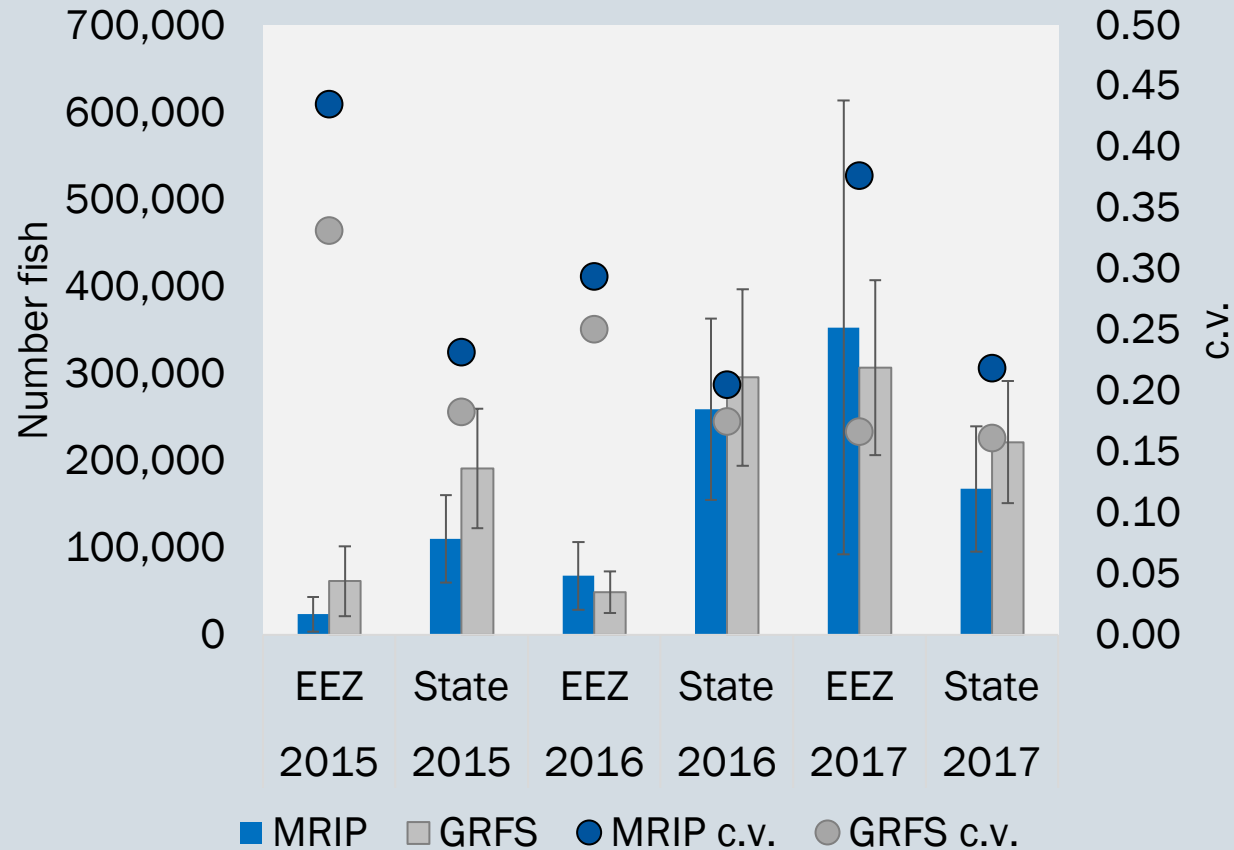


Data Inputs for Estimation

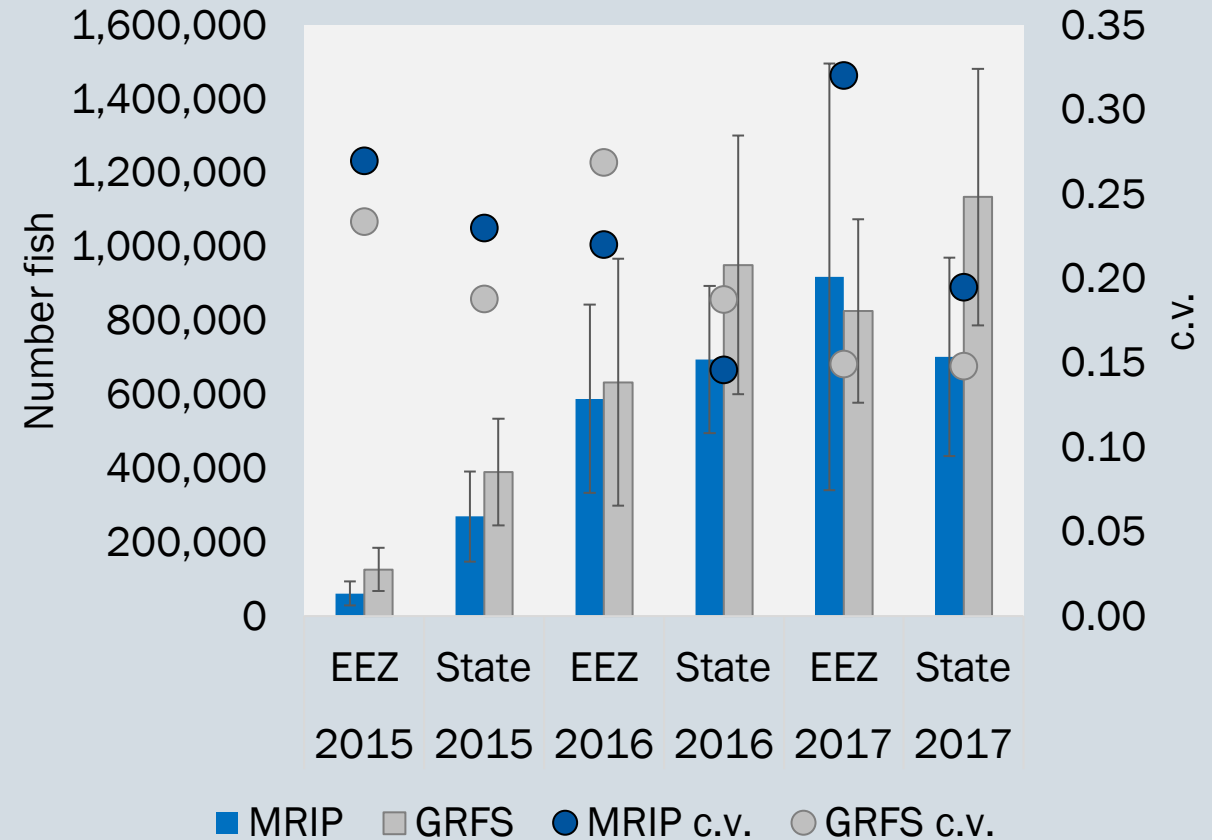


Results from Pilot Testing in Gulf

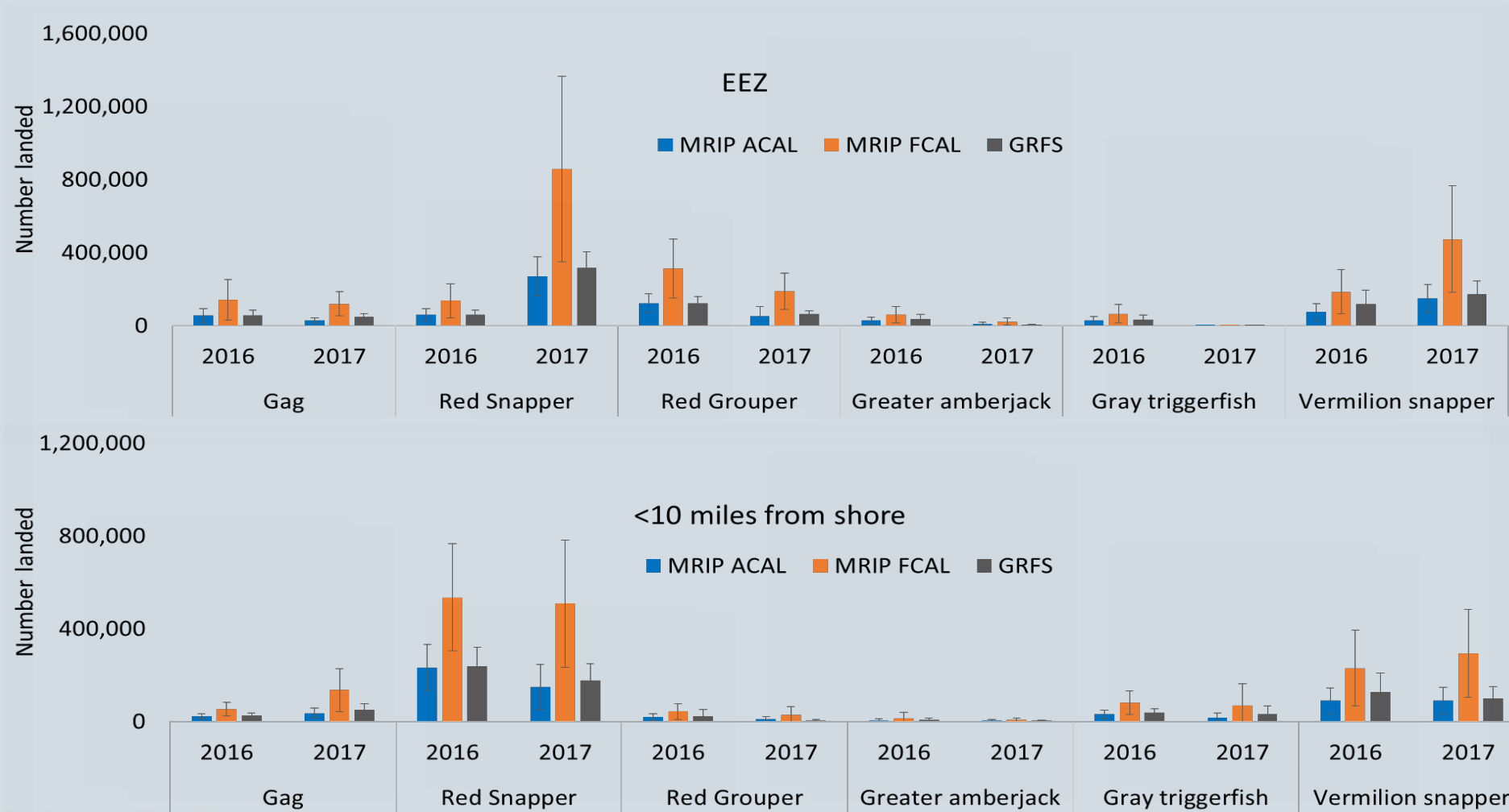
Red Snapper Landings



Red Snapper Discards



Re-Calibrated MRIP Estimates

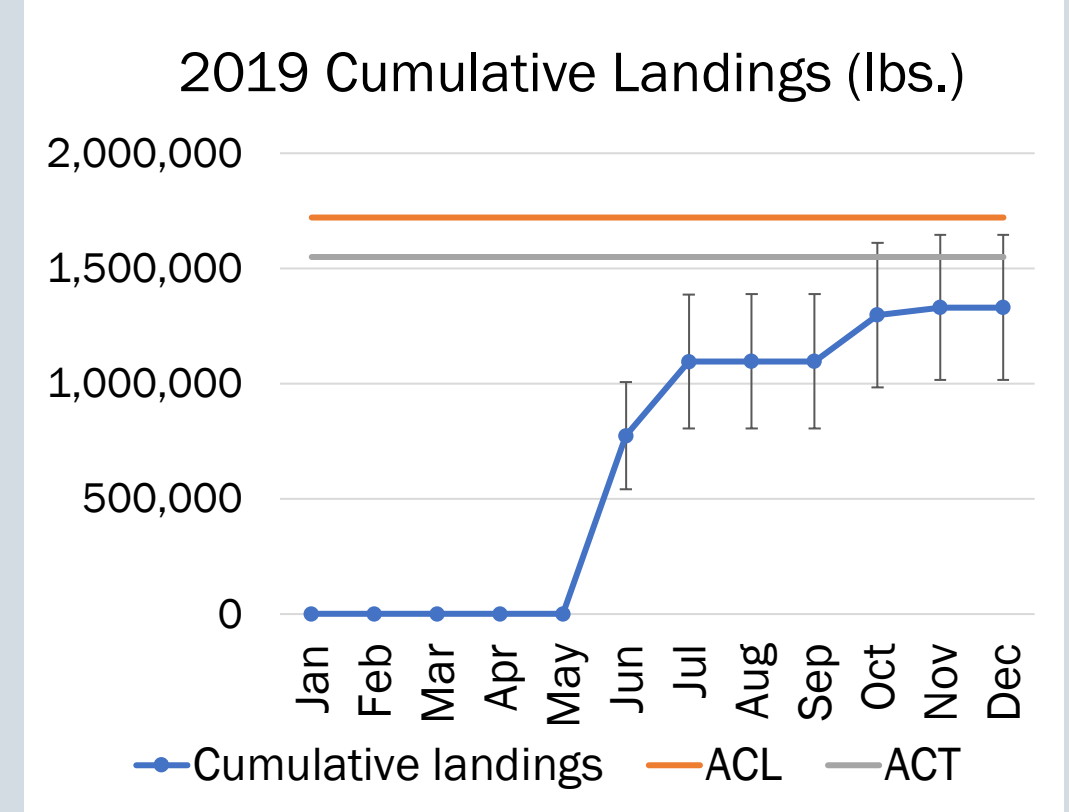


Facilitating Better Management of Red Snapper in the Gulf of Mexico



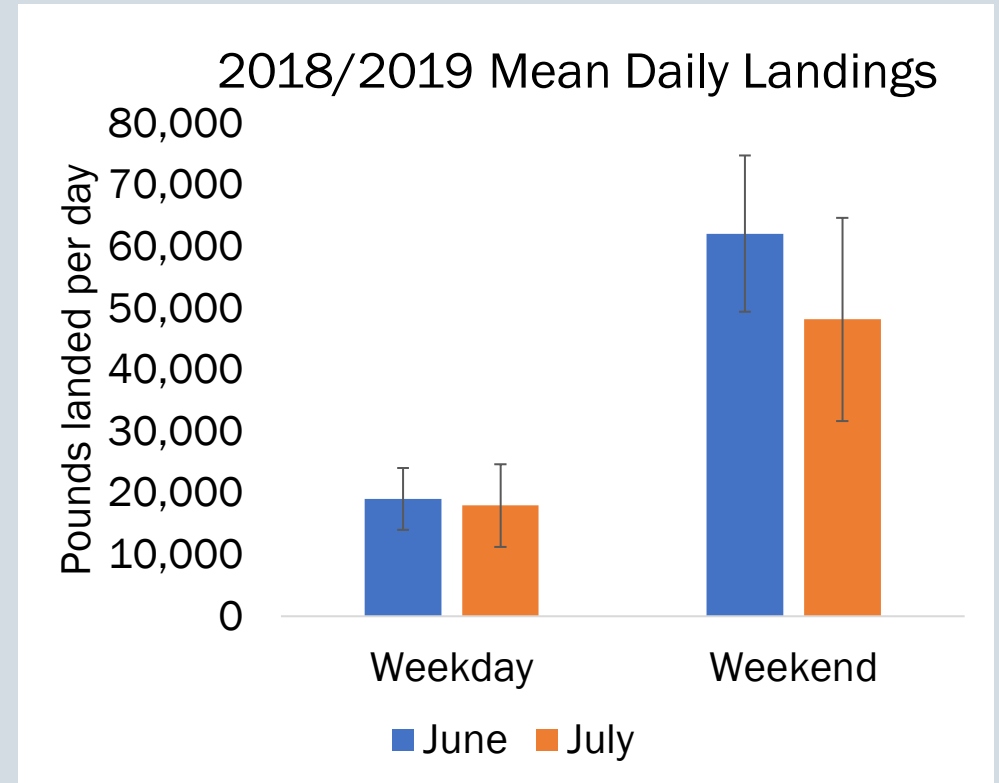
Managing the Red Snapper Recreational Fishery

- Florida manages 43% of Gulf-wide recreational quota
- FWC sets season in state and federal waters
 - Opens June 11
 - Closes mid to late July
 - May re-open if quota not harvested
- Gulf Reef Fish Survey used to:
 - Monitor landings, track state quota
 - Project season length for next year



Setting the Season Length

- Monthly landings in prior year(s) can be estimated separately for weekends versus weekdays.
 - Divide by number of open days to get daily harvest rate.
- Used by managers to select dates for upcoming season and stay within catch limit.



Red Snapper Season: June - July

JUNE: 2 nd month of MRIP Wave 3	GRFS	MRIP*
Intercept data	July 1	August 15
GRFS effort estimate	August 15	
GRFS catch estimate	August 15	

JULY: 1 st month of MRIP Wave 4	GRFS	MRIP*
Intercept data	August 1	October 15
GRFS effort estimate	September 15	
GRFS catch estimate	October 15	

* Data available 45 days after end of two-month wave



Red Snapper Season: June - July

JUNE: 2 nd month of MRIP Wave 3	GRFS	MRIP
Intercept data	July 1	August 15
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GRFS catch estimate	August 15	

JULY: 1 st month of MRIP Wave 4	GRFS	MRIP
Intercept data	August 1	October 15
GRFS effort estimate	September 15	
GRFS catch estimate	October 15	



In-Season Monitoring

- GRFS intercept sample weights calculated same as MRIP APAIS
- Sample weights provide a reliable index of fishing effort
 - Individual weights are a measure of the total angler trips each interview represents.
 - Sum gives an estimate of total fishing effort at all sites in sample frame



APAIS Sample Weights



PSU – Stage I Sample Weight

$$w_1 = \frac{1}{\text{inclusion probability}}$$

Sample Duration – Stage II Sample Weight

$$w_2 = \frac{\text{length of assigned time interval}}{\text{time spent subsampling at a site within a cluster}}$$

Angler-Trip – Stage III Sample Weight

$$w_3 = \frac{\text{Total angler trips observed at a site}}{\text{Total angler trips intercepted at a site}}$$

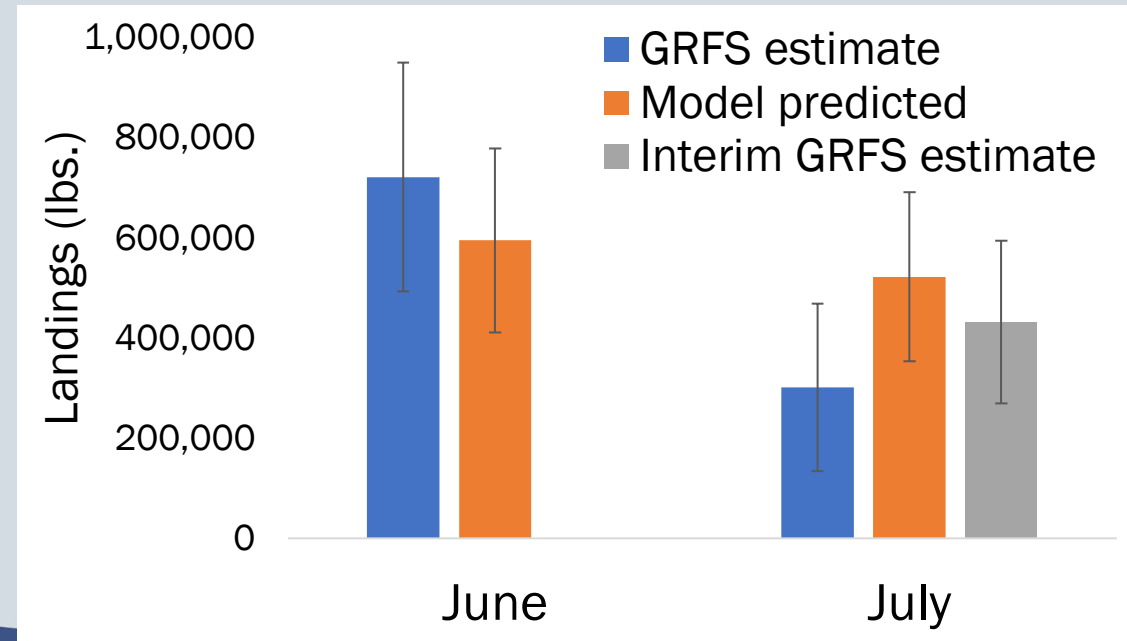
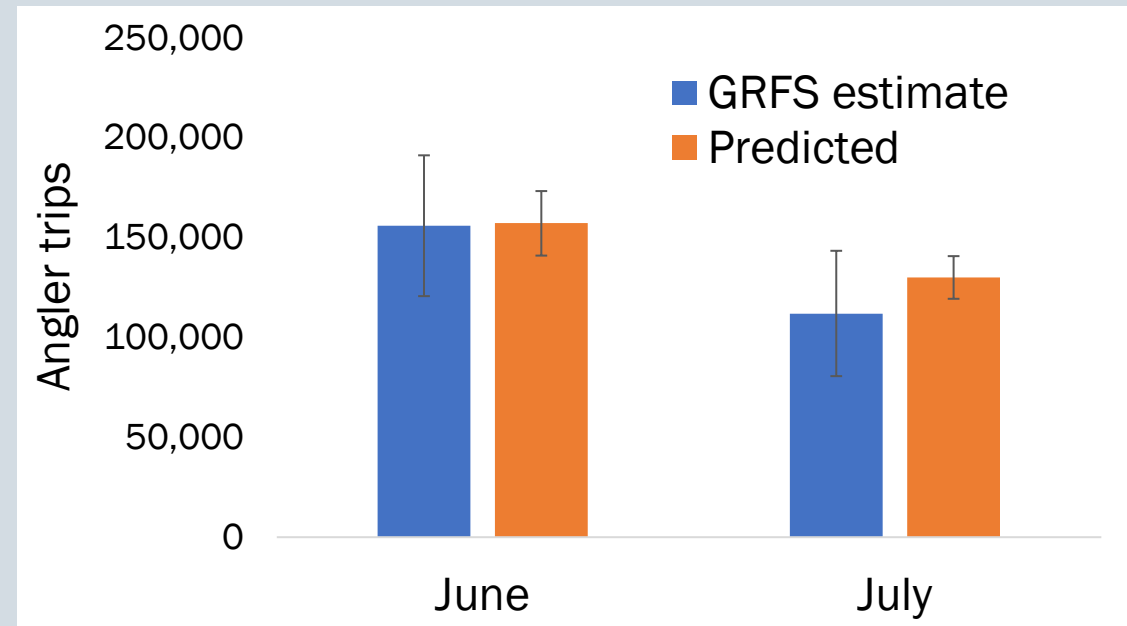
Catch – Stage IV Sample Weight

$$w_4 = \frac{\text{Total number of fish harvested by an angler trip}}{\text{Number of fish sampled from that angler trip}}$$

From presentation given by John Foster, NOAA OS&T, at Gulf SSC MRIP Workshop, July 2020

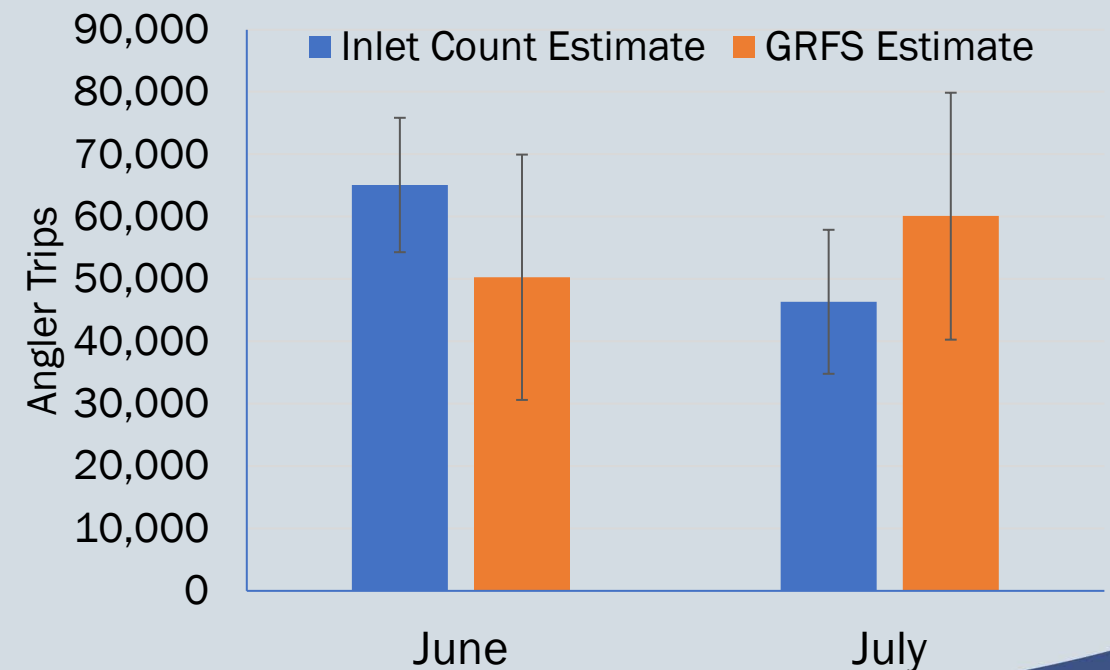
In-Season Predictions

- Linear regression to predict effort in 2019
 - Response: monthly GRFS effort (2016-2018)
 - Predictor: sum GRFS intercept sample weights
 - Covariates: region, “fishable days”, days season open
 - $R^2 = 0.60$
- Applied simulated mean CPUE to estimate landings in 2019
 - Needs refinement
- Interim July estimate to evaluate fall season
 - July effort x June CPUE



Monitoring Effort In-Season and Validation of Mail Survey

- Monitored recreational boats entering Gulf of Mexico
 - Four inlets in panhandle
 - June and July 2019
- Compared GRFS effort estimate with inlet count method
- Promising method for providing in-season management advice.
- Validates GRFS effort estimates

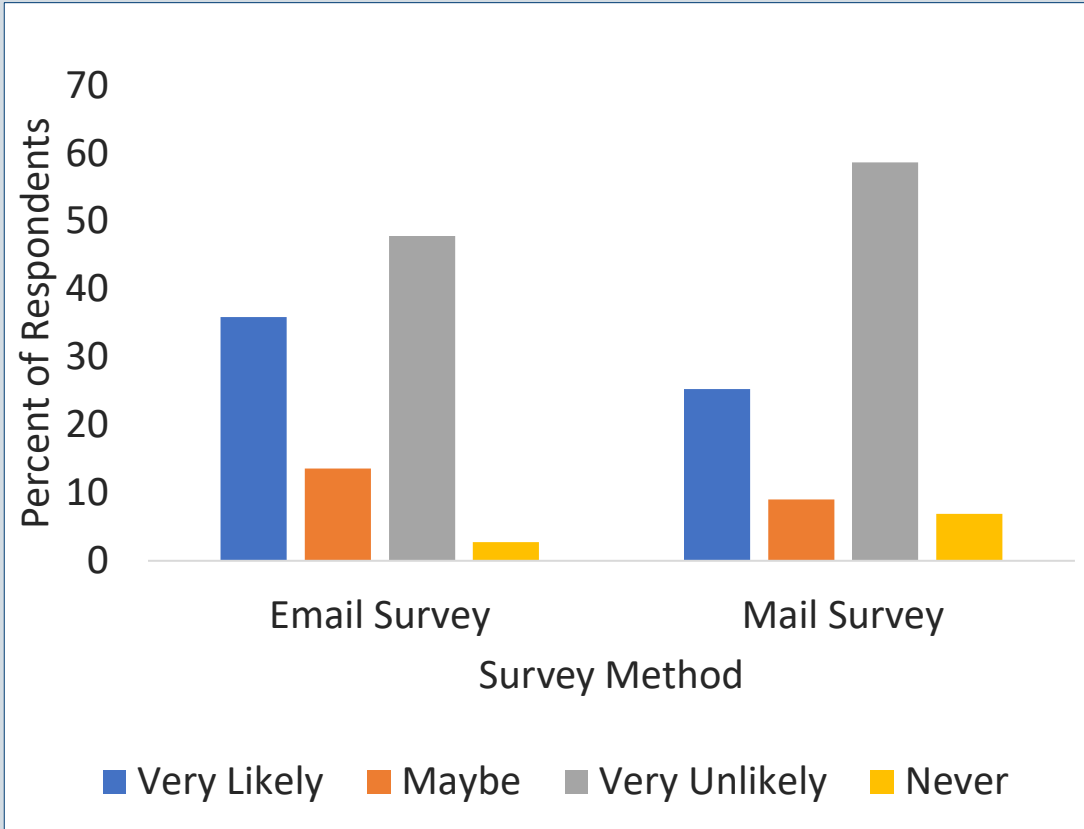


Ongoing Work

- Explore potential sources of bias
 - Use intercept survey data to:
 - expand effort for non-resident anglers
 - Allocate effort across regions, areas fished
- Sample size, stratification
 - Simulation model
- Cognitive recall
 - Side-by-side mail survey questionnaires
- On-site validation
 - Video monitoring at ocean inlets



Lessons Learned



Results of avidity survey during pilot testing of State Reef Fish Survey on Gulf coast.



- Method to identify participants in reef fish fishery is a key component
 - Effective when mandatory, enforced
 - Outreach and buy-in also key
- Should minimize oversubscription
 - ~60% during Gulf pilot unlikely to participate in a reef fish trip
 - Survey design can account for potential non-response bias
 - Still want to minimize source
 - Peer review recommended fee or other mechanism to ensure subscription is intentional

Lessons Learned

- Clearly defined goals for regional survey development
- Strong state-to-state and state-federal coordination
- Compatible survey methods that allow data to be used together regionally



Last slide😊



Acknowledgements

- FWC Fish and Wildlife Research Inst., Fisheries Dependent Monitoring
 - Tiffanie Cross
- FWC Division of Marine Fisheries Management
- Technical support provided by NOAA Office of Science and Technology
- Development and implementation funded by:
 - National Fish and Wildlife Foundation, Gulf Environmental Benefit Fund



Contact Information

- My email: Beverly.Sauls@MyFWC.com
- More Information:
 - State Reef Fish Survey
<https://myfwc.com/srfs>
 - NOAA Certification of Gulf Reef Fish Survey
<https://www.fisheries.noaa.gov/recreational-fishing-data/certified-recreational-fishing-survey-designs>
 - Gulf Red Snapper Workshops
<https://myfwc.com/research/saltwater/fishstats/gulf-reef-fish-survey/timeline/>
 - State management of Red Snapper in Gulf
<https://www.fisheries.noaa.gov/southeast/state-recreational-red-snapper-management-exempted-fishing-permits>



**The following slides are considered backup material
and are not anticipated to be part of the actual
presentation**



Comparison Across Surveys

- MRIP and GRFS use a similar approach
 - Mail survey for Effort
 - Intercept survey for CPUE
 - Effort x CPUE = total catch
- MRIP is a general survey
 - Estimates total effort for all saltwater species anywhere in state
 - Partitioned by area and region
- SRFS is more specialized
 - Directly estimates effort for reef fishes by area and region
- Both use intercept sample weights to expand catch
 - Trends are similar
 - MRIP estimates 2-3 times higher



Design	MRIP - Effort	Florida GRFS - Effort
Recall period	2 month waves	1 month
Survey method	Paper questionnaire sent by mail	Same as MRIP
Sample universe	State households (postal addresses)	Registered anglers
Expansion	State population (American Community Survey)	Registered anglers
Sample stratification	- Florida households by: - With/without in-state fishing license	- Out-of-state residents by: - GA/AL, other - In-state residents by: - Region of state - Coast or inland - With/without in-state boat registration
Sample Size	FL households selected per wave: 886 to 1,240	Anglers selected per month: 7,000
Response Rate	32% (280-400 responses)	20% (~1,400 responses)
Estimate provided before under-coverage adjustments	Total angler trips that target any type of saltwater fish from: - Florida (any region) - By mode (private boat, shore)	Total angler trips that target reef fish from: - West Florida (except Keys) - Private boats only - By area fished (state, EEZ)
Under-coverage adjustments	Out-of-state residents	Non-registered anglers
Effort partitioning	Intercept data used to partition total effort by: - Area fished (inland, state, EEZ) - Region (Gulf versus Atlantic)	Not necessary