State Reef Fish Survey in Florida

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St. Petersburg, Florida
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Outline

- Overview of methods
- Overview of peer review and response
- Changes since certification
- Ongoing efforts to evaluate bias and verify accuracy of estimates

Housekeeping
- Where to send documentation
- Follow-up questions
  - Contact information provided at the end of this presentation
Overview

- Three Gulf regional workshops 2013-2014
  - need for more directed reef fish surveys
- Florida’s Gulf Reef Fish Survey
  - Implemented in 2015
  - Designed to run concurrent with general MRIP survey to provide more precise estimates for reef fishes.
  - Intended to support stock assessment and management goals
    - Year-round, monthly estimates
    - Effort, landings, discards
Design Overview

- Complementary methods
  - Combined to estimate catch
- Integrated with MRIP
  - APAIS and supplemental assignments drawn together
    - Joint sample weights
    - Estimates incorporate data from both surveys
- Expanded statewide in July, 2020
  - Renamed State Reef Fish Survey
Reef Fish Angler Designation

- Pilot survey in Gulf
  - Reef Fish Angler Designation required to harvest reef fish from a private boat along Gulf coast of Florida
    - Keys were excluded
  - Included senior citizens that are not required to purchase a saltwater license

- Statewide expansion
  - Requirement extended to private boat anglers in the Keys and along Atlantic coast of Florida
  - Three new reef fish species added to requirement

Provides a directory of participants in the reef fish recreational fishery
Peer reviewers had no major concerns with the survey design:

- The general approach of using two surveys, one to estimate effort and one to estimate CPUE, which are then combined to provide a final estimate of catch, is sound.
- This approach has been studied extensively by two National Academy panels and deemed appropriate for the challenging problem of estimating recreational catch.
- We consider most of the concerns to be relatively minor problems and not disqualifying.

Peer review report available as an appendix to this document:
Peer Review

- Minor concerns
  - Response rates low and declining over time
  - Oversubscription potentially contributes to non-response bias
  - Under-coverage estimated from supplemental GRFS intercept assignments
- Provided a list of recommended improvements
  - Did not include any changes to the survey design
Options for addressing non-response

- Recommendation: side-by-side testing of different colors and layout for questionnaire
  - Gray-scale and color questionnaires, no difference in response rates
  - Horizontal layout improved response, and was implemented

- Recommendation: add a pre-letter, test mixed-mode approach that includes an internet reporting option
  - NFWF proposal submitted in 2018, not funded
  - State contract includes option to test both in 2022-23
Options for Addressing Non-Response

- Recommendation: Increase saliency, reduce anglers on frame who do not have interest in fishing for the species covered by the GRFS

- Response:
  - Encourage anglers to report non-reef fish trips
  - Make survey more inclusive
    - Includes Gulf, Atlantic, and Keys
    - Includes new reef fish species important to S. Florida

Photo credit: https://www.floridasportsman.com/editorial/hogfish-on-the-hook/400597
Effort Questionnaire

Title inclusive of all saltwater fishing

Screening question shortened, placed first (recommended by peer review)

Still includes calendar for most recent month to help anglers recall trips.
New fishing area map provided with questionnaire
• Allows for direct estimation of effort in Gulf vs. Atlantic
• Important for maintaining consistent time-series in Gulf

Trip level reporting
• Reduced from 12 to 9 trips
• Recommended by peer review
## Trip Level Reporting

**Trip date**
- Please write in the day the boat departed: **05/22/2021**
- Did you fish on an artificial reef during this trip? **Yes**

**Fishing area, Gulf and Atlantic**
- **Trip 1**
  - Select ONE region the boat spent the majority of time fishing: See enclosed map
  - Gulf of Mex: Florida panhandle, Big Bend, West Peninsula, Western Keys
  - Atlantic O.: Miami & Eastern Keys, Southeast Peninsula, Northeast Peninsula

**% time, if any, fished in EEZ**
- More than 10 miles from shore:
  - Gulf of Mex: 0% 10% 20% 30% 40% 50%
  - More than 3 miles from shore:
    - Atlantic O.: 0% 10% 20% 30% 40% 50%

**Includes non-reef fish target species**
- Snappers & Groupers:
  - Red snapper
  - Vermilion snapper
  - Mutton snapper
  - Yellowtail snapper
  - Gag, black or red grouper
  - Other snappers, groupers

- Other reef fish:
  - Gray triggerfish
  - Hogfish
  - Amberjack
  - Almaco jack
  - Banded rudderfish
  - Other jacks

- Inshore species:
  - Snook
  - Red drum
  - Seatrout
  - Bay scallops

**Trip level details allow for direct estimation of reef fish effort by region and area fished**
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.

Anglers must also abide by all state and federal recreational seasons, size limits and bag limits.
Annual Response Rates
Under-coverage

- GRFS intercept data collected at small sub-set of APAIS sites could bias under-coverage adjustment.

Peer Review Recommendations:
- Increase number of sites included in GRFS intercept survey
- Include an under-coverage question in the APAIS interview

Response:
- Added more sites to the offshore site group.
- MRIP site register modified to allow FWC to directly edit offshore site pressures and add/delete sites.
- GRFS/SRFS registry question added to APAIS in January 2019.
Since Certification

- No changes to survey methodologies
- Statewide expansion
  - Minor modifications to mail survey sample stratification
  - Modified questionnaire to accommodate Atlantic effort estimation
  - Expanded supplemental intercept survey to Keys and Atlantic coast sites
- Effort estimation preserves Gulf time-series

**Statewide Expansion**

- Implemented mid-2020
- Current subscribers
  - 25% out-of-state residents
    - 25% live in AL or GA
  - 75% state residents
    - 45% live on Gulf coast
    - 34% live on Atlantic coast
    - 19% live inland
    - 2% live in Keys
  - 15% of state residents live in household with a recreational boat

*first month of statewide expansion
## Stratification

<table>
<thead>
<tr>
<th>Region</th>
<th>Coastal Strata</th>
<th>Boat strata</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GRFS</td>
<td>SRFS</td>
</tr>
<tr>
<td><strong>NW</strong></td>
<td>Gulf</td>
<td>Gulf</td>
</tr>
<tr>
<td><strong>North</strong></td>
<td>Gulf</td>
<td>Gulf</td>
</tr>
<tr>
<td></td>
<td>Non-Gulf</td>
<td>Inland</td>
</tr>
<tr>
<td><strong>Central</strong></td>
<td>Gulf</td>
<td>Gulf</td>
</tr>
<tr>
<td></td>
<td>Non-Gulf</td>
<td>Inland</td>
</tr>
<tr>
<td><strong>South</strong></td>
<td>Non-Gulf</td>
<td>Monroe Co.</td>
</tr>
<tr>
<td><strong>Non-residents</strong></td>
<td>AL/GA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other states</td>
<td></td>
</tr>
</tbody>
</table>

Sub-stratified for anglers in households with/without a registered boat.

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

- Implemented mid-2020
  - GRFS: Jan-Jun
  - SRFS: July-Dec
- Strata for non-residents and Gulf coast residents sampled the same for both surveys
  - No apparent change in response rates between old and new questionnaires
Non-Gulf Coast Strata

Non-Gulf coast residents were split into inland and Atlantic coast sub-strata in SRFS sample

- Response rates higher among residents adjacent to the Atlantic coast, particularly those with a boat
- Similar to trend among Gulf coast residents during pilot

Non-Gulf coast strata - 2020

GRFS (Jan-June)  SRFS (July-Dec)
South Florida residents split into Keys (Monroe) and S. Atlantic (Miami/Dade) strata

Response rates higher in the Keys, particularly anglers with a boat
Key Points

- Response rates improved after peer-review recommendations were implemented
- Statewide expansion has helped
  - Survey more inclusive for anglers that fish in the Keys and along Atlantic coast
  - Less confusion about who should subscribe
  - Atlantic coastal strata account for more potential non-response bias
Verifying the Accuracy of SRFS
Florida’s Commitment

- July 2020, state Legislature committed funds to support long-term monitoring of recreational fisheries for reef fishes
  - $3.0 million, annually recurring
- Stable funding has allowed us to develop an internal work plan to investigate potential sources of bias and verify the accuracy of SRFS estimates.
  - Underway and ongoing
SRFS estimates are consistently lower than MRIP since FES implemented.

Both surveys use similar methods to estimate CPUE:
- APAIS data are shared.

Key differences in effort surveys:
- Research is focused on evaluating the accuracy of SRFS effort estimates.
How SRFS effort survey design minimizes or eliminates potential error

<table>
<thead>
<tr>
<th>Source</th>
<th>How SRFS effort survey design minimizes or eliminates potential error</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample universe</strong></td>
<td>Reef fish angler registry, includes residents and non-residents.Eliminates non-response bias from non-fishing households, potential bias in residency of anglers at public vs. private sites.</td>
</tr>
<tr>
<td><strong>Under-coverage</strong></td>
<td>Angler intercept data used to account for effort by non-registered anglers. This is the only use of intercept data in fishing effort estimates. Enforcement conducted on the water and on land; all boats leaving from public and private access points subject to compliance checks.</td>
</tr>
<tr>
<td><strong>Effort partitioning</strong></td>
<td>Effort in Gulf vs. Atlantic and by area fished (state, EEZ) is directly estimated through mail survey, includes trips from public and private access points.</td>
</tr>
<tr>
<td><strong>Recall bias</strong></td>
<td>Recall period reduced to 1 month, calendar helps with recalling date of each trip.</td>
</tr>
<tr>
<td><strong>Saliency</strong></td>
<td>Respondents report all private boat trips, not just for reef fish. Statewide expansion made survey salient to all Florida anglers.</td>
</tr>
<tr>
<td><strong>Sample size</strong></td>
<td>7,000 anglers selected per month, ~1,400 responses per month. Increased sample size to 10,000 per month with statewide expansion</td>
</tr>
<tr>
<td><strong>Non-response bias</strong></td>
<td>Sample stratified by region, coast, and boat ownership and appropriately weighted to account for varied response rates among angler groups with different avidities. Post-stratification weighting corrects for varied response rates not accounted for in the initial sample stratification.</td>
</tr>
</tbody>
</table>
Evaluating the Accuracy of SRFS Estimates

- Research focused on the following:
  - Under-coverage
  - Non-response
  - Sample size and stratification
  - Cognitive recall
  - Effort validation
Under-coverage

- Saltwater license holders without the State Reef Fish Angler designation selected to receive SRFS questionnaire
  - $3,000/month, distributed across all strata
  - July, Aug, Sep, 2021
  - Concurrent with regular mailings for SRFS
- Estimated reef fish trips taken by license holders with and without the State Reef Fish Angler designation
  - Compared with under-coverage estimated through intercept surveys
Under-coverage

- Intercept survey ratios (MRIP, SRFS, and Both)
  - Total reef fish angler interviews / number registered for SRFS
- Effort survey ratio (SW)
  - Total estimated effort by all licensed anglers / effort by anglers registered for SRFS
Non-response bias

- Evaluate demographics of responses to identify potential sources of bias not accounted for in stratification and post-stratification sample weights
  - Gender
  - Age
- Resident seniors 65+
  - Must opt in for free SRFS registration

2021 SRFS Registrants by Age

- Percent of population
- Percent of responses
Trips per Response by age class and registration method - 2021

- ~60% of SRFS registrations obtained via the internet
  - Must opt in
- Most differences in avidity are explained by registration method
  - Accounted for in post-stratification
Conclusions:

- Registration method accounts for largest portion of the known non-response bias.
  - Results in small decrease in effort estimates.
- Additional post-stratification on age will not change effort estimates.
- Focus on improving response rates for younger anglers in future.
Cognitive Recall Test

- Side-by-side testing of the SRFS and simplified questionnaires
  - Waves 4 and 5, 2021
  - NW panhandle and North peninsula
  - Four fishing questions
    - No calendar
    - No trip level details
  - Two additional questions
    - Seasonal residency
    - Avidity

Anglers asked to report total trips over 1 or 2 month period

Q1. How many saltwater recreational fishing trips on a private boat that launched from Florida did you personally participate in during the month of OCTOBER? (Clearly write the number ( #) of trips in the box)

Number of saltwater recreational fishing trips taken from a private boat in OCTOBER:

Q2. Of the trips reported in Q1 above, how many were taken in each of the following locations:
   (see Map on reverse side; Clearly write the number ( #) of trips taken in each location in the boxes)

West coast of Florida?  #

East coast of Florida?  #

Q3. Of the trips reported in Q1 above, how many were targeting or harvesting:
   (Clearly write the number ( #) of trips in the boxes)

Shellfish only (e.g., bay scallops, crabs, lobster, shrimp, etc.)?  #

Finish only?  #

Both shellfish and finish?  #

Q4. Of the trips reported in Q1 above, how many were targeting or harvesting:
   (Clearly write the number ( #) of trips in the boxes)

Reef fish? (see species guide included)  #

Gulf or Atlantic coast (map included)

Finfish vs. shellfish effort

Any reef fish species (ID guide included)
Cognitive Recall Test

- Results from cognitive recall survey will be compared with SRFS responses from the same strata and months
  - Response rates
  - Trips per response
  - Total estimated trips over 1 and 2 month periods
- This can only tell us whether estimates differ, not which method is better.
  - Goal is to understand why SRFS effort estimates are lower than FES, and direct future research.
Sample Size and Stratification

- Constructed a fictitious Florida population using:
  - Number of households (American Community Survey)
  - Number of saltwater fishing license households (FWC)
- Assigned fishing effort to households in each county using:
  - Fishing trips per household (1991-2011 Coastal Household Telephone Survey data)
  - Proportion of households matched/unmatched to fishing license that fish (FES, Source Gregg Bray/Rob Andrews)
- Provided a population with known fishing effort that we could sample

Documentation will be provided
Simulations

- Sampled these households with different stratification schemes and sample sizes.
- Compared effort estimates from each sample to the true effort for the known population.

Sample runs:
- Stratification
  - All FL, Gulf Atlantic inland Keys, SRFS, coastal & inland, north & south, north/south & inland/coast
- Sample size
  - Range 1,000 to 14,000 households per wave
Regional Stratifications

![Bar chart showing relative bias (%)](image-url)
Sample Sizes

![Graph showing sample sizes and error rates for different sampling schemes. The x-axis represents sample size per wave, ranging from 2,000 to 14,000. The y-axis represents percent standard error, ranging from 0 to 40. Different sampling schemes are indicated by various markers and colors. The graph shows a trend where higher sample sizes generally correspond to lower percent standard errors.](image-url)
Main takeaways

- Regional stratification does not affect the accuracy of the estimates.
  - All the sampling schemes were accurate

- Increased regional stratification increased estimate precision.

- Considering a reduction in the number of surveys we send out.
Effort Validation: On-Site Survey

- Counted recreational boats entering Gulf of Mexico
  - Four inlets in panhandle
  - June and July 2019

Documentation will be provided
Effort Validation: On-Site Survey

- Sampling Design
  - Pass, Week, Kind-of-Day, Time-of-Day
- Intercept Survey
  - Vessels egressed pass?
  - Hour egressed?
  - Reef fished?
  - Total anglers aboard?

Documentation will be provided
Effort Validation: On-Site Survey

- Compared GRFS effort estimate with inlet count method
- Validates GRFS effort estimates

Documentation will be provided
Effort Validation - Ongoing work

- Cameras to monitor recreational fishing effort
- Working with an AI developed by CVision AI to automate boat counts
- Pilot test of 3 inlets
  - 2 of 3 systems deployed
- Validate with On-Site survey
Camera Setup – Cumberland Sound
Camera Footage – Ponce Inlet

2/1/2022, 1:57:09 PM EST
Thank you.

- **Contacts:**
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  - Tiffanie.Cross@MyFWC.com
  - Chloe.Ramsay@MyFWC.com
  - Luiz.Barbieri@MyFWC.com

- **More Information:**
  - State Reef Fish Survey
    https://myfwc.com/srfs
  - NOAA Certification of Gulf Reef Fish Survey