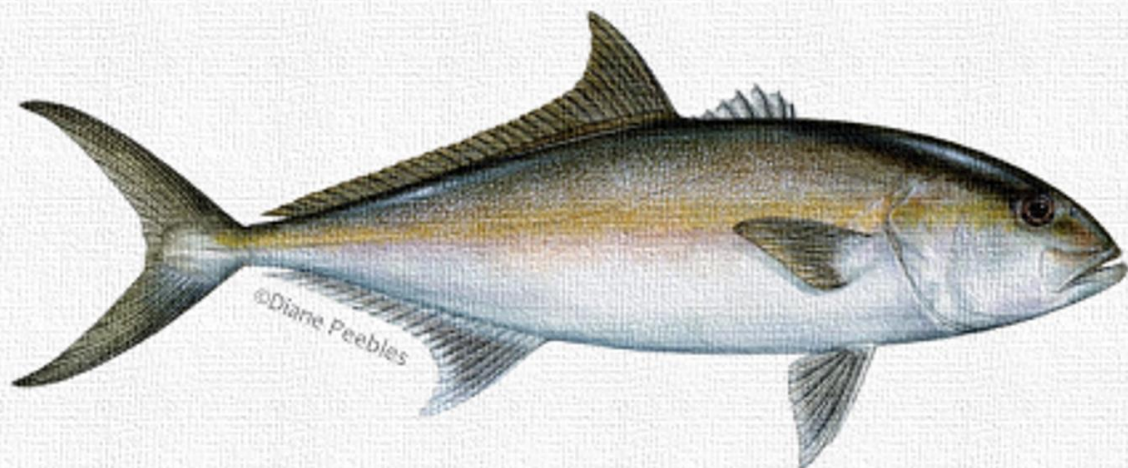# 2020 — 2023
Gulf of Mexico and South Atlantic Greater Amberjack Research Program

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Visioning Component Report

December 2021

Content

Gulf of Mexico and South Atlantic Greater Amberjack Research Program (2020-2023)

Visioning Component

Program Description

The Greater Amberjack (*Seriola dumerili*) is an important recreational and commercial fish species in the Gulf of Mexico (GOMEX) and South Atlantic (SA) regions. To address management and stakeholder concerns about the Greater Amberjack (GAJ) fisheries in both regions, Congress authorized funding of $ 10 Million for a multi-year GAJ Research Program to be implemented through a cooperative agreement with the National Sea Grant Office (NSGO) and the National Marine Fisheries Service (NMFS).

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"   The **GOAL** of this research program is to develop additional data sources, assessment approaches, and knowledge to improve agency and agency independent estimates of the abundance of Greater Amberjack throughout the Greater Amberjack's range.

Research Program Objectives

- Engage with stakeholders to identify and prioritize regional research needs.

- Synthesize regional research needs into prioritized research objectives that address needs of both stocks and are feasible within the budget and timeline of the program.

- Develop and release a request for research proposal (RFP), solicit proposals and select high priority and feasible projects.

- Synthesize and convey knowledge gained from the regional or multi-regional research project(s) to facilitate the incorporation of new data and methodologies from the research program into future GAJ stock assessments.

Approach

July-Dec 2020
Visioning Team
Jan 2021 - July 2023
Mississippi-Alabama Sea Grant

Visioning Phase
Implementing Phase
Documenting Phase

Steering Committee

Stakeholders input
Research priorities

Request for
Proposals - RFP

Transfer of
knowledge

The project consists of three phases in which a steering committee provides overall guidance.

Visioning Phase

During this phase the program's prioritized regional research recommendations were developed using existing information and input from stakeholders. The steering committee used this prioritization in their development of the Request for Proposals (RFP).

Implementing Phase

Consisting of:

(1) finalizing, releasing, and advertising the (RFP),

(2) evaluating and selecting the fundable proposals, and

(3) implementing the research projects that address the priorities.

Documenting Phase

This phase will summarize the results of research funded by this program to facilitate the transfer of new knowledge derived from the research to stakeholders involved in the stock assessment process.

This report describes the processes, implementation, and execution of the visioning phase, which were finalized in December 2020.
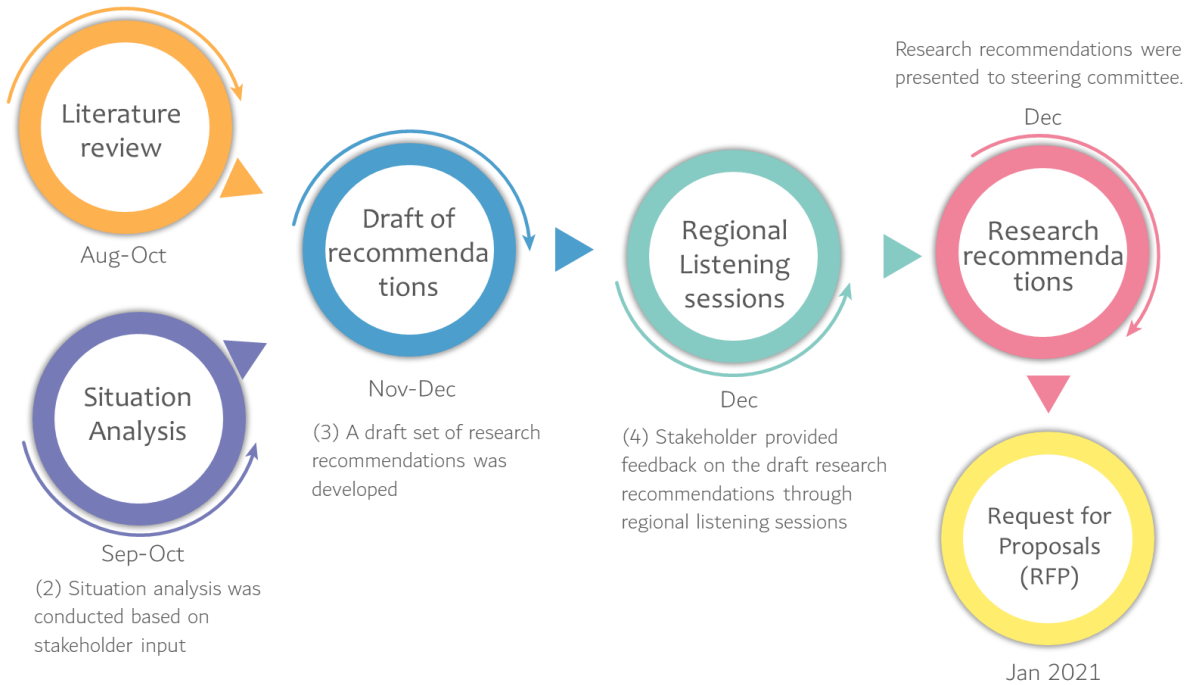
For more information about

The implementing and the documenting phases please visit

http://masgc.org/greater-amberjack/about

Visioning Process

The aim of the visioning process was to develop a set of research recommendations to be considered for the implementation phase of the GAJ program. The visioning process entailed:

(1) Review of existing information from stock assessments, management reports, and the scientific literature

Research recommendations were presented to steering committee.

Literature review

Aug-Oct

Situation Analysis

Sep-Oct

(2) Situation analysis was conducted based on stakeholder input

Draft of recommendations

Nov-Dec

(3) A draft set of research recommendations was developed

Regional Listening sessions

Dec

(4) Stakeholder provided feedback on the draft research recommendations through regional listening sessions

Dec

Research recommendations

Request for Proposals (RFP)

Jan 2021

Literature Review

A summary of current knowledge of greater amberjack stocks in the GOMEX and SA, as well as significant research gaps was conducted. The review included summaries of GAJ biology, historic fisheries management, and key issues in the harvesting/conservation of the species.

Situation Analysis

A situation analysis was conducted to collect fishery stakeholder thoughts on the GAJ fishery as a whole, management/research recommendations, and stakeholder participation in research.

A structured survey instrument was developed and the qualitative interviews were conducted by Sea Grant agents of the GOMEX region. The survey instrument asked participants about their perceptions regarding changes experienced in the GAJ

> "The situation analysis allowed the visioning team to understand how stakeholders view the greater amberjack fishery, its management, and the science used in management."

fishery, feelings about the fishery, management and science, research recommendations, and the potential role of fishers in research. Stakeholders were invited to give input to the situation analysis in September-October 2020, resulting in 89 qualitative interviews. The majority of interviews (80%) were conducted by phone, followed by video meetings (12%) and in person meetings (8%).

Draft of Recommendations

Based off both the literature review and the situation analysis, a draft with a series of recommendations was developed by the core visioning team in November 2020. The developed draft included the following sections: themes, recommendations, problems addressed, level of importance, regions (GOMEX or SA), approach, feasibility, source, and whether recommendations were within the scope of project.

Regional Listening Sessions

The draft of recommendations informed a series of listening sessions, whose purpose was to provide stakeholder input. Originally this component involved organizing six in-person meetings with federal and state agencies, non-governmental organization, academics, commercial and private anglers. However, due to the COVID-19 pandemic, in-person meetings were not possible. Instead, six virtual meetings were organized and held in December 2020. An Americans with Disabilities (ADA) compliant announcement was distributed to key actors in the GOMEX states by Sea Grant agents involved in the visioning team. Direct emails, a press release about the project, and several social media posts (Facebook, Twitter) were also used to invite stakeholders to participate in any of the six scheduled listening sessions.

Each virtual listening sessions followed the same protocol. Each session started by providing participants with background and preliminary information about the project and the GAJ fisheries. Each participant introduced itself (their role in fisheries and region of work). The participants were then presented with a brief summary of the literature review, situation analysis findings, and a draft of recommendations. During the meetings, participants were asked the following questions:

> - Are there any specific comments on how recommendations should be implemented (i.e. areas to survey, specific methods to adopt or avoid)?
> - Is anything missing?
> - Which of the research recommendations should be prioritized and why?
> - Suggestions for stakeholder involvement in the program.
> - What else do you want to tell us?

Research Recommendations

After including the recommendations of the regional listening sessions, the new/amended research recommendations were presented to the project's implementation team (Sea Grant Mississippi-Alabama) and the steering committee in December 2021. Subsequently, a request for proposal (RFP) call was released in January 2021 by the implementation team.

Results

Literature review

The literature review found that GAJ are a large, widespread species noted for its fast growth, high meat quality, and good fighting ability. GAJ are both frequently targeted by the recreational/commercial fishermen in the wild and used in aquaculture. The US fishery is managed as two separate, non-mixing stocks, GOMEX and SA. GAJ are considered overfished (since 1987) and are currently undergoing overfishing in the GOMEX, while in the SA populations are not overharvested. There are multiple possible reasons for the difference in fishing pressure. There is widespread concern that large quantities of GAJ aggregate around artificial reefs, creating informal fish aggregating devices (FADs). There are more artificial structures in the GOMEX than the SA, which may lead to a higher proportion of the fishery aggregating at artificial reefs. For example, 45% of the entire estimated GOMEX GAJ stock was found on platforms in 2019. It is also possible overfishing is exacerbated by fishing mortality in large female amberjack, which would explain the species' overfished status despite increased size limits and reduced quotas. In contemplating these factors however, it should be considered that there is a higher level of research in the GOMEX than the SA, possibly due to higher levels of interest and fishing pressure from recreational and commercial anglers.

The key issues and uncertainties associated with the GAJ fishery concern their morphology, behavior, and life history. GAJ are difficult to differentiate from other species. Lesser amberjack, banded rudderfish, and almaco jack were historically combined with greater amberjack to produce an "unclassified amberjack" category that wasn't made more specific until 1992. As a result, there's uncertainty of fishing mortality and overall biomass estimates prior to the 1990s. GAJ often have a seasonal abundance, and that combined with being a schooling species means that GAJ counts are highly variable. Amberjack also respond strongly to research/fishing gear, making sampling more difficult. The life history of GAJ is also considered patchy. There are significant uncertainties in distribution, seasonal patterns, and spawning aggregations. The nature of GAJ stocks is largely unknown; there may be multiple stocks within the GOMEX and SA or there may only be a single stock per region. These issues make estimations of abundance, stock trajectory, and subsequently fisheries management, difficult. The literature review recommended investigations into predictions of recreational catches, analyses of long-term fishing mortality, socioeconomic data of GAJ

fishermen, and further research into life history. Key to all these suggestions was ranking the research recommendations to prioritize certain goals/projects.

Situation Analysis

Out of the 89 qualitative interviews conducted, 60% of the stakeholders interviewed were GOMEX and 40% were SA. The majority of respondents were from Florida (43%). Interviewees stated that 75% of GAJ fishing occurred in federal waters. The majority of interviewees were fishermen (33 recreational, 32 commercial, 37 charter, and 7 headboat), followed by researchers (27), managers (20), the seafood industry (7), the marine industry (4), other (4), and conservation groups (3). Many respondents in the fishing industry identified themselves in multiple categories (i.e. charter fishermen for part of the year, commercial fishermen for the rest of the year).

Respondents typically considered the GAJ fishery of moderate importance, a "fish of opportunity." GAJ were described as a by-catch, boutique, gap-filler, good fighter, and/or trophy fish. While the fishery has not been historically targeted, interest in GAJ targeting/specialization is increasing. There were some participants that specifically targeted GAJ during some seasons/periods. The charter fishing industry has particular interest in GAJ due to their fighting abilities, even when harvest is prohibited. Spearfishermen also showed a specific interest in GAJ.

Generally, the perspectives on GAJ management were positive, with the majority of respondents feeling the stock assessments provided a good estimate of stock status. While the GAJ population has been perceived to have recently stabilized, there has been an observed long term decline in GAJ thought to be tied to an increase in shark populations. GAJ populations have also been observed declining near the coasts. There has also been a distributional change observed in the SA due to environmental change.   Finally, there were concerns regarding the increase in fishing pressure and an increase in artificial reefs (which were perceived to act as fish aggregating devices for GAJ). Some respondents believed that regulations have lagged behind the growth of the recreational sector, rendering them ineffective. Many also felt there were regional difference in GAJ abundance not accounted for in management decisions.

To improve the management of the GAJ fishery, it was recommended to better characterize regional differences and fishing pressures. Also discussed was improving the alignment of seasons/zone management to match environmental conditions and opportunities for fishermen. There was also an emphasis on better managing/monitoring private/recreational catches, with some hoping this could lead to a longer season. There was interest in taking researchers on fishing boats, participating in tagging programs, collecting animals for researchers, video documenting catches, and engaging private recreational angling organizations.

Draft of Recommendations

The draft of recommendations consisted of 21 recommendations split into four categories:

Program's scope	Recommendations that could be done in the scope of the proposed GAJ count program.
Monitoring	Recommendations for developing better methods for long term monitoring.
Problem solving	Recommendation related with problem solving management issues.
Expanding management	Recommendations for expanding management efforts.
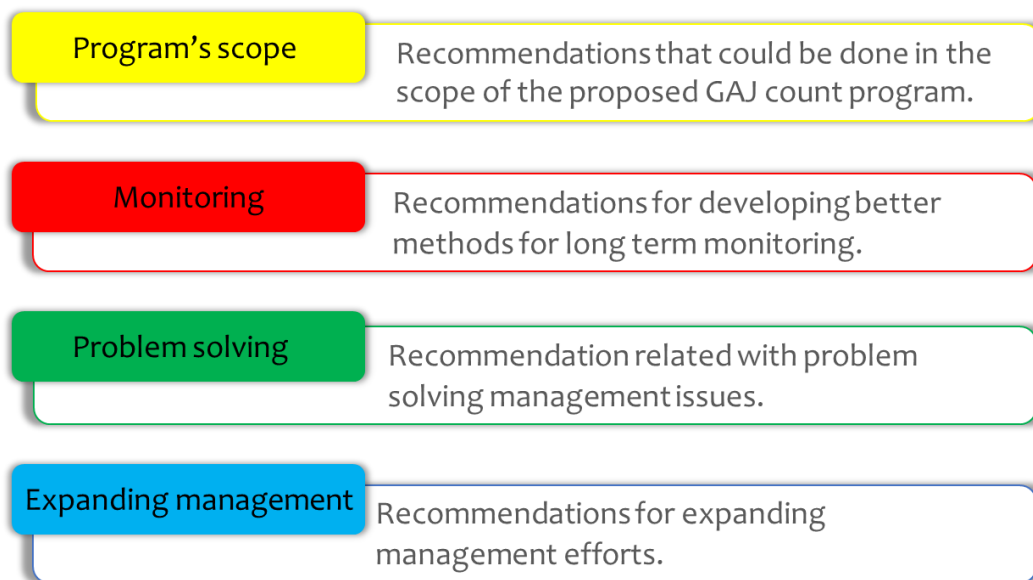
Program's Scope Recommendations:

The draft contains eight recommendations grouped in this category. The main themes of this recommendations are: absolute abundance, distribution, movements and migrations, life history, spawning aggregations, and ecosystem interactions. Recommendations are listed below:

1. Estimate absolute abundance and size structure across the continental range of GAJ (including areas where GAJ are not currently fished to explore possible 'cryptic biomass'). Importance: high. Source: Congress language and intent.

2. Estimate the distribution and size structure of GAJ in space and among habitat types throughout its range. Importance: high. Source: situation analysis and great red snapper count project.

3. Better characterize the movement and migratory dynamics of the stock and the potential for distribution shifts. Importance: high. Source: SEDAR 59 and situation analysis.

4. Provide direct estimates of (age-dependent) natural mortality. Importance: very high. Source: SEDAR 59.

5. Better characterize reproductive parameters including age and size at maturity, batch fecundity, spawning seasonality, and spawning frequency. Importance: moderate. Source: SEDAR 59 and SEDAR 70.

6. Discard mortality estimates. Importance: moderate. Source: GMFCM and SAFMC.

7. Identify spawning aggregation sites and times. Importance: moderate.

8. Assess impact of shark population increase on GAJ abundance and dynamics. Importance: moderate. Source: situation analysis.

Monitoring recommendations:

This category is comprised of seven recommendations. Main theme topics are: fisheries surveys, recruitment oceanography, life history, assessments, and fishery-dependent surveys. The list of recommendations in this category are listed below:

9. Develop methods to characterize length and age composition of greater amberjack observed on videos from the SERFS fishery independent survey. Importance: high. Source: SEDAR 59.

10. Identify GAJ larvae in SEAMAP ichthyoplankton surveys and construct a larval abundance index. Importance: not determined. Source: SEDAR 70.

11. Remote sensing or other survey methods to determine spatiotemporal variations of Sargassum coverage and any correlations to recruitment success for GAJ. Importance: low? Source: GMFMC and SAFMC.

12. Age validation, reader comparison and calibration. Importance: high. Source: SAFMC.

13. Quantify and evaluate appropriate weighting procedures of length and age compositions at finer spatial and temporal scales (e.g., quarterly/state/sub-region strata). Importance: not determined. Source: SEDAR 70.

14. Investigate options for developing fishery-dependent surveys that better reflect abundance of GAJ. Importance: not determined. Source: SEDAR 70.

15. Investigate appropriateness of use of design-based estimator for Coastal Logbook Program given that a survey design is not in use for the fisher reported logbook data. Importance: not determined. Source: SEDAR 70.

Problem solving recommendations:

The only theme of this category was management and there were only three recommendations:

16. Develop improved models for predicting recreational catches based on fish population projections and bag/size/season limits to improve implementation of recreational ACLs. Importance: moderate. Source: situation analysis.

17. Assess the feasibility and acceptability of harvest tags and/or mandatory reporting for the private recreational sector to improve ACL management. Importance: moderate. Source: situation analysis.
18. Explore alternative spatial and seasonal regulations to enhance socio-economic benefits and reduce discarding. Importance: low. Source: situation analysis.

Expanding Management recommendations:

The only theme of this category was management and there were only three recommendations:

19. Implement a systematic age sampling program for both the general recreational and commercial sectors. Importance: high. Source: SEDAR 59.
20. Expand commercial fishery observer coverage and in particular focus on better quantifying retained fish out of season. Importance: moderate? Source: SEDAR 70.
21. Increase sampling of length and age composition data from both commercial and recreational landings, in particular for discarded fish. Importance: high. Source: SEDAR 70.

Regional Listening Sessions

Demographics

In December 2021, the visioning team organized six virtual listening sessions. However, one of the sessions (Dec 9, 2021) got cancel due to the low number of participants (one participant). On average, each of the five virtual meetings were conducted with 10 stakeholders and have an average meeting time of 1 hour 50 minutes.

In total, 50 participants attended five meetings, with the majority (74%) of participants being from academic/researcher or management backgrounds (Figure 1). The majority of meeting attendees (n=19) represented the fisheries management community, followed by representation by the scientific community (n=18), and the commercial/recreational fishing community (n=12). Additionally, only one non-profit/environmental organization representative was present at the meetings.
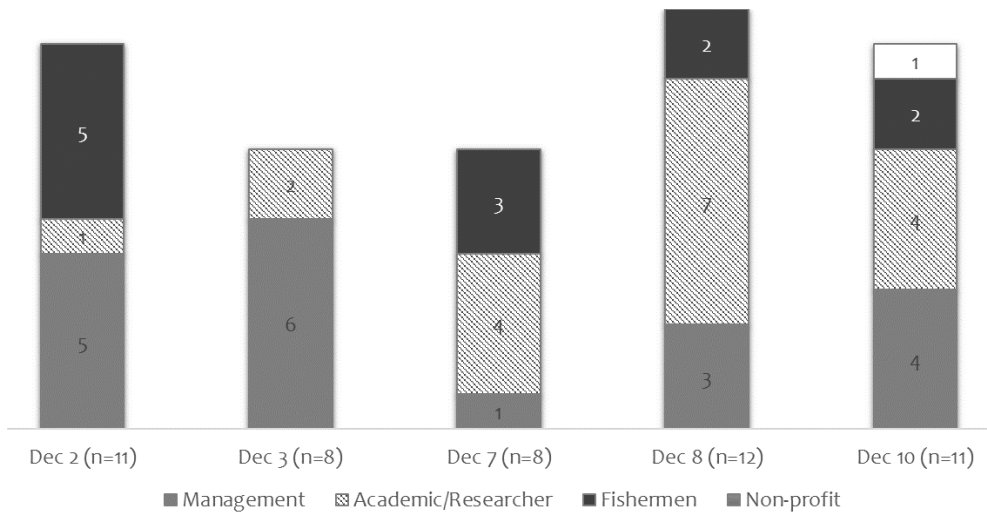
Figure 1: Regional listening sessions participation and breakdown of participants background/representation.

In terms of regionality, 52% of participants region of focus was GOMEX, while most of the remaining participants (36%) main region of focus was the SA (n=50). In 12% of cases, participants did not have a defined region of focus (e.g., FWC participants) or their region of interest is unknown.
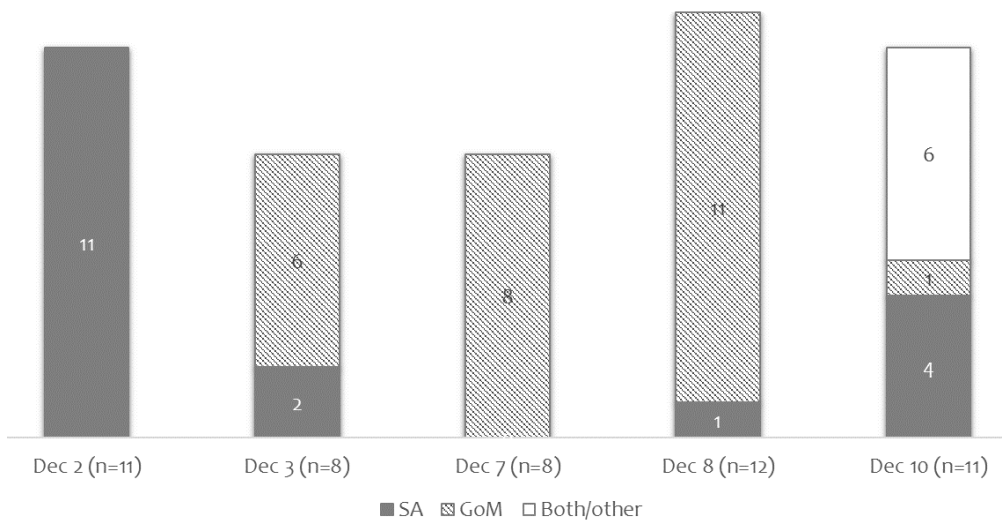

Figure 2: Regional representation of stakeholders per meeting.

Listening Session Summaries

South Atlantic, December 2nd

A roughly equal distribution of fishermen and managers, as well as one researcher, attended the first South Atlantic meeting. The discussion/outcomes of the meeting were focused on the first eight out of 21 research recommendations. There was feedback concerning poor visibility and strong currents in the South Atlantic reducing the effectiveness of visual surveys (especially the northern section of the South Atlantic), as well as the South Atlantic not being as well mapped as the Gulf. The length of the program will not be long enough to capture the tags from the proposed tag-recapture program, leading to lost datapoints and logistical issues. Acoustic tagging is limited to nearshore areas in the South Atlantic and may not be suitable for tracking GAJ offshore. It was proposed that combining acoustic and recapture tagging could potentially overcome the concerns/limitations of both techniques. Spawning special management zones have already been established by SAFMC, which may answer recommendation 7 (identifying spawning aggregation sites and times).   There also appeared to be potential to combine GAJ efforts with other programs including the red snapper count (although coordination of the two programs may be difficult) and an existing reef fish survey (SERFS). Finally, there was an interest in projects that could address the "lower" priority recommendations, as well as a climate vulnerability assessment (and the possible northward extension of GAJ caused by climate change), possibly through collaborations with larger projects addressing the more significant priorities.

South Atlantic, December 3rd

The second South Atlantic meeting was mostly attended by managers, as well as two researchers. Similar to the first South Atlantic meeting, there were concerns at this meeting regarding poor visibility for visual surveys, and interest in studying the effects of climate change on GAJ stocks (specifically investigating the possible northward expansion of the stock). There was interest in utilizing close-kin mark recapture/fin clips, including working with anglers to leverage efforts and engage with stakeholders. However, there were reservations from other individuals that the practice is expensive and time consuming, despite being a "good" monitoring method. It was also recommended to collect/preserve as much data as possible (sex, otolith, genetic information), perhaps with assistance from a program based off the NCDMF red snapper carcass program, so that subsequent studies can add value to the planned research years after the program reaches completion. Information on discard data and length/age composition were remarked as "critical" factors in the stock assessment that are relatively limited in the current body of research.   It was also stated that ichthyoplankton surveys relevant to GAJ have not been conducted in the South Atlantic.

There were multiple individuals concerned that the GAJ populations were declining, with fishermen in North Carolina also seeing fewer large fish. Due to the increasing fishing pressure on GAJ, it was proposed to collect fishery dependent data (versus the historically collected fishery independent data). There will also be a logbook program started for charter boats to better track their catch, which will also provide relevant data. Another issue introduced concerning the sustainability of GAJ was shark predation. Sharks and GAJ often occupy the same areas, and it was perceived that sharks play a major role in successful GAJ releases. Otherwise, it was remarked that GAJ is a hardy fish, and with the required use of fish descending devices they would have relatively low mortality.

Gulf of Mexico, December 7th

The first Gulf of Mexico meeting was attended by a roughly equal number of fishermen and researchers, with a single manager present. Consistent with previous meetings, there were concerns about the use of visual surveys due to visibility issues, and it was suggested to complement the method with different techniques (sonar/acoustic technology, laser sampling, and hook and line). There was also a stated need to conduct broad surveys of GAJ habitat, as the many of the fish are not found in traditional locations. It was believed that much of the "cryptic biomass" may be found around oil rigs, as those structures were not considered until the great red snapper count. The size of reef structures appeared to be associated with GAJ presence/absence, and previous work can be used to exclude areas where GAJ are not observed (i.e. GAJ are not present on the smaller reefs where red snapper are found). There were abundant but variable populations of GAJ observed on natural banks, and populations were generally found on low relief natural bottom (200-300 feet with some success at 800+ feet) and hard bottom off Tampa in 60-90 feet. Key to the perceived success of research was providing flexibility to the researchers and finding opportunities to collaborate with fishermen. By doing this, many of the "smaller" priorities may be more easily approached by researchers as they answer the "larger" questions asked by the GAJ research program. As the new reporting for charters was coming into effect, there was interest in sending them kits/working with them to collect otoliths, scales, etc.

There were similar concerns to the last meeting regarding significant regional shifts/losses in GAJ populations (i.e. absence of GAJ in formerly productive areas off the coast of Alabama, whereas Florida/Texas charters still have reliable GAJ). This shift started approximately 5-6 years ago, and there were concerns that populations may not rebound (and that management has not effective in changing current trends). Finally, sharks were again discussed as a significant issue for GAJ, considered a "growing problem" to the fishery.

Gulf of Mexico, December 8th

The second Gulf of Mexico regional meeting consisted primarily of researchers with a smaller, almost equal number of fishermen and managers. One the more significant topics

discussed was the importance of the GAJ fishery. It was first stated that GAJ are not typically the targeted species, as red snapper are a more desired target (don't want space filled with GAJ) and fishing is restricted when GAJ fishing would be most successful.   A charter captain responded that GAJ are not a "boutique" fishery (at least in the Gulf of Mexico), with the change of management seasons of GAJ affecting commercial harvests. It was also stated that charter fishermen consider GAJ a prize fish, with the greatest increase in landings found in the recreational sector. The issue was perceived as primarily management based; GAJ is a data poor species, with no definitive science on spawning season/aggregations/migrations, and attempted solutions have limited effectiveness/unintended consequences.

As in the first Gulf of Mexico meeting, there were concerns about declines in GAJ abundance. One stakeholder suggested that much of the decline could be due to the recreational fishery, as it was stated the recreational/commercial fishery split was 75/25. A significant research question suggested was explaining why GAJ haven't seemingly recovered from declines, and how potential factors may be mitigated to promote recovery informing management. Opportunities for answering some of the research questions may be found in a collaboration with the NOAA long line assessments (not currently included in stock assessments) and/or footage taken during the great red snapper count footage for potential GAJ data (despite the previous suggestion that GAJ and red snapper typically live in different areas/structures). Areas suggested to survey included muddy bottom off the panhandle (300-480 feet). It was also suggested to interview fishermen to determine general spawning aggregation areas, to incorporate sonar/acoustic for sampling.

The value of working with fishermen (especially as it related to the charter fishing reporting program and highliners) was again emphasized during the meeting. There was a consensus that the main task/priority for the project was estimating abundance, it was also thought that much of the research recommendations could be nested within the estimation of abundance (not either/or). Further topics recommended/emphasized included studying geographic variability, age structure of GAJ, the movement of GAJ (i.e. on/between reefs), and the variation in harvest across the Gulf of Mexico. Stakeholders additionally agreed that research recommendations 5 (better characterizing reproductive parameters) and 7 (identifying spawning aggregation sites and times) were critical for management/stock rebuilding, while recommendation 4 (providing direct estimates of age dependent natural mortality) was a low priority (difficult to determine/least value for management).

Gulf of Mexico, December 10th

The third Gulf of Mexico regional meeting and final listening session consisted primarily of researchers and managers, with a couple fishermen and a single non-profit stakeholder present. There were concerns primarily regarding management, specifically there was interest in changing the season regionally to follow perceived migrations (Pasco County

season in the summer and Lee County season in the winter). Stakeholders also did not believe that the stock assessments were working/were accurate, and that, generally, there has been an overestimation of stock abundance. There were also concerns about how the outcome of the abundance estimates would affect perceptions of the fishery, as GAJ are a historically overestimated stock (the great red snapper count was also cited in the discussion).

Feedback related to research questions focused on identification issues, genetic sampling, and collaborative opportunities with fishermen. It was stated that if visual surveys were to be conducted, there will be a need for confidence in identification (referencing video work conducted by FWRI). There were reservations regarding species identification issues for fish discarded at docks, for port samplers, and fishermen (i.e. easily confused with banded rudderfish). It was perceived during this meeting that there was a decent ability to identify GAJ in videos, but with stereo ID and/or DNA samples the confidence of proper identifications would be greatly improved. eDNA was also discussed as having cascading effects for identifying distribution and size composition (and was recommended especially in shallow areas of the western Gulf of Mexico where visual surveys will be less effective). DNA samples were identified as critical for identifying movement/migratory patterns of GAJ (as demonstrated in King mackerel research). More generally, there were concerns that the migratory nature of GAJ may make it difficult to capture abundance (versus red snapper that do not migrate). There were also questions about the nature of GAJ stocks not being bound to US water and consequences for GAJ abundance and management (i.e. some GAJ migrate to Caribbean waters). There were recommended research questions regarding the location of the juveniles/young of the year and their use of habitat (i.e. sargassum). The usefulness of collaboration with fishermen (especially charter fishermen who understand the timing of movements/migrations) was emphasized (although some incentive program was stated as necessary given the extra work involved), and there was interest in having researchers join fishermen to tag or collect samples (it was noted that Florida has at least made big investments in placing fishery observers on charter boats/headboats). There is also an otolith working group that have age comparisons/validations potentially useful to the GAJ research program.

Regarding specific research recommendations, there was a consensus that recommendation 1 (estimating absolute abundance and size structure across the continental range of GAJ) is difficult to achieve (due to the migratory nature of GAJ) while recommendations 2 (estimating the distribution and size structure of GAJ in space and among habitat types) and 3 (better characterizing the movement and migratory dynamics of the stock/potential for distribution shifts), are the most feasible. There was concern regarding redundancy of GAJ reproductive parameters (recommendation 5, stated as "pretty well described" unless considering when considering a northward movement of GAJ) and discard mortality estimates (recommendation 6) due to work already being done via the BP oil spill fund. Key to understanding GAJ was the identification of GAJ movements and spawning aggregations

(how many, how large, and differentiating between schooling behavior and spawning). There was uncertainty over whether recommendation 12 (age validation, reader comparison and calibration) is necessary, as "lots" of labs contribute to the age comparisons, well covered in the South Atlantic and Gulf of Mexico. It was also agreed that recommendation 18 (exploring alternative spatial and seasonal regulations to enhance socio-economic benefits/reduce discarding) was a valuable future objective.

Recommendations

There were multiple recommendations compiled from the visioning session, with the most significant listed below:

1. **Estimate (absolute) <u>abundance</u> and characterize <u>distribution</u> and <u>movements</u> throughout the continental range of GAJ (in the context of the first three research recommendations).**

    Rationale:

    - GAJ stock components show extensive seasonal movements which must be accounted for when interpreting local abundance estimates.

    - Distribution and movement information will help address widespread stakeholder concerns about different regional conditions and management.

    - Regional exploitation rates can be estimated alongside movement in tagging studies and will provide further important information.

    - Integrated suite of visual and acoustic survey methods and tagging programs can address the first 3 recommendations.

2. **Address GAJ-specific survey and identification issues**

    Rationale:

    - GAJ pose specific survey issues due to difficulties of differentiating GAJ from similar species, behavioral responses to survey equipment, and use of full water column.

    - Accounting for these issues in developing survey approaches is critical.

    - Routine sampling of eDNA is suggested as an independent check on visual/acoustic survey estimates and as a potential future survey method.

3. **Task applicants with designing an approach to address the first 3 recommendations that is appropriate to GAJ.**

    Rationale:

- Estimating abundance and characterizing distribution and movements of GAJ appropriately poses challenges given limited *a priori* information on stock structure and movements and known challenges of species identification and behavior.

- Applicants should be tasked with developing approaches to address these challenges and provide appropriate justification.

- The RFP should avoid being overly prescriptive, particularly in the light of important differences between red snapper and GAJ.

4. **Encourage auxiliary sampling for life history information, age composition and future genetic studies throughout the GAJ range.**

   Rationale:

- GAJ life history (reproductive parameters, growth, natural morality) and age composition data are comparatively poor.

- Improving life history and age comparison data has been identified in many SEDAR and Council research recommendations.

- Samples (fin clips) can easily be collected for future genetic studies (stock structure and close-kin mark recapture for absolute abundance).

- Moderate funding allocations to auxiliary sampling can help address long-standing recommendations.

5. **Encourage synergies with existing efforts.**

   Rationale:

- There are many related, ongoing survey and sampling efforts as well as parallel (South Atlantic red snapper count) and previous (Gulf red snapper count, Louisiana rig survey) surveys with GAJ data.

- Applicants should be encouraged to explore and leverage such synergistic efforts to enhance returns to investment.

6. **Consider setting aside some funds for smaller side projects that address specific stakeholder concerns.**

   Rationale:

- Stakeholder consultations identified certain concerns relevant to dynamics of GAJ that could be addressed in smaller side-projects.

- Discard mortality was frequently mentioned, subject to very different perceptions, and is moderately important in assessments.

- Recent increases in shark depredation were frequently mentioned and may benefit from further study.

- Identification of spawning aggregations in space and time was frequently mentioned as a priority for improving management implementation.

Research Recommendations

The draft of research recommendations was modified based on input from the regional listening sessions. Final research recommendations are shown below:

Program's scope recommendations:

1 Estimate absolute abundance and size structure across the continental range of GAJ (including areas where GAJ are not currently fished to explore possible 'cryptic biomass').

Theme: Absolute abundance.　　　　**Importance:** High.
Problem addressed: Provide a snapshot of absolute abundance to test and scale assessment models.
Approach: Visual surveys, tagging, close-kin mark recapture, videos (e.g., greater red snapper count project).
Source: Congress language and intent.

2 Estimate the distribution and size structure of GAJ in space and among habitat types throughout its range.

Theme: Distribution.　　　　**Importance:** High.
Problem addressed: Distribution information needed for regionalized management.
Approach: Visual surveys, videos (e.g., greater red snapper count project).
Source: Situation analysis and great red snapper count project.

3 Better characterize the movement and migratory dynamics of the stock and the potential for distribution shifts.

Theme: Movement & migrations.　　　　**Importance:** High.
Problem addressed: Poor knowledge of migratory dynamics and distribution shifts - perceived as important particularly in SA.
Approach: Tagging and acoustic or satellite tracking.
Source: SEDAR 59 and situation analysis.

4 Provide direct estimates of (age-dependent) natural mortality.

Theme: Life history.　　　　**Importance:** Very high.
Problem addressed: Uncertainty about natural mortality rate, highly influential in stock assessments.
Approach: Tagging & biotelemetry.
Source: SEDAR 59.

5 Better characterize reproductive parameters including age and size at maturity, batch fecundity, spawning seasonality, and spawning frequency.

Theme: Life history.　　　　**Importance:** Moderate.
Problem addressed: Limited data on reproductive parameters.
Approach: Biology
Source: SEDAR 59 and SEDAR 70.

6 Discard mortality estimates.

Theme: Life history.　　　　**Importance:** Moderate.
Problem addressed: Uncertainty about discard mortality rate.
Approach: Tagging & biotelemetry.
Source: GMFCM and SAFMC.

7 Identify spawning aggregation sites and times.

Theme: Spawning aggregations.　**Importance:** Moderate.
Problem addressed: Management implementation: temporal spatial closures.
Approach: Observations & biotelemetry.

8 Assess impact of shark population increase on GAJ abundance and dynamics.

Theme: Ecosystem interactions.   **Importance:** Moderate.
Problem addressed: Predation.
Approach: Trophic interactions, multi-species modeling.
Source: Situation analysis.

Monitoring recommendations

9 Develop methods to characterize length and age composition of greater amberjack observed on videos from the SERFS fishery independent survey.

Theme: Fish surveys.   **Importance:** High.
Problem addressed: Limited length and age composition information. Trap sampling of greater amberjack was limited and potentially biased due to size selectivity of the gear.
Approach: Video and trap sampling analysis.
Source: SEDAR 59.

10 Identify GAJ larvae in SEAMAP ichthyoplankton surveys and construct larval abundance index.

Theme: Fish surveys.   **Importance:** ?
Problem addressed: Index of spawner abundance.
Approach: Ichthyoplankton.
Source: SEDAR 70.

11 Remote sensing or other survey methods to determine spatiotemporal variations of Sargassum coverage and any correlations to recruitment success for GAJ.

Theme: Recruitment oceanography.   **Importance:** Low?
Problem addressed: Recruitment index.
Approach: Remote sensing.
Source: GMFMC and SAFMC.

12 Age validation, reader comparison and calibration.

Theme: Life history.   **Importance:** High.
Problem addressed: Reduce aging error.
Approach: Biology.
Source: SAFMC.

13 Quantify and evaluate appropriate weighting procedures of length and age compositions at finer spatial and temporal scales (e.g., quarterly/state/sub-region strata).

Theme: Assessment.   **Importance:** ?
Problem addressed: Weighting of composition data.
Approach: Statistical analysis.
Source: SEDAR 70.

14 Investigate options for developing fishery-dependent surveys that better reflecting abundance of Greater Amberjack.

Theme: Fishery-dependent surveys.   **Importance:** ?
Problem addressed: Impact of regulation changes on fishery-dependent index quality.
Approach: Statistical analysis.
Source: SEDAR 70.

15 Investigate appropriateness of use of design-based estimator for Coastal Logbook Program given that a survey design is not in use for the fisher reported logbook data.

Theme: Fishery-dependent surveys   **Importance:** ?
Problem addressed: Improved catch reporting.
Approach: Survey design.
Source: SEDAR 70.

Problem solving recommendations:

16 Develop improved models for predicting recreational catches based on fish population projections and bag, size, season limits to improve implementation of recreational ACLs.

Theme: Management implementation.   **Importance:** Moderate.
Problem addressed: Recreational overages impede stock rebuilding.
Approach: Modeling.
Source: Situation analysis.

17 Assess the feasibility and acceptability of harvest tags and/or mandatory reporting

Theme: Management implementation.   **Importance:** Moderate.
Problem addressed: Recreational overages impede stock rebuilding.

for the private recreational sector to improve ACL management.

Approach: Modeling and human dimensions.
Source: Situation analysis.

18 Explore alternative spatial and seasonal regulations to enhance socio-economic benefits and reduce discarding.

Theme: Management implementation. **Importance:** Low.
Problem addressed: Current seasons are sub-optimal for certain regions and sectors and may lead to high GAJ bycatch that must be discarded.
Approach: Modeling and human dimensions.
Source: Situation analysis.

Expanding Management recommendations:

19 Implement a systematic age sampling program for both the general recreational and commercial sectors.

Theme: Fishery-dependent surveys. **Importance:** High.
Problem addressed: Limited length and age composition information.
Approach: Catch sampling.
Source: SEDAR 59.

20 Expand commercial fishery observer coverage and in particular focus on better quantifying retained fish out of season.

Theme: Fishery-dependent surveys. **Importance:** Moderate?
Problem addressed: Limited discard data.
Approach: Observers.
Source: SEDAR 70.

21 Increase sampling of length and age composition data from both commercial and recreational landings, in particular for discarded fish.

Theme: Fishery-dependent surveys. **Importance:** High.
Problem addressed: Limited length and age composition information.
Approach: Catch samples.
Source: SEDAR 70.

Conclusions

Summary of Regional Inputs

The outcome of the visioning phase was several tangible and consistent points discussed by stakeholders across locations and expertise. The most important research questions were the estimation of absolute abundance and the characterization of the distribution and movements of GAJ throughout their continental range (in the context of the "big three" recommendations produced by the situation analysis). Key to these estimates is addressing the difficulty of identifying and surveying amberjack due to their shape, life history, and behavior. To address this issue, it was suggested to task RFP applicants with designing approaches to better measure GAJ stocks. Potential techniques included a coupled depletion/tagging method, acoustic surveys, and (depending on environmental conditions) visual surveys using cameras. Collaboration with fishermen and existing research programs (i.e. rig surveys) was also stressed by all stakeholders as a method to promote cooperation and save resources. The procurement of GAJ life history information, age composition, and genetic information was encouraged for auxiliary sampling as a method of better understanding migratory patterns and stocks. There were also recommendations to set aside funds for smaller auxiliary projects that could address present and future stakeholder

concerns. Finally, there were a few considerations in conducting counts in the SA versus GOMEX fisheries. For example, the SA fishery may face issues with counts related to mapping resolution (GOMEX has oil company maps that are more detailed and therefore provide more information on possible GAJ aggregation sites).

Summary of Regional Outputs

The majority of the recommendations provided by the situation analysis and the visioning sessions were reflected in the RFP. Special emphasis was placed on collecting GAJ across spatial and size ranges to provide estimates of age, sexual maturity, and stock connectivity via genetic samples. The species specific issues of GAJ were addressed, with instructions on required survey and statistical methods. Investigators are also required to provide detailed steps on how they minimize biases related to GAJ for future experiments. In addition to measuring known artificial and natural reefs, projects must measure at least some unknown/uncharacterized bottom in an effort to find previously unknown areas of GAJ abundance. Research projects that only study one region (SA or GOMEX) must also provide a proposal for the other for replication in future studies. If studying certain sub-regions (i.e. Eastern GOMEX or southern SA), there must be justification for spatial divisions based on exiting knowledge of GAJ stock composition and dynamics.

Researchers were highly encouraged to collaborate with the commercial and recreational fishing industries. In addition, the RFP highly encouraged outreach strategies so update the fishing community, managers, and other stakeholders. Leveraging existing datasets was also prioritized as a method of reducing redundancies and improving cost effectiveness. Other ideas brought up in the visioning sessions, including the implementation of eDNA, spawning season length, and the identification/size of spawning aggregations were also added to the RFP as auxiliary research priorities.

In summary, the results of the situation assessment and visioning sessions brought forward important opportunities and challenges in understanding the GAJ stocks in the SA and GOMEX. The feedback of stakeholders and managers/fisheries experts were largely applied to the RFP. The results of these sessions are crucial to the successful measurement of GAJ stock structure and dynamics and an important step in deepening connections between researchers, managers, and fishermen.