

Proposed Allocation Decision Trees: A Blueprint for Applying Biological, Social, and Economic Considerations in Allocation Decisions

Scientific and Statistical Committee

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Introduction

In March 2020, the South Atlantic Fishery Management Council (Council) identified criteria they were interested in considering when discussing allocations that included: *landings history, expected/known discard rate, accountability of a sector, fairness, equity, market needs, importance of a species to a sector, cultural importance, and the possibility of removing sector allocations*. At the end of March 2020, the Government Accountability Office (GAO) released a report on its review of fishery sector allocations in the South Atlantic and Gulf of Mexico¹. There are many similarities between the two lists compiled by the Council and the GAO. The GAO recommended that the Councils develop methods for analyzing sector allocation needs using the following five criteria: *trends in catch and landings, stock assessment results, economic analyses, social indicator analyses, and ecosystem models*.

Since the last reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) in 2007, which required establishing annual catch limits (ACLs) and prompted establishment of sector allocations for managed species, landings have been the primary data source used for allocation purposes in the South Atlantic region since they have been the most consistent data available and can be obtained for all species. However, the Council has acknowledged that other biological or ecosystem data sources, as well as input from economics and the social sciences, could also help inform sector allocation decisions.

In most cases, the Council has not used data other than landings because other types of data are at times lacking for the South Atlantic region or there has not been a consistent method to apply the concepts across all species. Currently, the Council is reconsidering sector allocations in a systematic manner without specific time constraints that were present after the MSA reauthorization, which allows time to consider additional methods.

The Comprehensive ACL Amendment (2012) created sector allocations for all species that did not already have them using landings from 1986 through 2008. The formula used a long-term “historical” time series and a more “recent” trend. Sector allocations were determined using fifty percent of the average landings from 1986 through 2008 (“historical” trend) and fifty percent of average landings from 2006 through 2008 (“recent” trend). The same amendment also put sector ACLs and accountability measures (AMs) in place. In-season harvest closures were often implemented to keep landings from exceeding ACLs. Prior to implementing the Comprehensive ACL Amendment, in-season closures were uncommon. Since closures likely disrupt how the fishery would otherwise operate, and closures might occur for one sector and not the other, applying the same allocation formula to more recent years (after 2012) may not similarly reflect each sector’s unrestricted use of a stock. Hence, modifying sector allocations by

¹ The GAO report is available at <https://www.gao.gov/products/gao-20-216>.

using landings from years *after* AMs were implemented, particularly those used for short-term trends, could introduce a management effect that should be considered when developing landings-based allocations between sectors. Nonetheless, trends in catch and landings remain a valuable source of information to help determine future modifications to sector allocations.

The purpose of this paper is to identify readily available information to assist the Council in considering different approaches to allocations and introduce the decision tree approach that is being developed to aid the Council in objectively examining the allocation of ACLs across all managed species. Throughout the document, examples of data for the fictional Shadow Shark fishery are provided where appropriate.

Identified Criteria to Consider When Discussing Allocations

Landings History

For future allocation decisions where there is a recreational component, it is important to examine landings inclusive of the Fishery Effort Survey (FES) rather than the Coastal Household Telephone Survey (CHTS) methodology. This applies to current estimates of landings as well as historic landings. The transition from CHTS to FES resulted in noticeable changes in recreational landings estimates for many species such that a comparison between FES- and CHTS-estimated landings is not appropriate in most cases.

For most species, the Council could continue to use a landings-based approach with updated datasets for recreational landings using FES estimates. However, as mentioned previously, landings after 2012 may be impacted by regulatory closures when ACLs have been met, which should be considered if developing allocations based on these data. The Council may want to compare potential allocations to recently observed landings in the fishery. Additionally, landings history can help determine the potential trajectory of future needs for a fishery as well as some of the likely distributive effects of allocations.

Available Data Sources:

- SEFSC commercial landings dataset
- MRIP/SEFSC recreational landings dataset

Examples:

- Historic landings by sector:

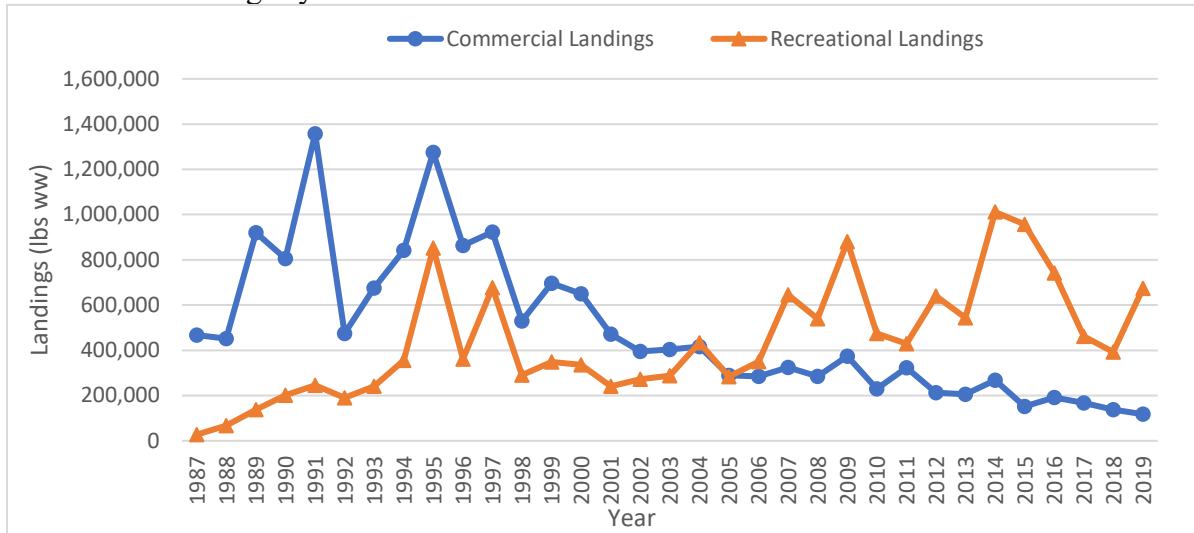


Figure 1. Shadow Shark landings by sector, 1987-2019.

Note: Recreational landings are in FES estimates.

- Historic landings in comparison to potential sector allocations:

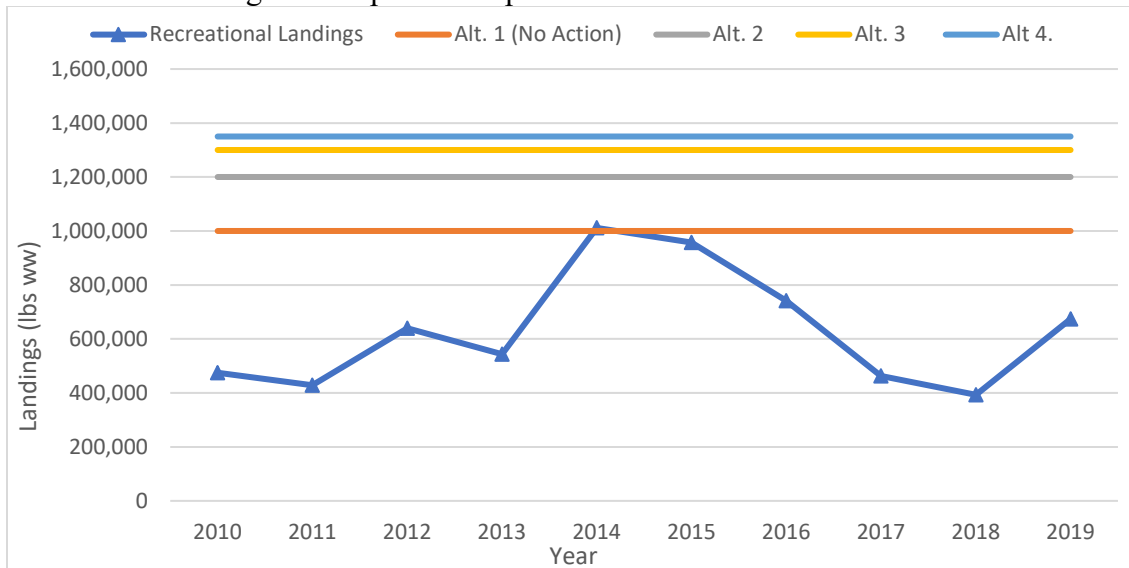


Figure 2. Recreational Shadow Shark landings in comparison to allocation alternatives, 2010-2019.

Note: Recreational landings are in FES estimates.

Discard/Bycatch Rates

SEDAR stock assessments routinely evaluate discard and bycatch rates for assessed species as part of the assessment process. Dead discard rates, particularly when the rate is different for one sector compared to another, could be considered when deciding sector allocations if it is determined that avoiding dead discards is especially important for the stock, such as stocks that are in rebuilding plans.

SEDAR stock assessment documents have information regarding species bycatch in managed fisheries. Information on bycatch, the life history characteristics of the bycatch, and the disposition of the bycatch by sector could be used to help inform allocation decisions.

Available Data Sources:

- SEDAR Assessment Documents
- SBRM Documents

Accountability

When examining allocations, the Council could take into consideration a sector's likelihood of staying within its respective allocation. When considering accountability, the Council may want to consider whether there are adequate data and mechanisms to accurately track sector ACLs. Many species that the Council manages have considerable fluctuation in landings from year to year or there may be inconsistent data on landings. Additionally, while sector allocations are being determined, the Council may want to also review accountability measures to help ensure that a sector does not consistently exceed its ACL and thereby can remain "accountable."

A sector's previous accountability to a respective allocation may be particularly important when examining historic landings where a sector has exceeded its ACL. Under these circumstances, the Council may want to decide whether a sector's landings should be capped at the sector ACL or use observed landings that may be above the sector ACL when specifying sector allocations.

Available Data Sources:

- SEFSC commercial landings dataset
- MRIP/SEFSC recreational landings dataset

Fairness and Equity

National Standard 4 requires that "if it becomes necessary to allocate or assign fishing privileges among various U.S. fishermen, such allocation shall be fair and equitable to all such fishermen." (50 CFR §600.325(a)(1)). Regarding what should be considered fair and equitable, the CFR states that an allocation should be "connected to the achievement of OY" and should be "justified in terms of the objectives of the FMP." Finally, the CFR states that "an allocation need not persevere the status quo in the fishery to qualify as "fair and equitable," if a restructuring of fishing privileges would maximize overall benefits" (50 CFR §600.325(c)(3)(i)).

When considering the fairness and equity of allocations, the Council may need to consider a review each FMP's goals and objectives to ensure they balance biological and human needs and paint a comprehensive picture of the fishery. Then the Council may need to determine the relevant biological, social, and economic costs and benefits of allocations to be considered, as well as how they will be measured. The regulations provide little guidance in this area. The decision tree approach, described below, may help the Council determine which factors are most important to consider for a given species.

An additional aspect of considering fairness and equity can come into play when implementing management changes that may allow or encourage new entrants into a fishery. In

such cases, the Council may want to consider whether changes in allocations would be appropriate to mitigate the effects of increased landings and participation on current fishery participants. Examples of such management changes that have come up recently in the South Atlantic include removing the 2 for 1 permit requirement for new entrants into the commercial Snapper Grouper fishery, allowing bag limit sales of Dolphin landed during for-hire trips, and accommodating landings of Dolphin or Wahoo when vessels have certain gear onboard that is unauthorized for use in that fishery.

Market Needs and Trends

The Council has identified examining market needs as an important consideration in determining allocations. As part of this, the Council may want to also explore trends in demand for a species. To address this, trends in ex-vessel price and trends in directed effort could be examined. Changes in ex-vessel price and directed effort over time can offer insight into the demand for a species and the potential current or future needs of a sector.

Fishery performance reports (FPRs) put together by the Council's advisory panels (APs) may offer understanding of the market needs and trends in demand for a species. The intent of the FPRs is to assemble information from Council Advisory Panel members' experience and observations on the water and in the marketplace to complement scientific and landings data. These reports provide qualitative information that broadly covers both sectors and different states within the South Atlantic region. These reports can be found on the Council's website by clicking [HERE](#). Questions related to market trends and needs include:

- For the commercial sector, how has price and demand for species x changed?
- How has demand for charter/headboat trips targeting species x changed?

Available Data Sources:

- SEFSC ex-vessel price data
- MRIP/SEFSC recreational landings dataset
- Fishery Performance Reports

Examples:

- Trends in ex-vessel price:

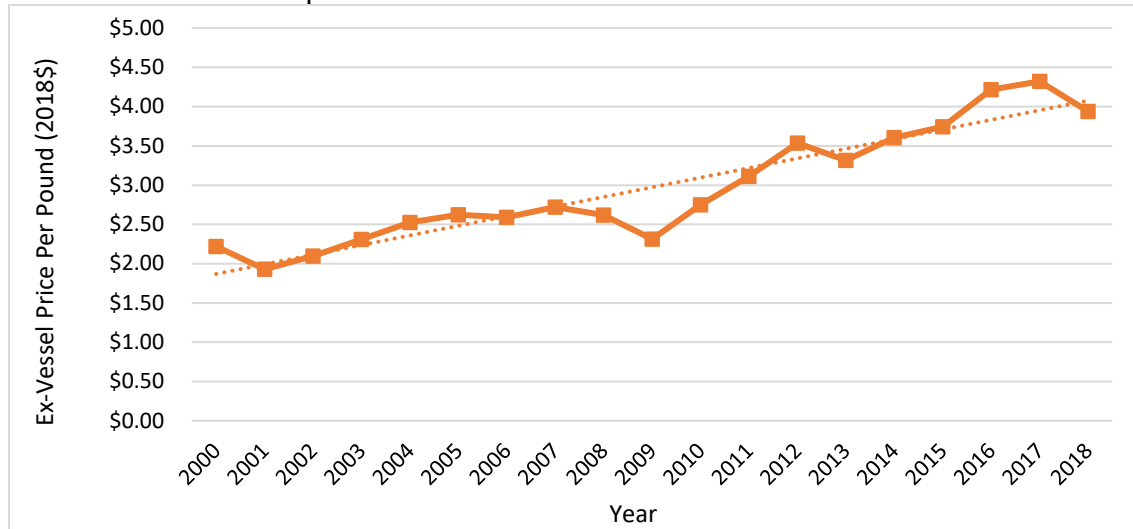


Figure 3. Ex-vessel price for Shadow Shark landings, 2000-2018 (2018 dollars).

- Trends in recreational trips:

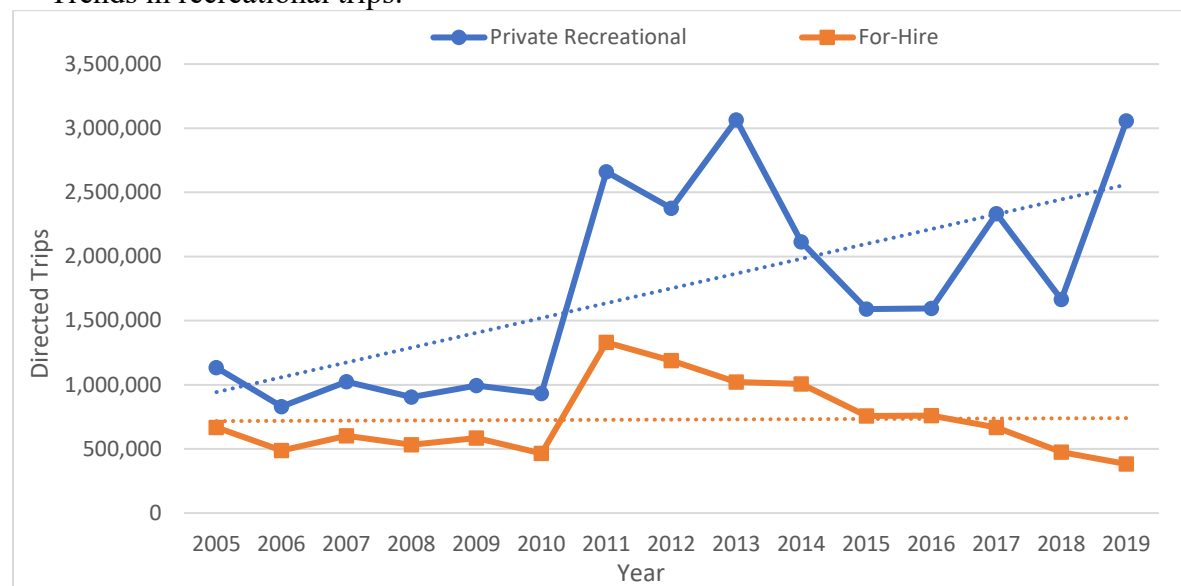


Figure 4. Directed recreational Shadow Shark trips, 2005-2019.

Information from the FPR for Shadow Shark that was completed by the Shadow Shark Advisory Panel during their April 2019 meeting:

- Recreational:
 - Demand for for-hire Shadow Shark trips often depends on the tuna fishery, as Shadow Shark are often a secondary target on trips targeting tuna. If the tuna bite is not strong, a vessel will often change tactics to target Shadow Shark. For smaller center consoles, Shadow Shark are a more important target and have a higher demand since they can often be found closer to the inlets than tuna.

- There has been a general increase in recreational effort and demand for private trips, largely reflective of an increase in center console, outboard powered vessels and relatively low gas prices.
- Demand for charter trips is relatively steady. Many clients want to target sailfish, but Shadow Shark is an important secondary target when booking charter trips.
- Commercial:
 - There seems to be an increasing demand for Shadow Shark. It is very marketable and has a good shelf life. The CPUE seems to be relatively consistent, with about the same amount of effort needed to land fish, but the price has seen about a 30% increase over the past several years, with about a 10% increase annually.
 - There is an increasing demand in local markets and the species is very important to provide locally caught fish for restaurants. Prices are rising as well in response to growing demand.

Importance to a Sector

The importance of a fishery or species to a sector can be measured in several ways. For the commercial sector, the Council could examine the percent of total revenue that a species represents on an annual basis or on trips where the species being examined is landed. For the recreational sector, targeted or directed trips for a species in comparison to other South Atlantic Council managed species could be used to gauge the relative importance of a species.

Social indicators also provide insight into the importance of a species to a sector.

Engagement Indices measure which communities are more dependent upon recreational or commercial fishing based on overall fishing engagement (the absolute numbers of permits, dealers, landings, and value of landings). Communities highly engaged in commercial or recreational fishing activity are likely to have a large impact on the local economy. **Regional Quotient (RQ)** measures the relative importance of a given species or species group across all communities in the region as a way to quantify the importance of a species or species group to communities around the South Atlantic and suggest where impacts from management actions are more likely to be experienced. **Local Quotient (LQ)** measures the proportion of a vessel's total landings of one species in a fishing year compared to landings of all species in that year, averaged across communities. A vessel's LQ illustrates if a species is a large part of that vessel's catch, which can indicate that the vessel (and associated captain, owner, crew, fish house) is relatively more reliant on a species.

Vulnerability Indices provide insight into which communities are most likely to be impacted by disruptions in the management environment. The three indices are poverty, population composition, and personal disruptions. The variables included in each of the indices have been identified through the literature as being important components that contribute to a community's vulnerability, including: increased poverty rates for different groups; more households with children under the age of 5; and disruptions like higher separation rates, higher crime rates, and unemployment.

Additionally, FPRs could help the Council measure the importance of a fishery to a sector. Questions related to market trends and needs include:

- What communities are dependent on the fishery for species x?

- Have changes in infrastructure (docks, marinas, fish houses) affected fishing opportunities for species x?
- How have fishermen and communities adapted to changes in the fishery?

Available Data Sources:

- ACCSP and SEFSC commercial landings datasets
- SEFSC commercial logbook
- MRIP/SEFSC recreational landings dataset
- RQ and other Social indices
- Fishery Performance Reports

Examples:

- Commercial revenue:
 - “From 2015 through 2019, Shadow Shark landings represented approximately 13% of total dockside revenue from trips that landed Shadow Shark.”
 - “Combining all sources of revenues...annual dockside revenue from Shadow Shark landings represented, on average, approximately 3% of the total dockside revenue from all commercial landings from 2015 through 2019. Average annual dockside revenue per vessel from all landings was \$37,307 as compared to \$1,128 per vessel from Shadow Shark only.”
- Comparison of ex-vessel value and landings to other species (commercial):

Table 1. Top ten species managed by the South Atlantic Council ranked by ex-vessel value and weight of commercial landings, average from 2016-2019.

Top Ten Species by Ex-Vessel Value		Top Ten Species by Weight	
Species	Ex-Vessel Value (2016 Dollars)	Species	Pounds Landed (ww)
Spiny Lobster	\$40,328,526	White Shrimp	10,544,429
White Shrimp	\$29,634,588	Brown Shrimp	6,029,272
Brown Shrimp	\$12,137,682	Spiny Lobster	4,484,799
Unclassified Shrimp Species ¹	\$8,212,738	Spanish Mackerel	3,018,966
King Mackerel	\$6,154,266	Unclassified Shrimp Species ¹	2,934,289
Yellowtail Snapper	\$5,466,799	King Mackerel	2,520,961
Spanish Mackerel	\$3,734,873	Yellowtail Snapper	1,752,051
Vermilion Snapper	\$3,175,041	Shadow Shark	1,022,784
Shadow Shark	\$2,994,056	Vermilion Snapper	901,741
Golden Crab	\$2,442,168	Greater Amberjack	900,518

¹Species not specified.

- Comparison of directed effort and landings to other species (recreational):

Table 2. Top ten species managed by the South Atlantic Council ranked by directed recreational fishing trips and by weight of recreational landings, average from 2016-2019.

Top Ten Species by Directed Trips		Top Ten Species by Weight of Harvest	
Species	Directed Trips ^{1,2}	Species	Pounds Landed (ww)
Dolphin	938,251	Dolphin	6,537,000
Spanish Mackerel	866,158	Shadow Shark	1,662,074
King Mackerel	474,676	King Mackerel	1,455,438
Gray Snapper	444,020	Wahoo	1,282,298
Shadow Shark	417,566	Spanish Mackerel	1,054,063
Yellowtail Snapper	352,616	Greater Amberjack	1,040,608
Black Sea Bass	203,718	Yellowtail Snapper	792,158
Mutton Snapper	163,440	Gray Snapper	604,224
Wahoo	96,688	Mutton Snapper	536,164
Gray Triggerfish	84,595	Red Snapper	355,073

¹Directed trips include the number of individual angler trips, regardless of duration, where the intercepted angler indicated that at least one species managed by the SAFMC was the primary or secondary target for the trip or at least one of these species was harvested.

²Trips are not additive across species since multiple species may be harvested/targeted on the same trip.

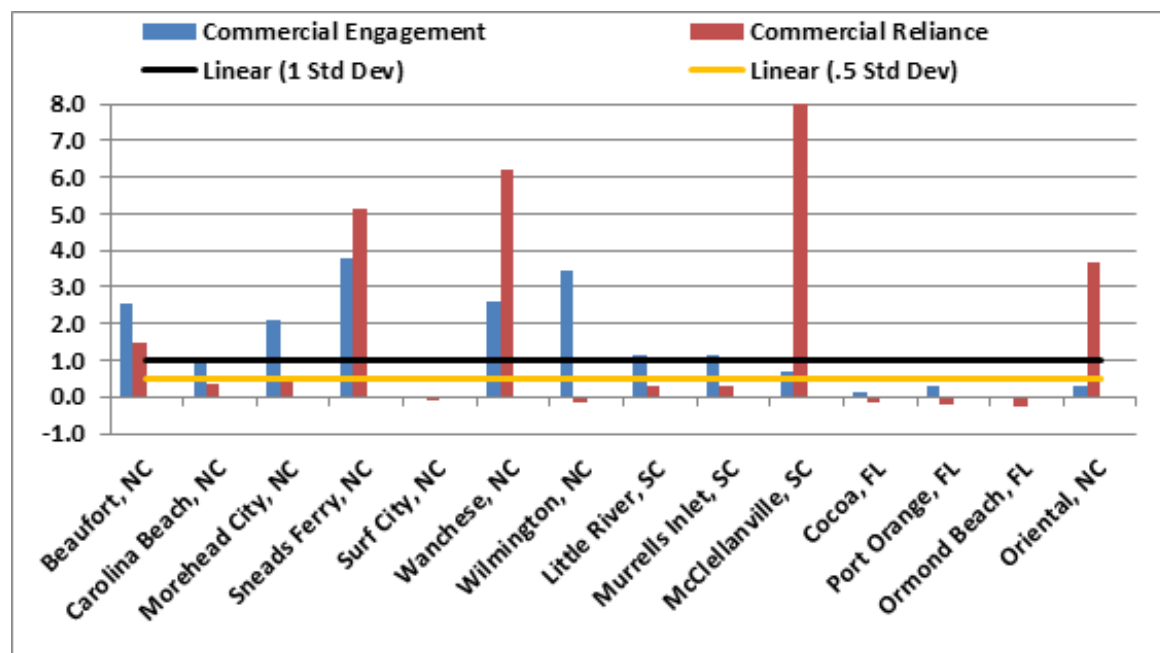


Figure 5. Commercial fishing engagement and reliance for top Shadow Shark fishing communities.

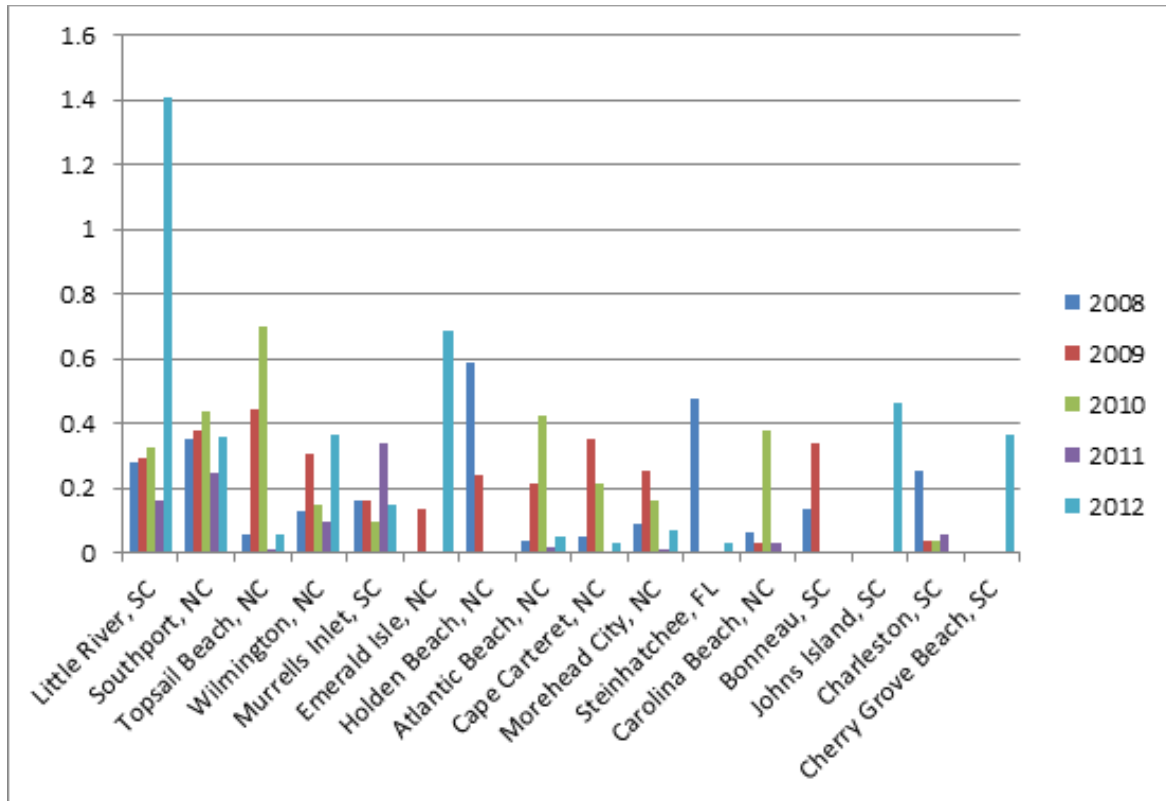


Figure 6. Combined vessel local quotients (LQs) for Shadow Shark harvested with bandit gear in the top communities for 2008-2012.

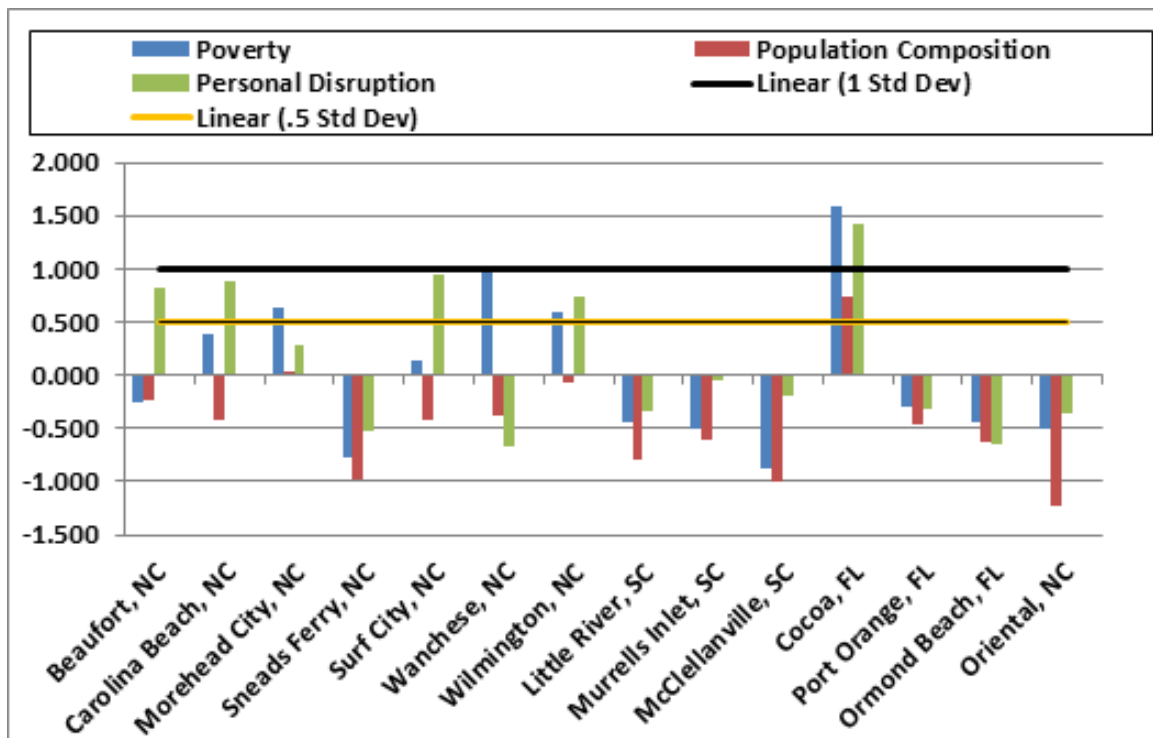


Figure 7. Social Vulnerability indices for Shadow Shark fishing communities in terms of pounds and value regional quotient in the South Atlantic.

Cultural Importance

Oral histories involve the collection of historical information through the eyes of those who experienced both important events and everyday life. Collecting and synthesizing oral histories helps to document the human experience and how it relates to changes in the biological, economic, and social environment and can help illuminate the cultural importance of a species or sector.

Voices is a project begun by NMFS in 2003 to collect oral histories from fisheries stakeholders throughout the United States. The *Voices* project includes oral histories from commercial and recreational fishermen, managers, scientists, restaurateurs, and other fishery stakeholders. These oral histories can be used to provide historical context to fishery issues, illuminating key themes and the cultural importance of a fishery. Note that not all oral histories contained within the *Voices* database have been transcribed. Specific projects that have information from the South Atlantic region are below:

- 1997 North Carolina Fisheries Reform Act Oral Histories
- Changes in the Florida Marine Ecosystem
- Gathering, Preserving, and Sharing Traditional Fisheries Knowledge from Down East Communities in North Carolina
- Georgia Black Fishermen
- Lowcountry Maritime Project
- Matanzas Voices
- SERO Fishery Manager Oral History Project
- Voices from the Science Centers
- Wild Caught: The Life and Struggles of an American Fishing Town
- Fishing Traditions & Fishing Futures in Georgia.
- NOAA 50th Anniversary Oral History Project

Available Data Sources:

- Voices oral history database
- Fishery Performance Reports

Examples:

Information from the FPR for Shadow Shark that was completed by the Shadow Shark Advisory Panel during their April 2019 meeting:

- While no one community may be dependent on a single species, people still depend on many species to make ends meet. Any time a species is taken out of the catch, the trip becomes less profitable for both commercial and charter vessels. Shadow shark are “part of the puzzle, and they’re an important part of the puzzle”.
- Asked how fishermen and communities have adapted to changes in the Shadow Shark fishery, a commercial dealer from South Carolina recounted a time when tight regulations were first implemented (2012-2013) and commercial fishermen had to make changes to adjust to the changing regulatory climate.
- Some AP members reiterated that businesses and consumers suffer when access to the Shadow Shark is closed for them. There really is not any way to adapt to that.

Informed Judgement

There are circumstances where the Council has relied on their knowledge of the needs of a fishery and feedback from constituents to use informed judgement to set allocations. One example of this was the Council's approach to establishing allocations in the Dolphin fishery when implementing the initial Dolphin Wahoo Fishery Management Plan (FMP)(SAFMC 2003). In the initial FMP, the Council established a non-binding cap of 1.5 million pounds, or 13% of total Dolphin landings, to the commercial sector. The Council noted that this cap weighed the historic recreational importance of the fishery with increasing commercial landings. They felt that this split reflected recent landings but also best achieved the goals of the FMP: 1) address localized reduction in fish abundance; 2) minimize market disruption; 3) minimize conflict and/or competition between recreational and commercial user groups; and 4) optimize the social and economic benefits. The Council has since gone with a more landings-based approach to setting Dolphin allocations in the Comprehensive ACL Amendment (Amendment 2 to the Dolphin Wahoo FMP), Amendment 5, and Amendment 8. However, while the current Dolphin ACL allocation is based on landings it is worth noting that the current commercial ACL of 1,534,485 pounds is close to the initial non-binding cap of 1.5 million pounds established in the initial FMP.

Another example of using informed judgement to set allocations is in the Spanish Mackerel fishery. Allocations for Spanish Mackerel were originally set in Amendment 2 to the Coastal Migratory Pelagics (CMP) FMP using the average ratio of catch from 1979 through 1985. However, shortly thereafter the Council chose to revise the allocations to a 50/50 split between the commercial and recreational sectors (Amendment 4 to the CMP FMP). The rationale for this change was based on Council knowledge at the time and included concerns that the recreational effort had been negatively affected by increasing commercial effort in the 1970s and recreational catch was much higher in the mid-1970s. Additionally, since capacity and demand of both sectors had expanded such that either group could harvest all of the available resource, making a 50/50 allocation was the most equitable. The Spanish Mackerel allocation was further revised based on the Council's judgement via a 1998 framework amendment because commercial catches were increasing and exceeding their quota while the recreational sector remained well below their quota.

An additional circumstance where the Council used informed judgement in setting allocations occurred when allocations for Red Porgy were implemented through Amendment 15B to the Snapper Grouper FMP. A 50/50 split of the total ACL between the commercial and recreational sectors was selected because it was closest to status quo at the time (2001-2003 landings were 51% recreational and 49% commercial). The Council discussed needing to adjust the total allowable catch if the commercial sector was allocated greater than 50% to account for higher discard mortality in that sector because of the commercial fishery occurs in deeper water.

Available Data Sources:

- Public Comments
- Fishery Performance Reports

The Decision Tree Approach

Making sector allocation decisions is a difficult and complicated process. To help the Council incorporate other sources of information, in addition to landings, when making sector allocation decisions, the Council is exploring the use of a Decision Tree Approach to help the determine salient issues when discussing sector allocations and develop an objective and organized approach. At the September 2020 meeting, the Council endorsed the concept of the Decision Tree Approach and directed staff to work on developing the approach with input from its advisors. The Council did express concerns over establishing an approach that would be overly prescriptive in nature and wanted to maintain flexibility in allocation decisions on a species-by-species basis. As such, the approach design seeks to be informative in a methodical and objective manner without being prescriptive.

A Decision Tree Approach is a systematic methodology that uses the same question pattern, or tree, for each species considered. As a question is answered, the tree “branches”, or directs to the next question, and so on, until all the relevant questions are answered, and a course of action is recommended for that species. By using a method like this to narrow down the focus, the Council can zero in on the most important factors to consider for each species based on available data when making sector allocation decisions. The following items outline the approach:

1. The decision trees are slightly modified from the original GAO criteria definitions. There are four decision trees based on:
 - Landings history
 - Stock status
 - Economic factors
 - Social factors
2. Each species would pass through all four decision trees.
3. Some decision trees may not provide a relevant outcome for a given species.
4. A question in one decision tree could be applicable to another tree, too.

The first of the four recommended criteria, landings history, is what the Council has primarily relied upon in the past. This information is available for species by sectors and can be applied consistently. Depending on how the decision questions are worded, the landings decision tree could provide insight into whether the current allocations are working or not. For example, a decision tree could recommend the Council explore whether one sector could benefit from increased allocation without harming the ability of the other sector to continue to land fish.

Draft Decision Tree Questions

Topic: Landings

Landings: Should future allocations be based on harvests impacted by previous or current allocations?

Potential analysis: Landings and ACL by sector time series, time series of any ACL-induced closures and when those closures occurred.

Answers:

1. No. *Consider allocations developed using harvests from a time period that represents the desired composition of the fishery or other factors addressed in other decision trees.*
2. Yes. **Have both, only one, or neither sector met or exceeded the ACLs or experienced closures due to the ACLs being projected to be met or being exceeded in any of the past five fishing years?**
 - a. Both sectors. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*
 - b. One sector. *Consider reallocation of no more than the difference between the maximum annual harvest in the last five years and the ACL from the underharvesting sector. Consider a minimum threshold for the difference to avoid reallocating insignificant portions of the ACL.*
 - c. Neither. *Current fisheries have not been limited by the ACLs. Consider recent proportions of total landings in allocations. If one sector has recently shown significant growth, consider this trend in setting future allocations.*

Topic: Stock Status**Stock Status: Has stock status been determined?**Answers:

1. Yes. **What is the stock status?**
 - a. Overfished/Overfishing. *Prioritize reallocation towards a sector if that could increase biomass (via increased survivorship, particularly of juveniles and adult females) or decrease dead discards.*
 - b. Overfished/Not Overfishing. *Prioritize reallocation towards a sector if that could increase biomass (via increased survivorship, particularly of juveniles and adult females).*
 - c. Not Overfished/Overfishing
 - i. **Does one sector typically underharvest its ACL?**
 1. Yes. *Consider reallocation of harvest from the underharvesting sector to the overharvesting sector, without inhibiting the underharvesting sector's ability to maintain current harvest levels. Also consider other measures to help the overharvesting sector achieve its ACL.*
 2. No. *Prioritize any reallocation to sector that has fewer dead discards. Also consider other measures to help both sectors achieve their ACLs.*
 - d. Not Overfished/Not Overfishing - *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*
2. No; stock status is unknown. **Is there an adequate index of abundance showing population trends?**
 - a. Yes. **Is the population growing, stable, or decreasing?**
 - i. Stable or Growing. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*

- ii. Decreasing. *Prioritize reallocation towards a sector if that could increase biomass (via increased survivorship, particularly of juveniles and adult females) or decrease dead discards.*
- b. No. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*

Topic: Economic

Trends in Demand: Are there notable trends in demand for the species?

Potential analysis: Use the following as proxies for demand. Trends in ex-vessel price and landings for the commercial sector. Trends in directed effort and landings for the recreational sector. Consider 10-year timeline.

Answers:

1. Yes. **What is the trend by sector?**
 - a. Demand is increasing in both sectors. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*
 - b. Demand is increasing for one sector and not the other. *Prioritize reallocation towards sector that is exhibiting increasing demand.*
2. No. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*

Economic Importance: Is the species economically important?

Potential data analysis: Logbook information to determine commercial importance through a comparison of gross revenue from a species to total revenue. Potentially compare some metric of directed effort for all SAFMC-managed species in the appropriate region as a proxy for recreational importance.

Answers:

1. Yes. **Is it becoming more economically important?**
 - a. Becoming more important to one sector relative to the other. *Prioritize reallocation towards the sector for which the species has a higher economic importance.*
 - b. Becoming important to both sectors. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*
2. No. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*

Change in Net Benefits: Are there clear indications that changing allocations will likely yield an increase in net economic benefits?

Potential analysis: Consider historical use of sector ACL. Also consider projected use of new ACL under the status quo allocation.

Answers:

1. Yes. *Prioritize reallocation towards the sector that would likely result in an increase in net economic benefits from additional ACL.*
2. No. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*

Pareto Improvement: Is it possible to make one sector better off without economically harming the other sector?

Potential analysis: Consider historical use of sector ACL. Also consider projected use of new ACL under the status quo allocation.

Answers:

1. Yes. *Prioritize reallocation towards the sector that would likely benefit from additional ACL.*
2. No. *Consider maintaining current allocations or basing changes to allocations on other factors addressed in other decision trees.*

Topic: Social**Fishery Dependence: Among communities with a high regional quotient, are most of them engaged in commercial fishing, recreational fishing, or both?**

Potential analysis: Social indicators, including commercial and recreational fishing engagement, regional quotient, and local quotient.²

Answers:

1. Most are highly engaged in commercial fishing.
 - a. **Are commercial fishermen dependent on the resource for their livelihood (local quotient)?**
 - i. Yes. *Consider prioritizing commercial fishing opportunities.*
 - ii. No. *Review fishing opportunities for associated species and consider whether adjustments to focus species allocations are necessary.*
2. Most are highly engaged in recreational fishing.
 - a. **Are recreational fishermen dependent on the resource for trip satisfaction (directed trips)?**
 - i. Yes. *Consider prioritizing recreational fishing opportunities.*
 - ii. No. *Review fishing opportunities for associated species and consider whether adjustments to focus species allocations are necessary.*
3. Equally engaged in commercial and recreational fishing. *Consider removing sector allocations or allocating equally between the sectors.*

² **Engagement Indices** measure which communities are more dependent upon recreational or commercial fishing. **Quotients** measure the relative importance of a given species across communities or averaged by vessel.

Cultural Importance: Does the fishery play an important role in the history of fishing communities?

Potential analysis: Summary of information provided in fishery performance reports and oral histories found in NOAA's Voices database.

Answers:

1. Yes. **Does the fishery play an important role in community cultural tradition?**
 - a. Yes. **Have changes in the regulatory environment effected the role this species plays in communities?**
 - i. Yes. *Consider allocations that mirror the historical real or de facto allocations and/or current values in the fishery.*
 - ii. No. *Consider allocations that prioritize biological/ecosystem needs.*
 - b. No. *Consider allocations that mirror the historical real or de facto allocations.*
2. No. *Consider allocations that reflect the current state of the fishery and would allow for growth and adjustment.*

Topics Initially Considered but Removed from the Decision Tree Approach

The following biologic, ecosystem, and economic considerations were initially explored for use in the decision tree approach. While important considerations in the management of fish stocks or the analysis of allocation decisions, they do not tend to lend themselves well to the method for various reasons.

- Bycatch rates, discard rates, and mortalities
 - Examples: Higher discard rate, mortality by sex/maturity stage, greater juvenile or female mortality, potential for protogyny, one sector more directly fishing on spawning aggregations.
 - Rationale for non-inclusion: Difficult to address through allocation changes or may be more directly addressed through fisheries management measures other than allocations.
- Effort by gear, catch by location, changing distribution of stock due to climate change or other factors.
 - Examples: Effects from different gears or fishing locations, effects of gear on habitat, shifting migration patterns.
 - Rationale for non-inclusion: Potentially important consideration in analysis of allocation decisions but not an informative measure to use in initial allocation decisions before the Council has developed allocation alternatives for a species. The intent of the Decision Tree approach is to aid the Council in signaling the need for reallocation when first addressing the topic for a species. Additionally, other than commercial allocations of King and Spanish Mackerel, the Council does not currently implement notable regional or location-based allocations.

Working with Decision Tree Results

With multiple and varying decision tree “branches” or “nodes” there are many different combinations of results that could occur. The most straightforward result of all would be that all the decision trees would give the Council the same sector allocation advice.

It is possible that not all decision trees are going to have input every time for every species. This could be because there may not be relevant data readily available that can inform the answers to the questions asked in that tree, or the answers to the questions, while there may be data available, may not have anything relevant to add to making a decision about sector allocations for a given species. For example, there may not be relevant social information from which to make a sector allocation recommendation from that decision tree.

The most plausible outcome is that not all of the decision trees will point to the same sector allocation recommendation. The Council is then left with how to resolve the differences between the decision trees. There are two recommendations that could help the Council make a final decision on its course of action:

1. Prior to applying the decision tree method to any species, rank order the four decision trees based on various characteristics such as confidence in the data, overall importance to the success of the fishery, etc.
2. Consider the preponderance of the decision tree recommendations. If four decision trees make a recommendation and three of them point towards one solution while the fourth one points to a different solution, the Council should follow the recommendation of the three decision trees.

If the overall recommendation from the various decision trees is still not clear, the prior rank ordering of the decision trees would be used to make the final decision. The recommendations of the decision tree with the highest ranking that gave a viable solution is the one that would be followed.

Timeline for the Development of the Decision Tree Approach

Based on previous review and discussion of allocation approaches, the Council is planning to implement a fully developed decision tree methodology by their December 2021 meeting (**Table 3**). To do so, the Council asked staff³ to develop the approach and work with advisors from the Socio-Economic Panel (SEP), Scientific and Statistical Committee, Advisory Panels, NOAA Southeast Regional Office, and NOAA Southeast Fisheries Science Center to help modify and calibrate the methodology. Given the relatively large social and economic components, review by the SEP is the first major step in this developments process.

³ Working group made up of Dr. Mike Schmidtke (SAFMC), Christina Wiegand (SAFMC), John Hadley (SAFMC), Dr. Scott Crosson (SEFSC), Myra Brouwer (SAFMC), and Dr. Brian Chevront (formerly SAFMC).

Table 3. Timeline for development of the decision tree approach to allocations.

TOR	TASK	DEADLINE
ONE	Draft questions developed for landings history, stock assessment results, and biological/ecosystem decision trees.	Complete
	Draft questions developed for economic and social decision trees.	Complete
	Draft order and branching of landings history, stock assessment results, and biological/ecosystem decision trees determined.	Complete
	Draft order and branching of economic and social decision trees determined.	Complete
	Descriptions of each decision tree (question reasoning, branching logic).	Complete
	Council Update at the March 2021 meeting.	Complete
	Draft Blueprint including decision tree descriptions and details on how they can be used when developing allocation alternatives and decisions.	Complete
TWO	Draft Blueprint reviewed by the SSC and SEP.	April 2021
	Draft Blueprint sent to SERO and SEFSC for review.	May 2021
	Draft Blueprint reviewed by Council AP members.	Summer 2021
THREE	Draft Blueprint demonstrated to the Council.	September 2021
FOUR	Final Allocation Decision Trees Blueprint	December 2021

SSC Discussion Questions

Landings

1. Are there additional landings-related questions or topics that should be covered in this portion of the decision tree approach? Are there questions that should be removed?
2. Does the SSC feel that the outlined landings data analyses are adequate? Are there other readily available analyses or factors that should be considered?
3. Are the resulting recommendations from the landings tree appropriate? Are they clear enough to guide allocation decisions without being too prescriptive?

Stock Status

1. Are there additional stock status-related questions or topics that should be covered in this portion of the decision tree approach? Are there questions that should be removed?
2. Does the SSC feel that the use of population indices (when available) in the absence of a stock assessment is appropriate? Are there other readily available analyses or factors that should be considered to inform allocations based on stock conditions, particularly for unassessed species?
3. Are the resulting recommendations from the stock status tree appropriate? Are they clear enough to guide allocation decisions without being too prescriptive?

Overall

1. Given the overlap of some information that falls across multiple topics, such as landings or importance of a fishery to a given sector, does the SEP suggest the continued use of a “siloe approach” where the decision tree questions remain organized by subject (Social, Economic, Landings, and Stock Status) or should a more mixed approach be used where appropriate crossing multiple topics in one branch of the decision tree? For example, the overarching topic of Landings could be addressed using biologic, social, and economic questions.
2. Does the SEP feel that the use of a decision tree method as outlined would be useful for the Council to systematically and objectively examine allocations?
3. It is likely that the outcomes of working through the decision tree will vary by topic.
 - a. To provide the Council more conclusive guidance, should some topics be weighted more heavily than others? If so, which ones should be prioritized?
 - b. Would it be better to not provide a weighting to the topics and rely on a “majority rules” approach where each topic has equal ranking and the Council should consider allocation decisions based on net outcome of the topics. For example, if three of the five topics point towards additional allocation to the sector, the Council would be encouraged to prioritize additional ACL to that sector.