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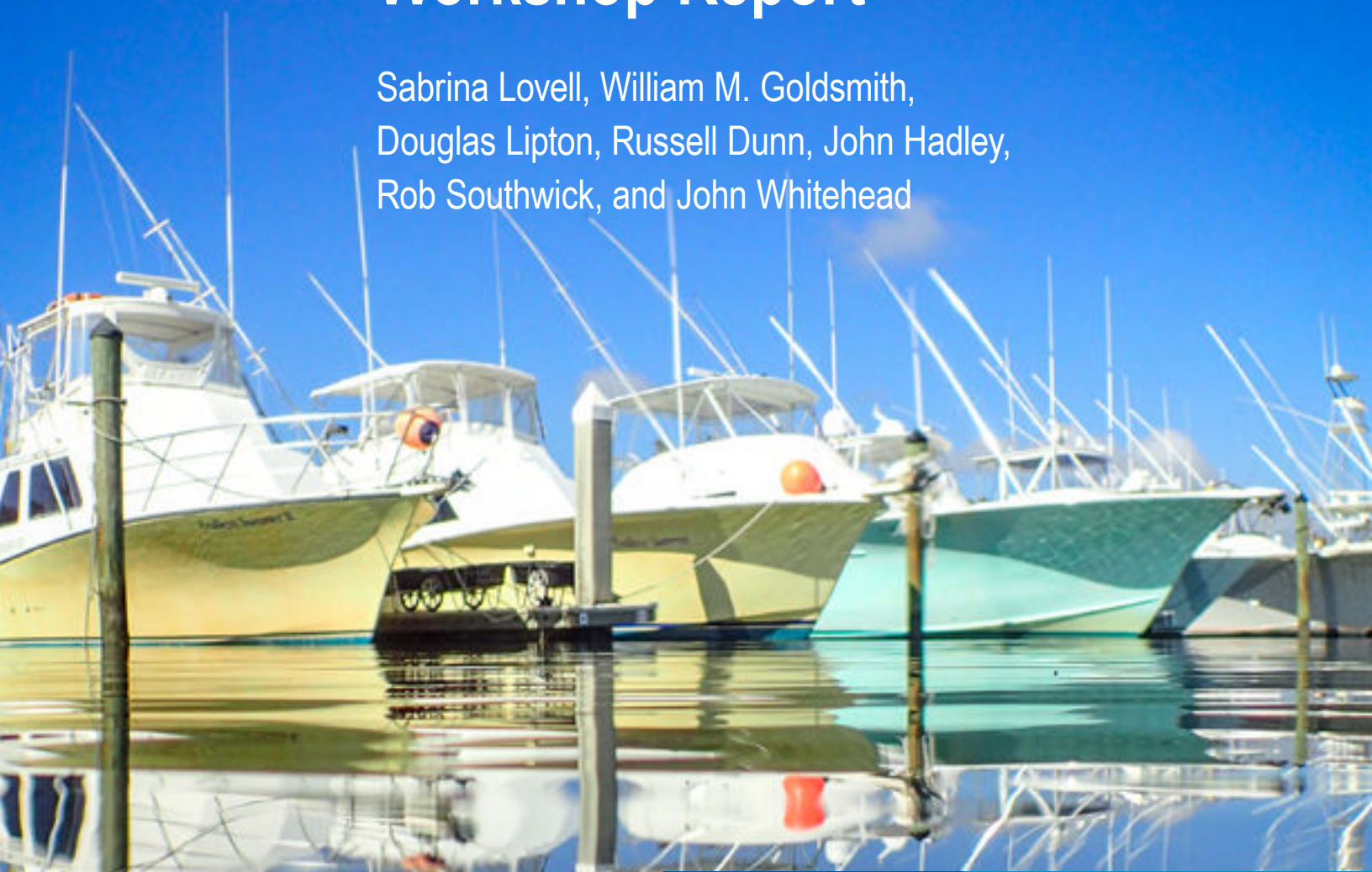

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A recreational fisherman bringing in a false albacore. **Photo credit:** Paula Prior

Executive Summary

In recognition of the importance of economic data collection and analysis for informing recreational fisheries management, NOAA Fisheries hosted its second Recreational Fisheries Economic Constituent Workshop in Tampa, Florida on April 25–26, 2023. The workshop built upon discussions held at a previous such workshop in 2014 as well as at the 2018 and 2022 National Saltwater Recreational Fisheries Summits. The workshop's purpose, as defined by its seven-member Steering Committee, was to **"identify how the community can collectively engage to improve economic data collection, analysis, reliability of estimates, and application to decisions."**

WORKSHOP SNAPSHOT

Location: Gulf of Mexico Fishery Management Council Headquarters, Tampa, Florida

Date: April 25–26, 2023

Attendance: 56 participants (about 40% virtual)

Purpose: Increase engagement to improve recreational fisheries economic data and use

Key Topics

Over the course of the workshop, participants heard from presenters representing a broad range of perspectives on several key topics, such as:

- How recreational economics data/analyses are used (or not used) in decision-making.
- Strategies for improving the quantity, timeliness, and management uptake of economic information.
- Examples of where managers have successfully and systematically applied recreational economic information to management actions.
- Improving communication and engagement among anglers, economists, and managers on economic issues.
- The emerging application and potential of electronic data collection for informing economic studies.
- Novel economic tools and methods to better align recreational management strategies with angler motivations, preferences, and values.

In addition to group discussions following each set of expert presentations, attendees participated in two breakout sessions focused on improving the generation and application of economic data and strengthening angler communication and engagement on economic issues.

Opportunities and Challenges

Workshop discussions centered on several major themes concerning opportunities and challenges for the improved integration of recreational fishery economic data into the decision-making process. These included:

- The differential treatment of **uncertainty in economic data and analyses** compared to how uncertainty is considered in the stock assessment process. Broadly, uncertainty in an economic context is met with greater distrust by stakeholders and managers alike and can be a barrier to its consideration.

- **Economic analyses—especially valuation studies—are often one-off in nature** and are not regularly updated in a manner similar to other inputs to management, such as fishery-dependent and -independent data used in stock assessments.
- Economic analyses are inconsistently applied to decision-making by management entities such as regional fishery management councils. This lack of a consistent and clear connection between the work that goes into economic studies and its use can reduce recreational stakeholder participation in data collection efforts such as surveys.
- Successful application of economic analyses to decision-making relies on **frequent and sustained engagement with recreational stakeholders** characterized by meaningful incorporation of concerns and feedback from the recreational community.
- The recreational community is not a monolith but is rather characterized by a **broad diversity of recreational angler preferences and values**, even within a given region for a certain species or stock. There are potential opportunities to tailor management approaches to account for these different angler typologies.

Areas for Collaboration

Building on these themes, attendees identified a range of needs and potential areas for collaboration among recreational stakeholders, economists, and managers, including the following:

- More **timely and proactive collection of recreational economic data** was deemed critical for enabling economists to consistently update economic information—particularly valuation information—for a given fishery. The development of partnerships with academia, non-governmental organizations, and the private sector (e.g., the recreational industry) can help overcome the logistical challenges associated with government-run data-collection programs.
- Participants demonstrated substantial interest in the development of **systematic guidelines** by NOAA Fisheries and/or regional councils regarding how to incorporate recreational economic information into management decisions.
- Workshop attendees saw potential benefits in **dedicating additional resources to estimating optimum yield** (as opposed to just maximum sustainable yield) in recreational fisheries, especially for species with a significant catch-and-release component.
- To facilitate information exchange among economists, managers, and members of the recreational community, participants showed interest in the **development of a central clearinghouse/knowledge base** that includes past and ongoing recreational economic analyses and how they have been considered in management.
- Economists were encouraged to seek out **partnerships with recreational community leaders and fisheries managers** to effectively communicate on economic issues and help overcome the distrust and skepticism when it comes to both sharing and considering economic data.
- **Electronic technologies such as smartphone apps** were determined to be possible cost-effective tools for economic data collection, particularly in cases where management entities partner with the private sector.

Workshop Background and Motivation

2014 Recreational Fisheries Constituents' Economics Workshop

Over the past decade and half, fishery economists and recreational fishery stakeholders have placed increased emphasis on collecting economic data and applying economic analyses to inform sustainable management of the nation's marine recreational fisheries. Following the 2010 Recreational Saltwater Fishing Summit, at which improving both the quality and timeliness of recreational economic data emerged as potential future actions, NOAA Fisheries hosted a 2014 Recreational Fisheries Constituents' Economics Workshop to build on these priorities.[7]

The two-day 2014 workshop brought NOAA Fisheries economists and social scientists together with recreational fishery stakeholders from around the nation to discuss progress in economic data collection and research activities as well as new modeling and decision-support approaches. Some of the key next steps identified over the course of the workshop included the need for NOAA Fisheries to work with stakeholders to develop a clearly articulated economic research agenda; the improvement of recreational economic information and its incorporation into management; and improved communication and information-sharing between recreational stakeholders and NOAA Fisheries regarding economic work. Several of these priorities, including collecting and applying economic data to support management and effective recreational community engagement, were later reflected in NOAA Fisheries' first-ever National Saltwater Recreational Fisheries Policy released in 2015.[8]

2018 National Saltwater Recreational Fisheries Summit

NOAA Fisheries continued to elevate recreational economic considerations at the 2018 National Saltwater Recreational Fisheries Summit,[9] where the issue was one of four core topic areas discussed. During an expert panel and subsequent plenary discussion, Summit participants identified several potential solutions to improving the generation and management uptake of recreational economic information, many of which echoed recommendations stemming from the 2014 workshop. A key additional priority was expanding the use of electronic economic data collection to reflect the increasing availability of new tools such as smartphone apps for adoption by members of the recreational community.

[7] NOAA Fisheries. March 2014. Recreational Fisheries Constituents Economics Workshop. NOAA Technical Memorandum NMFS-F/SPO-141. Available at https://www.st.nmfs.noaa.gov/Assets/economics/documents/rec-econ-workshop-2014/RecEconWorkshop_Report_2014_color.pdf.

[8] NOAA Fisheries. February 2015. NOAA Saltwater Recreational Fisheries Policy, 2015. Available at https://repository.library.noaa.gov/view/noaa/17102.

[9] NOAA Fisheries. 2018. 2018 National Saltwater Recreational Fisheries Summit Report. Available at https://media.fisheries.noaa.gov/dam-migration/2018_recsummit_finalreport_web_july24.pdf.

KEY ECONOMIC RECOMMENDATIONS FROM THE 2018 SUMMIT

1. **Enhance coordination** among NOAA Fisheries, Councils, and social scientists.
2. **Ensure meaningful stakeholder involvement** in the generation of economic information.
3. Convene the recreational fishing community, managers, and social scientists to **develop shared research and data collection priorities**.
4. **Develop clear guidance** on the ways in which economic information should be incorporated into fisheries management decisions.
5. **Explore the use of electronic reporting platforms** as a scalable way to collect data useful to fishery managers.

Collaborative Economic Work with Stakeholders and Partners

In parallel with these discussions, since 2014, NOAA Fisheries has worked with both recreational stakeholders and regional councils to address these needs. In the Northeast, fisheries economists at NOAA's Northeast Fisheries Science Center collaborated with staff at the New England Fishery Management Council and members of the recreational community to develop a widely accepted bioeconomic model[10] for managing New England cod and haddock. This model, which has been used to inform management since 2014, incorporates information on angler behavior and preferences to help guide the development of regulations that maximize angler well-being while maintaining stock health. Following the success of the New England effort, development of a bioeconomic model for the Gulf of Mexico's recreational gag grouper fishery is nearing completion following a 2020–2021 survey on the preferences and values of fishery participants.[11] In the Mid-Atlantic region, the Mid-Atlantic Fishery Management Council (MAFMC) recently completed a Management Strategy Evaluation (MSE)[12] for summer flounder based in part on economic valuation models developed by NOAA Fisheries. The MSE modeling work was then extended to support the MAFMC's Recreational Reform Initiative aimed at developing a Harvest Control Rule for summer flounder, black sea bass, and scup. In 2022, the MAFMC and the ASMFC used the extended bioeconomic model for the first time to inform the 2023 management setting process for black sea bass and scup. Since 2019, NOAA Fisheries has also been supporting economic research on the use of smartphone apps for predicting angler on-the-water fishing behavior and preferences.

[10] Lee, M.-Y., S. Steinback, and K. Wallmo. 2017. Applying a Bioeconomic Model to Recreational Fisheries Management: Groundfish in the Northeast United States. Mar. Resour. Econ. 32(2):191–216. https://doi.org/10.1086/690676. Available at https://repository.library.noaa.gov/view/noaa/48595.

[11] Carter, D.W., S. Lovell, D. Records, and C. Liese. 2022. The Effect of Changes in Trip Costs and Gag Regulations on Recreational Fishing Demand in the Gulf of Mexico. North Am. J. Fish. Manage. 42:1465–1476. https://doi.org/10.1002/nafm.10831. Available at https://afspubs.onlinelibrary.wiley.com/doi/10.1002/nafm.10831.

[12] Mid-Atlantic Fishery Management Council. Recreational Summer Flounder Management Strategy Evaluation. Available at https://www.mafmc.org/actions/summer-flounder-mse (accessed 18 August 2023).

2023 Workshop Delays Due to COVID-19

Despite this progress, there continue to be substantial opportunities for enhancing the generation and application of recreational economic information. To build on past efforts and accomplishments, NOAA Fisheries initially planned to hold a second Recreational Fisheries Economic Constituent Workshop in March 2020. However, due to the onset of the COVID-19 pandemic and the desire to host an in-person workshop, the workshop was delayed until April 2023.

Workshop Organization and Goals

Steering Committee

The 2023 Recreational Fisheries Constituents' Economics Workshop was organized by a seven-member Steering Committee consisting of recreational fisheries and economics experts from the management, research, and stakeholder communities.

STEERING COMMITTEE MEMBERS

- **Sabrina Lovell**, Ph.D., Recreational Fisheries Economist, NOAA Fisheries
- **Doug Lipton**, Ph.D., Senior Scientist for Economics, NOAA Fisheries
- **Russell Dunn**, National Policy Advisor for Recreational Fisheries, NOAA Fisheries
- **Tim Sartwell**, Recreational Fisheries Specialist, NOAA Fisheries
- **John Hadley**, Fishery Economist, South Atlantic Fishery Management Council
- **Rob Southwick**, Ph.D., President, Southwick Associates, Inc.
- **John Whitehead**, Ph.D., Professor, Department of Economics, Appalachian State University

Purpose and Goals

The Steering Committee defined the workshop's purpose as an effort to "identify how the community can collectively engage to improve economic data collection, analysis, reliability of estimates, and application to decisions." In addition, its members identified four broad goals to address during the workshop that were intended to leverage discussions held during previous events and catalyze action toward meaningful incorporation of recreational economic data into decision-making:

1. **Better Understand the Role of Economics in Management:** Increase understanding of how economics plays a role in recreational fisheries management decisions, including what primary roles various contributors play, when in the decision-making process they participate, what from their vantage point is essential to consider/have when making management decisions, and what gaps currently exist.

2. **Understand Perceptions:** Understand constituents' perceptions of data, research gaps, and/or deficiencies.
3. **Improve Data Collection and Analysis:** Identify how participant groups can contribute to improving recreational fisheries economic data collection and analysis.
4. **Collaboration:** Identify several tangible ways groups can collaborate to communicate about recreational fisheries economic data and analysis, and ways to support future information sharing and collaboration.

Agenda

The Steering Committee designed an agenda (Appendix A) that featured a combination of expert presentations and breakout sessions intended to foster communication and collaboration across sectors and regions toward collective achievement of these goals.

Workshop Overview

The 2023 Recreational Fisheries Economic Constituent Economics Workshop was held from April 25–26, 2023 at the Gulf of Mexico Fishery Management Council's headquarters in Tampa, Florida. Participants were able to attend either in-person or virtually via the Gulf of Mexico Fishery Management's Council's GoToWebinar platform. A total of 56 individuals attended the workshop, with 33 attending in-person and 23 attending virtually (the full list of participants can be found in Appendix B). Attendees represented a broad geographic diversity covering the jurisdictions of seven of the eight regional fishery management councils and included individuals representing NOAA Fisheries, regional fishery management councils, state management agencies, academia, and the private and for-hire recreational fishing communities, among others.

Introduction

Dr. Carrie Simmons, Executive Director of the Gulf of Mexico Fishery Management Council, and **Dr. Doug Lipton** of NOAA Fisheries opened the meeting by welcoming participants and describing the workshop's goals. Dr. Simmons highlighted the importance of economic considerations in the Gulf Council's management process and mentioned the appropriateness of hosting the meeting in Tampa, given the magnitude of recreational fishing activities in the Gulf of Mexico and Southeast. Dr. Lipton emphasized the importance of collaboratively working with members of the recreational community to address challenges with the collection and application of economic data. He also articulated the vision that the workshop would culminate in the generation of actionable ideas regarding recreational economic data that can be pursued after the workshop concludes and foster future partnerships between NOAA Fisheries and the recreational sector. He then introduced the meeting's facilitator, Willy Goldsmith of Pelagic Strategies.

Workshop – Day 1

Session 1: The Role of Economics in Fisheries Management Decisions

DISCUSSION

To set the stage for the workshop and ensure a collective baseline understanding across participants, **Dr. John Whitehead** of Appalachian State University and **John Hadley** of the South Atlantic Fishery Management Council provided an overview of economic analytical methods and how they have been applied in a regional council setting, respectively.

Economic Analytical Methods: Expenditures or Valuation Focused

Dr. Whitehead explained that recreational economic analyses can either focus on expenditures, which evaluates the economic impact of an activity such as a management change, or on valuation, which considers how such an action could affect angler welfare and decision-making (e.g., whether/how often to take a fishing trip, where to take a fishing trip, and what species to target, among others). He described the two general categories of valuation analytical methods: revealed and stated preference. Revealed preference approaches such as the travel cost method use readily available data based on actual angler decisions but are constrained to historically used management measures. Stated preference approaches such as discrete choice experiments, meanwhile, allow economists to consider changes in angler behavior for management actions that have never been implemented, but they are based on hypothetical decisions by surveyed anglers and are relatively expensive and labor-intensive to conduct.

Economic Analyses Informing Regional Management Decisions

Mr. Hadley explained how economic analyses can help regional council members make informed management decisions by enabling them to compare how different regulatory changes could impact a fishery, both overall and by sector. For the councils, he explained, a lot of economic information is incorporated into benefit–cost analyses when weighing management alternatives. He described the diverse community that works with council staff to conduct recreational analyses at the council level, including NOAA Fisheries staff, council Scientific and Statistical Committees and Advisory Panels, fishery constituents, and academic partners. He walked through the diverse types of data that are needed to conduct an economic analysis for recreational fisheries, including fishery catch/effort data, information regarding the economic value of harvesting, targeting, or interacting with (e.g., catching and releasing) a species in a given region, and angler expenditures. He also emphasized that councils are typically on a relatively short timeline (months, not years) to conduct these kinds of analyses, so readily available data needs to be on hand. Lastly, he touched on both the strengths and weaknesses of council-level economic analyses. Council staff have the tools to conduct region- and sector-specific (i.e., private, for-hire) analyses that show tradeoffs across different management options and satisfy federal requirements. However, such analyses can be hamstrung by the relatively low spatial resolution of the available data as well as the quality and timeliness of the data used. For example, angler valuation data may be several years old, and recreational catch-and-effort estimates for a certain species and region may have low levels of precision. In addition to improving the quality and timeliness of such data, additional challenges for councils that he

noted included better understanding how angler behavior changes due to management actions and quantifying the value of a "quality" fishing opportunity.

KEY DISCUSSION TOPICS FROM SESSION 1

The Importance of Angler Valuation

Attendees discussed the importance of understanding angler valuation versus focusing solely on assessing economic impacts. One attendee described how valuation information is normative, illustrating, for example, what management alternatives might be better (i.e., produce a greater benefit) for society as a whole. Armed with valuation data, economic impact analyses can then be used to understand how (or if) such benefits may be distributed across participants in a given fishery.

Panel Data Use for Economic Analyses

There was also substantial discussion regarding the potential use of panel data—catch-and-effort information collected by the same anglers over time—for economic analyses. Economic add-ons to these programs could help bridge the gap between revealed and stated preference information, and help, for example, with estimates of how an individual's fishing behavior may be affected by regulatory change. This is particularly true for Gulf of Mexico reef fishes, where several states have implemented mandatory reporting requirements, although the nature of such requirements varies by state, and adjustments could be necessary because such programs were not designed with economic data collection in mind.

The National Benefits of Economic Analyses

A recreational stakeholder asked Mr. Hadley about the regional councils' focus on considering "net benefits to the nation" in their economic analyses, whereas in reality such benefits are likely realized at the regional or state level. Mr. Hadley explained that the analysis is framed in a national manner, but since economic information provided to the council is regionally focused, the estimate is typically regionally focused as well. State-level analyses are possible, but since most council-level decision-making is often regional in nature, such analyses are not conducted unless a state-specific management change is under consideration.

Session 2: Perspectives on Recreational Fisheries Economic Data and Analysis

DISCUSSION

During Session 2, several managers and recreational fishery stakeholders were invited to share their perceptions of how recreational economic considerations are currently folded into management and where there is room for improvement.

Two Different Perspectives on Economic Uncertainty

Dr. Doug Lipton shared how he views recreational economics through the two broad phases of his career. First, as an economics professor at the University of Maryland working on Chesapeake Bay restoration issues, most of the focus was on protecting and restoring the Bay's living marine resources. However, his work focused on the value of restoring those resources—for example, the recreational striped bass fishery. On the valuation side, it became clear that a lot of recreational fishing trips were being lost due to stock declines, so the economic benefit of

recovering the stock was substantial. This information was in turn important to justifying Bay habitat restoration efforts. Second, as a member of the Scientific and Statistical Committee for the Mid-Atlantic Fishery Management Council, he worked on analyses for summer flounder reallocation between the recreational and commercial sectors; however, there was too much uncertainty in the estimates, particularly from the recreational sector, to make a decision, highlighting the need for better economic data collection. Lastly, he highlighted how biological uncertainty, such as in stock assessments, is generally accepted and used for management, but economic analyses may be dismissed on the grounds of uncertainty even if the levels of uncertainty are similar.

The Importance of Economic Data to Inform Management and Advocacy

Kellie Ralston, Vice President for Conservation and Public Policy at Bonefish & Tarpon Trust, highlighted the importance of economic data for prioritizing stock assessments and informing allocation discussions, as well as its use by advocates for different fisheries/types. As a result, making that information available to stakeholders is very important. She emphasized the diversity of recreational fisheries with regard to participants and their goals (e.g., those who prioritize harvest versus catch and release), which can make it challenging to assess economic impacts compared to commercial fisheries, where there is a clear connection between harvest and economic output. She recommended that either NOAA Fisheries or regional councils develop guidelines for how economic information should be folded into management decisions (e.g., what information to use and how it should be weighted versus other information), particularly when it comes to allocation discussions. With regard to the data itself, she recommended improving economic data for certain recreational fisheries/species, which would be more helpful for both management and advocacy purposes. Lastly, for fisheries that are mixed-use or catch-and-release, assessing the value of fish left in the water and the ability to access those fisheries is important.

Management Challenges and the Importance of Community Trust Building

Spud Woodward, who serves as Chair of the Atlantic States Marine Fisheries Commission and is a member of the South Atlantic Fishery Management Council, mentioned there was never an economist on staff at the Georgia Department of Natural Resources during his 34-year career there. In general, in Georgia marine fisheries management, economics issues have taken a backseat to studying the animals themselves. Similarly, the Atlantic States Marine Fisheries Commission has no economist on staff, so the burden falls on individual member states and NOAA Fisheries to gather any economic information or conduct analyses to support interstate fishery management. At the regional council level, meanwhile, economic analyses are required, but council members are often confronted with huge amounts of uncertainty regarding both stock status/biological information and economic analyses, and have very little guidance on how to address that uncertainty when it comes to decision-making. As a result, there is often a tendency to try to maintain the status quo when it comes to making management decisions and especially decisions about allocation in mixed-use fisheries. He echoed the sentiment that harvest is often not equivalent to value, and so equating optimum yield with maximum sustainable yield defined as harvest for recreational fisheries can be inappropriate. He also mentioned the inherent challenge in predicting angler behavior in response to management given the adaptive nature of fishermen to target new fisheries and species, especially in the context of climate change. Lastly,

he emphasized the importance of building trust with the fishing community in order to help ensure the validity of economic information on which decision-making may be based.

Resource Allocation Informed by Inadequate Recreational Economic Information

Marc Gorelnik, Director of the California-based Coastside Fishing Club and Chair of the Pacific Fishery Management Council, described that a lot of the constraints on recreational fishing in his region, in his view, resulted from both inadequate recreational economic data and inadequate use of that economic data. He stated that the West Coast's recreational groundfish fisheries are more valuable than commercial fisheries for those species. However, that value is not reflected in the allocation of resources to assess data-poor stocks. For example, many restraints on the recreational groundfish fisheries in his region, such as closed areas, result from inadequate information regarding stock assessments (i.e., no fishery-independent data). The NOAA Fisheries Northwest Fisheries Science Center has no resources to make such improvements because those funds are prioritized for commercially targeted groundfish rather than recreationally important species.

KEY DISCUSSION TOPICS FROM SESSION 2

Economic Uncertainty

Participants discussed the apparent "double standard" with regard to uncertainty with biological information (e.g., stock assessments) versus uncertainty with economic information (e.g., valuation); in some cases, uncertainty with the latter is justified as a reason to disregard that information. As a result, there is a need to better communicate to managers how to work with economic uncertainty when it comes to informing management discussions. One economist noted that, in many valuation studies, the levels of uncertainty are fairly low, especially in comparison to other analyses conducted by the federal government and used to inform policy actions. However, just as certain interests might leverage uncertainty with biological information to further their goals (e.g., allocation), the same could be done with economic uncertainty.

In the case of allocation, one participant noted, the "bar" (i.e., confidence level) for applying economic analyses to inform those decisions has been extremely high. That being said, there have been successes in using economic information to assess how changes in regulations will affect both fishing mortality and angler behavior. The uncertainty in these analyses is still important, but the stakes do not appear to be as high as they are in allocation discussions such that uncertainty becomes a barrier to using these analyses.

Resource Allocation for Economic Analyses

The issue of resource (i.e., funding and staff) allocation by NOAA Fisheries and other management entities to biological versus economic analyses to inform fisheries management was also discussed. For example, for the stock assessment process, resources have been devoted to addressing such uncertainty proactively (e.g., the Southeast Data Assessment and Review [SEDAR] process), but no such resources have been applied to economic analyses. Similarly, resources rarely exist to allow for regular economic analyses or updates for certain fisheries in a manner analogous to the stock assessment process.

Economic Information Supporting Management Decisions

With regard to the idea of establishing a weighting protocol for considering biological versus economic information in decision-making, one participant noted that some guidance is important but that some discretion should continue to rest at the council level given the nuances of specific fisheries. Mr. Woodward shared that the South Atlantic Fishery Management Council has proposed a decision tree[13] to help inform how managers should consider various factors, including economic data and analyses, in allocation decisions.

At the federal level, participants also discussed the lack of clarity as to where in the management process economic information and the uncertainty that comes with it should be considered. For example, does it fall under scientific uncertainty to be considered when setting an Acceptable Biological Catch from an Overfishing Limit, or should it be considered management uncertainty when setting an Annual Catch Limit from an Acceptable Biological Catch? The burden appears to fall on managers to consider that uncertainty when setting a Total Allowable Catch, whereas in reality, it may be a question better suited to economists and social scientists (and should therefore be part of scientific uncertainty).

Several stakeholder participants reiterated the importance of better understanding the value of fish left in the water, especially for species where catch-and-release is an important component of the fishery. As a result, for those species adjusting Optimum Yield downward from Maximum Sustainable Yield is likely important, and understanding how much to do so could be informed by economic information.

Session 3: Understanding Economic Analysis Needs for a Regulatory Review

DISCUSSION

During this session, three fisheries economists at the regional and federal levels described the types of analyses that economists contribute to the regulatory process and how they confront the challenge of working with imperfect information.

Southeast Regional Office – Economic Needs and Opportunities

David Records, an industry economist with NOAA Fisheries' Southeast Regional Office, described how numerous federal laws, including the Magnuson–Stevens Act and National Environmental Policy Act, require NOAA Fisheries to examine the economic effects of regulatory actions. Analyzing the economic effects for anglers focuses on the potential change in consumer surplus—the aggregate benefits anglers derive from taking a fishing trip, catching/harvesting a fish, and other fishing-related factors—that would result from a new regulation. For the for-hire sector, meanwhile, economic effects analysis focuses on producer surplus, as measured by changes in net trip revenue resulting from a given regulatory change. A persistent challenge is finding available data to populate these types of analyses, such as

[13] South Atlantic Fishery Management Council. April 2022. Allocation Decision Trees: A Blueprint for Applying Biological, Social, and Economic Considerations in Allocation Decisions. Available at https://safmc.net/wp-content/uploads/2022/05/SEP_A5a_AllocationDecisionTreeBlueprint_Apr2022.pdf.

identifying angler willingness-to-pay for various trip attributes (valuation) and estimating for-hire revenues/costs, which may be more available/timely for some fisheries than for others. He described several recent/upcoming examples of pertinent research to inform these analyses, including a survey of Gulf of Mexico anglers to understand angler changes in effort in response to changes in trips costs and bag limits for gag grouper, and the development of a bioeconomic model in the Southeast that includes a model of angler behavior, stock assessments, and other relevant information to understand regulatory impacts on fishing effort, harvest, angler welfare, and other key metrics. Some areas where Mr. Records identified a need for improvement included increasing willingness-to-pay estimates across species; better identifying the "universe" of anglers participating in a given fishery and understanding how they may respond to regulatory changes in terms of number of trips taken; improving the timeliness and accuracy of for-hire cost and revenue information; and improving assumptions about the behavior of private angler and for-hire captains.

Gulf of Mexico Fishery Management Council – Economic Needs and Opportunities

Dr. Matt Freeman, an economist with the Gulf of Mexico Fishery Management Council, shared some of the recreational economic needs and opportunities at the Gulf Council. He presented the key challenge of trying to make decisions with imperfect information, which is an issue shared across all fishery management councils. Since council staff are not the ones making management decisions, it is imperative that such uncertainties/limitations are made clear to the public and to council members. Council staff rely on the best scientific information available for its economic analyses; for example, if recreational willingness-to-pay for a given species is not available, available estimates for a similar proxy species may be used instead. Looking ahead, Dr. Freeman identified the need for more timely and comprehensive research that includes improving and updating the available data, which in turn will inform better evaluations of management effects. For example, willingness-to-pay estimates that are a decade old may not be applicable due both to changing angler behavior/preferences and changes in the management landscape. Lastly, Dr. Freeman articulated the need to better educate both the public and council members on how economists contribute to the regulatory process.

Southeast Fisheries Science Center – Needs and Opportunities

Dr. Scott Crosson, an economist with the NOAA Fisheries Southeast Fisheries Science Center, provided his perspective as a member of the South Atlantic Fishery Management Council's Scientific and Statistical Committee (SSC) and the Chair of its Socio-Economic Panel. He noted that most participating economists are far more interested in economic valuation than on economic input/output analyses. As a result, they would like to see more regularly updated per-fish valuations for kept and discarded fish. He also touched on optimum yield, which may not always equal maximum sustainable yield, and the need for better information to estimate the value of recreational opportunity—in other words, the ability to access a fishery (catch-and-release, encounter rates) as opposed to simply harvesting fish. With regard to SSC dynamics, Dr. Crosson noted that biologists typically accepted recreational valuation estimates for certain species but in some cases were hesitant to accept them as the best scientific information available. That being said, he explained that there are continued opportunities to be proactive and elevate economic concerns at the SSC and perhaps the full council. For example, economists could more routinely present the progress and results of their analyses to the SSC. Lastly, he

described the SSC's ongoing challenge of effectively conveying to the council the results of and uncertainty associated with economic analyses.

KEY DISCUSSION TOPICS FROM SESSION 3

Better Understanding the Angler Population

There was some discussion about the need to understand the "universe" of anglers given that the 2006 reauthorization of the Magnuson–Stevens Act required saltwater recreational anglers to register and/or obtain a license. Some participants explained that having a better sense of, for example, who owns boats or targets certain species would help better define subsets of anglers for economists to survey for analytical purposes. In doing so, economists would be able to more efficiently achieve more representative estimates, and fewer anglers would be likely to receive multiple surveys of varying relevance and as a result be prone to survey fatigue, which could lead to lower response rates. In addition, not all states fully participate in the National Saltwater Registry, which in some cases could be a huge number of anglers. One participant believed that requiring additional permits to define these subsets would be met with resistance by members of the recreational community.

The Value of Bioeconomic Models

One attendee asked for clarification about how a bioeconomic model works and its value. Mr. Records explained that its main value is in better characterizing the interactions among fishermen, regulations, and fish. For example, the model allows economists to understand how a change in regulations could impact angler behavior and ultimately fishing mortality. In the Gulf of Mexico, the utility of the new bioeconomic model remains to be seen given how new it is, but a similar model has been implemented for managing groundfish in New England since 2014 (the The Bioeconomic Length-structured Angler Simulation Tool or "BLAST" model). Dr. Jaime Cournane of the New England Fishery Management Council shared that it took time for the council and for stakeholders to become familiar with the model but that they have come to understand and accept the process and its outputs well. She highlighted that consistency in explaining the inputs and results of the model, along with open lines of communication among council Staff, Northeast Fisheries Science Center staff, and the recreational community, has been integral to its success.

Differing Management Needs for Private and For-Hire Anglers

One recreational stakeholder raised the question of separate management approaches for private anglers versus the for-hire sector, which will soon be under consideration at the Mid-Atlantic Fishery Management Council. While charter businesses themselves may be different, he explained, those businesses derive significant benefits from the private anglers who book trips on board those vessels. Dr. Crosson shared that most economists believe private anglers and the for-hire sector should be managed differently because they have such different incentive systems. He emphasized the challenge of defining what sectors of the economy are affected by any business activity when it comes to assessing economic impacts.

Session 4: Bridging the Gap Between Analysis and Decision Making

DISCUSSION

During this session, **Brandon Muffley** from the Mid-Atlantic Fishery Management Council and **Mike Waine** from the American Sportfishing Association shared case studies illustrating how recreational economic information has been applied to the decision-making process.

Management Strategy Evaluation Benefits

Mr. Muffley walked participants through the Management Strategy Evaluation for summer flounder that the Council recently completed after a two-and-a half-year process. The broad intent of the MSE was to evaluate both the biological and economic benefits of minimizing recreational summer flounder discards (both live and dead) and converting them to landings. The MSE process was divided into 1) a public scoping and engagement phase and 2) a management application and model development phase. He highlighted the deep and sustained level of engagement with stakeholders throughout the process. In doing so, he and other members of the project team were able to capture stakeholder input and priorities and become comfortable with the MSE approach. The MSE sought to achieve four objectives, one of which was to maximize the economic stability of the fishery. Broadly speaking, the modeling framework to inform the MSE used a biological model to feed into a recreational demand model, which could simulate anglers' responses to changes in both stock availability and regulations, and in turn estimate recreational harvest and discards. Those recreational removals could then be fed back into the biological model, repeating the cycle. The project team found that most management options simulated with the model outperformed the status quo regulations through reducing recreational discards, increasing harvest opportunities, increasing angler welfare, and increasing economic benefits. Moreover, the benefits of these alternative management approaches generally did not come at the expense of summer flounder stock status. In the end, stakeholders were generally supportive of the effort, and the recreational demand model has been used to set recreational management measures not only for summer flounder but also for other Mid-Atlantic stocks.

Mid-Atlantic Fisheries Specification and Allocation Challenges and Opportunities

Mr. Waine's presentation focused on fishery specification and allocation challenges for the Mid-Atlantic's summer flounder, scup, and black sea bass fisheries. He described how these fisheries' catches have continuously exceeded desired catch limits, resulting in annual changes in regulations to try to better control catch (i.e., "chasing the Recreational Harvest Limit"). The root cause of these overages was a poor understanding of angler behavior, which NOAA Fisheries attempted to better define through choice experiment surveys in 2010 and 2022. These data were then incorporated into the bioeconomic modeling framework that Mr. Muffley described to better predict how fishery specifications will affect harvest/discards and angler welfare. While this approach is new in the Mid-Atlantic, it has been successfully applied for cod and haddock in New England. One challenge of this approach is that angler behavior and preferences are changing in real-time, so evaluating these changes in a timely and regular fashion is critical.

Mr. Waine described a recently completed multi-year harvest reallocation process for these species, which are largely considered harvest-oriented fisheries. The Marine Recreational Information Program's (MRIP) 2018 recalibration of catch estimates indicated that the recreational sector had historically been harvesting far more fish than previously thought, which

led to increases in catch limits overall as stocks were considered larger, but the benefit was only realized by the commercial sector. However, when it came to deciding how to reallocate harvest across sectors, Mr. Waine described, the council elected to make only marginal changes to the allocation, which he felt missed the mark because the change was largely based on how much of an allocation change the council was comfortable with rather than being based on what data showed. As a result, the recreational sector continues to face reductions in harvest, even when some of these fisheries are quite healthy. He closed by asking how economic information can be better integrated to drive decision-making for these recreational fisheries that are of critical importance to the recreational community.

Day 1 Breakout Session: Improving and Applying Economic Data

The workshop's first breakout session focused on the topic of recreational data. Specifically, breakout group participants were asked to consider the following questions to help guide their discussions.

DISCUSSION QUESTIONS

1. Are the current type and amount of recreational fisheries economic data adequate? Are there certain types of data we need to improve?
2. What can be done to improve the use of economic data in management contexts? What is missing, and what can we do collectively?

Workshop attendees were divided into five breakout groups of 9 to 11 attendees each, and every effort was made to ensure that each group included representation from a broad variety of sectors (scientists, managers, and stakeholders) and regions. Two of the breakout groups consisted solely of virtual attendees who met via Google Meet, while the other three groups were all in-person attendees. Each breakout group included a volunteer moderator (predominantly NOAA staff), to help guide the discussion, as well as a note-taker.

KEY DISCUSSION TOPICS FROM BREAKOUT SESSION 1

After 45 minutes of discussion, the breakout groups reconvened into plenary to discuss some of their key takeaways.

Virtual Group 1

Virtual Group 1 moderator **Dr. Tara Scott**, Acting Branch Chief of Sustainable Fisheries for NOAA Fisheries, shared her group's concern that willingness-to-pay studies for a given species/stock are typically out of date and don't occur at regular intervals in the same manner that stock assessments do. In addition, examinations of angler behavior typically focus on fish availability and regulations but ignore the potential impact of weather and other environmental conditions. These shortcomings are partly due to funding limitations for economic data collection and analysis. To overcome such data limitations, her group recommended leveraging existing data sources where possible (e.g., similar surveys conducted elsewhere) to help fill gaps and minimize the risk of survey fatigue among anglers. Lastly, she highlighted that there is often significant distrust from anglers when it comes to the collection of economic data and its

application to management. One possible strategy for addressing this challenge could be in asking angler groups to help facilitate more effective two-way communication on this issue between scientists/managers and recreational stakeholders.

Virtual Group 2

Virtual Group 2 moderator **Dr. Dan Lew**, an economist with NOAA Fisheries' Alaska Fisheries Science Center, highlighted his group's view that there is a general need to better understand who is fishing, what they're fishing for, and what they're catching in order to better evaluate how they could be impacted by changes to the fishery and its management. Leveraging new approaches for engaging with anglers, such as smartphone apps, could be valuable for collecting this information, especially as angler preferences and behavior may shift due to climate change. Similarly to Group 1, increasing trust in economic data and models among managers and stakeholders—particularly when it comes to better communicating its uncertainties—was seen as a pressing need. By the same token, the group felt that decision-makers often don't fully grasp what is meant by "economic value" for the recreational community, providing a key communication opportunity that could help drive more resources toward these issues. Lastly, the group raised the issue of needing to better define how priorities for researching recreational fisheries economics are decided upon—what dictates whether one fishery/issue should be studied versus another?

Group 3

Group 3 moderator **Scott Steinback**, an economist at the NOAA Fisheries Northeast Fisheries Science Center, along with Group 3 note-taker **Dr. Andrew Carr-Harris**, also an economist at the Northeast Fisheries Science Center, shared that their group's discussion focused on improving the process by which economic information is used to inform management, particularly at the regional council level. The group discussed that councils could benefit from a structured process for considering and incorporating recreational economic data, recognizing that specific guidance could vary by region and specific fisheries. In general, they identified a need to be proactive in engaging with councils on recreational economic issues, particularly with regard to communicating data/analytical limitations and potential uncertainties. They highlighted as a positive example the development of the summer flounder Management Strategy Evaluation in the Mid-Atlantic, which required a great deal of effort (and funding) at the beginning but eventually created a framework that could be applied to other species. Lastly, they echoed the sentiment that more timely and fishery-specific recreational data are needed to ensure that analyses and decision-making are based on the best possible information.

Group 4

Group 4 Moderator **Dr. Cliff Hutt**, Atlantic Highly Migratory Species Recreational Coordinator for NOAA Fisheries, shared his group's perspective that there was a need for more willingness-to-pay estimates that better account for spatial and temporal variability when such information is necessary for management. For example, state allocation decisions for recreational red snapper harvest in the Gulf of Mexico could benefit from state-specific rather than regional willingness-to-pay information. They also discussed the need for different tools besides surveys to collect economic data from anglers, given the logistical challenges of administering surveys, an ongoing trend of declining response rates, and reluctance from both anglers and for-hire captains to share cost and expenditure information. Alternative approaches could include "scraping" data off the

web, such as charter fees, or collecting data from angler apps such as Fishbrain. Lastly, to facilitate application of economic tools for more fisheries, the group considered whether it would be possible to develop a range of "off the shelf" recreational demand models that use existing data sources such as catch-and-effort data from MRIP.

Group 5

Group 5 Moderator **Dr. James Hilger**, Southwest Regional Recreational Fishing Coordinator at NOAA Fisheries, explained how his group considered three broad categories of data: 1) baseline angler data including the number of participants and trips; 2) expenditure information; and 3) valuation/consumer surplus estimates. Non-economists tend to focus on the first two categories, whereas economists focus on the last. However, for all three significant data gaps exist. In all cases, there is a need to improve spatial resolution of the data as well as estimates by species and by fishing mode. With regard to economic data specifically, the irregular nature of such data collection is a major shortcoming inhibiting analyses for key council questions such as allocation. The proactive and systematic dedication of resources and staff to data collection and analysis can help ensure that economists are armed with the most timely information possible to inform management decisions that can occur on a relatively compressed timeline. Other topics the group discussed included exploring bioeconomic modeling approaches for other regions/fisheries; better defining optimum yield in the recreational sector as opposed to managing for maximum sustainable yield; and improving education and outreach on economic issues for both recreational stakeholders and council staff.

Follow-Up Discussion

Following report-outs from each breakout group, attendees had the opportunity to reflect on the topics discussed in the breakout session in greater detail.

Participants discussed how past economic analyses and initiatives could be leveraged to inform new management approaches for other fisheries/species, particularly given the challenges of peer review/ensuring that the best scientific information was being used. Specifically, they described the multi-year development of the summer flounder Management Strategy Evaluation, which heavily engaged both recreational stakeholders and managers in the process. Eventually, the modeling framework developed for summer flounder was able to be adapted for other Mid-Atlantic species as part of the Mid-Atlantic Fishery Management Council's Harvest Control Rule Framework. One participant noted that it would be helpful to have a central clearinghouse for these tools but that such a system has not been created.

There was additional discussion concerning the need to examine economic information more regularly and proactively at the council level, and attendees considered what guidance would be helpful for regional councils regarding how to use recreational economic data and analyses in decision-making. One participant noted that council staff and members clearly understand the obligation to prevent overfishing and rebuild stocks but that there do not tend to be defined economic goals or triggers within the recreational fishery. Without such objectives, it is difficult to consider guidance on what economic data is needed and how it should be used, although one participant noted that such goals may vary substantially across recreational fisheries. Such guidance is important in its own right, but the need may be even more pressing given the increased emergence of alternative ocean uses such as offshore wind energy and aquaculture, for

which it will be important to demonstrate the value of recreational fisheries during the siting and development process.

Summary of Day 1

Dr. Lipton closed the day by reflecting on how during the previous workshop in 2014 the BLAST bioeconomic model being used to develop New England groundfish management measures was encountering numerous challenges. Nine years later, however, the model has been accepted for management purposes and is now spreading to new fisheries and regions such as the Mid-Atlantic, Southeast, and Northwest. He expressed his hope that when this group next reconvenes substantial progress will have been made on the challenges raised during the workshop's first day. He thanked participants for their constructive dialogue and a productive first day.

Workshop – Day 2

In welcoming attendees to the workshop's second day, Dr. Lipton reiterated the importance of keeping in mind two parallel goals: First, improving recreational economic data and research irrespective of how that information is used; and second, increasing the uptake of that information by regional fishery management councils for consideration in decision-making.

Session 5: Improving Communication on Economic Issues

DISCUSSION

Day two's first session and the workshop's second breakout session focused on the critical challenges of better engaging the recreational community to share economic information and establishing effective communication channels with fishery economists and managers.

Lessons Learned on Effective Communication and Engagement Strategies

Kevin Blinkoff, Editor-in-Chief at On The Water Media, presented lessons learned on communication and engagement and how those lessons could be applied to the challenges discussed at the workshop. He walked through the diverse communications tools On The Water uses, including a print magazine, TV shows/videos, social media, podcasts, emails, and its website. He described the importance of understanding an audience's needs and wants, and that those are not universal across anglers. As a result, On The Water focuses on identifying commonalities across anglers in its communications and creation of content. At the same time, the more that is known about anglers, the more they can be segmented into certain groups (e.g., region, fishing methods, and target species) for targeted communication. To effectively reach its audience, On The Water also emphasizes meeting anglers where they are in terms of their fishing experience level, where they access information, and the content they are seeking. Lastly, authenticity in communication—for example, revealing the authors of articles and interacting with anglers—is critical for building trust. Mr. Blinkoff explained that these strategies have been effective in communicating fisheries science topics to On The Water's audiences as well as

purely fishing-related content. Anglers, he explained, can be interested in science topics, including social science/economic issues, if they understand how it relates to them or their fishing. He highlighted the challenges of declining trust in science and the federal government but explained that potential solutions include partnering with well-known communicators in order to transfer trust/authenticity and reach a broader audience. For example, NOAA Fisheries staff have approached On The Water for outreach regarding safe boating around whales.

KEY DISCUSSION TOPICS FROM SESSION 5

Angler Survey Response Rates

One participant asked for insight on how to increase angler response rates for surveys. Mr. Blinkoff explained that providing education before the survey is distributed can be effective and is something that On The Water has done successfully in the past. In addition, segmenting the audience to target certain anglers for whom the survey is most relevant is important.

Partnering with Industry Influencers

A recreational stakeholder asked about partnerships with "influencers" such as charter captains to improve communication with the recreational community. Mr. Blinkoff explained that having a message come from a respected member of the recreational community will carry more weight than the same message delivered by, for example, a NOAA Fisheries social media account. Asking anglers what individuals or brands are influential in the industry is an effective way to identify these thought leaders, many of whom are happy to share information with their networks to improve scientific knowledge.

Trust Building with the Recreational Community

The group discussed the challenge of building long-term trust with the recreational community versus one-off examples such as increasing the response rate for a single survey. Mr. Blinkoff explained that building trust can take a long time and that it can be destroyed very quickly. He stated that an effective way to help build it is to show results with anglers. There has to be follow-up and examples of how the information was used in order to keep the community engaged and show that scientists and managers are listening. A stakeholder participant highlighted the frustration that while groups like On The Water might be working to build trust in science and the federal government, other groups are doing the exact opposite and sowing distrust.

Day 2 Breakout Session: Improving Communication on Economic Issues

The workshop's second breakout session also focused on the challenge of effectively communicating with the recreational community on economic issues. The format was the same as the previous day's breakout session, although breakout group assignments were altered to facilitate idea exchange among participants.

Breakout groups were asked to consider the following questions.

DISCUSSION QUESTIONS

1. What information does industry and/or anglers want from NOAA Fisheries/Councils?
2. What information does industry and/or anglers feel is important to share with fishery managers?
3. Who/what are the most effective sources for sharing economic information?
4. What are the most effective mechanisms and methods for sharing?

KEY DISCUSSION TOPICS FROM BREAKOUT SESSION 2

Virtual Group 1

Virtual Group 1 moderator **Dr. Tara Scott** emphasized the importance her group placed on the need to help anglers understand how sharing information could be beneficial to them in the long term. One potential mechanism for this could be providing MRIP dockside intercept samplers with talking points to better communicate to anglers the purpose of the data they are collecting. NOAA Fisheries has used this approach for expenditure survey add-ons in the past, including providing interviewers with a one-page "Frequently Asked Questions" list and brochures to share with anglers. Regarding economic information specifically, there is a need to simplify communications strategies (e.g., eliminating jargon) to make such information readily digestible to both anglers and managers. Lastly, her group discussed the idea of developing an education program similar to the Marine Resources Education Program but tailored specifically to economic issues.

Virtual Group 2

Virtual Group 2 moderator, **Dr. Chris Dumas**, Professor of Economics and Environmental Sciences at the University of North Carolina Wilmington, described his group's view that working through existing respected communication channels such as social media influencers, trade/industry associations, and other recreational thought leaders is critical for effectively communicating economic issues and increasing survey response rates. By the same token, anglers often have more trust in their own state agencies than in the federal government, so funneling communication through state channels may be a good strategy. There is a need to frame communication positively whenever possible—for example, illustrating increased fishing opportunities that could result from an angler's participation in a survey. Toward that end, timely communication of any results and success stories from a research and management perspective is critical.

Group 3

Group 3 Moderator **Brandon Muffley** shared his group's view that management entities need to more clearly and coherently explain the reasons why certain management decisions were made and what information was used to inform those decisions (as well as the information that was considered but not used). Equally critical is effectively disseminating such messaging to the recreational community through both the regional councils themselves (e.g., website and social media) and recreational community "influencers." When possible, enabling two-way communication and relationship-building between anglers and regional council members/staff is valuable but often resource-limited. There is often a disconnect between what anglers are seeing

on the water and the decisions that are made, and building these communication channels is a fundamental need for building and maintaining trust. All of this is particularly important given that engagement in the management process generally declined during the COVID-19 pandemic.

Group 4

Group 4 moderator **Dr. Cliff Hutt** explained that his group focused on the challenge of getting economic issues and information in front of regional councils more frequently for use in decision-making. By the same token, there is a need to better communicate to recreational stakeholders how such information can connect to management outcomes in a tangible way (e.g., bag/size limits and season/lengths). Council outreach staff and other entities such as Sea Grant programs could be effective avenues for facilitating two-way communication between the recreational community and the councils, providing, for example, a means for stakeholders to articulate their priorities to the councils.

Group 5

Group 5 moderator **Dr. James Hilger** described his group's view that many anglers are interested in economic data issues from an allocation perspective but that there is a tendency to confuse economic impact estimates with valuation estimates. Generally, industry is more interested in the former and tends to neglect the latter, providing a potential educational opportunity. A key theme through the group's discussion was the need for transparency during the collection, analysis, and application of economic data, as was done for the BLAST bioeconomic model for New England cod and haddock. Disseminating such information from government/managers to industry leaders and then to influencers/clubs will help ensure its reach and reputability, as well as its accessibility to the target audience. Lastly, the group discussed the need for regular periodic releases of economic data to increase recreational familiarity and application—for example, demand models could be generated using MRIP data and then regularly updated as new data comes online. Lastly, for existing sources such as the Fisheries Economics of the United States reports, improving the awareness and accessibility of an existing online query tool[14] could be helpful for increasing recreational access to and use of the data (NOAA Fisheries is currently in the process of incorporating these data into the "Fisheries One Stop Shop" database).

Follow-Up Discussion

Following the report-outs from each breakout group, there was a discussion focused on communicating research results to recreational stakeholders who had participated in economic surveys. Some of the approaches that workshop participants have employed include sending a one-page summary of survey results both to anglers who did and didn't complete the survey; presenting results to industry groups/associations; and—if permitted to do so given confidentiality protection measures—sending participants a copy of their responses along with the aggregated response of others to see how they compare.

[14] NOAA Fisheries. Fisheries Economics of the United States: Data and Visualizations. Available at https://www.fisheries.noaa.gov/data-tools/fisheries-economics-united-states-data-and-visualizations (accessed 18 August 2023).

Participants also briefly discussed low-odds, high-value lotteries as a potential incentive to increase survey response rates among recreational anglers. While such a strategy cannot be implemented by the federal government, there is potential for some states as well as industry partners to employ such an approach.

Session 6: Electronic Data Collection in Economic Studies

DISCUSSION

During this session, presenters shared perspectives on the application of electronic technologies for collecting economic data for recreational fisheries.

Real-Time Angler Data Collection Through Smartphone Applications

Dr. Rich Woodward of Texas A&M University discussed the collection of real-time angler behavior and choice data that can be gathered using a smartphone, which could be either actively entered by an angler (e.g., for reporting catch) or passively collected (e.g., through location sharing). Most regulations, he explained, can affect angler harvest/discard patterns and species targeting decisions, sometimes at fine spatial or temporal scales. For answering valuation questions regarding management changes, fish habitat, or other factors, revealed choice data collected via smartphones, such as travel distance by boat, can be used for travel-cost modeling. A major challenge is convincing anglers to regularly use an app, but effectively communicating the goal and/or leveraging apps on which anglers already share data are potential approaches to increase uptake.

Dr. Albrey Arrington of Fish Rules/Fishbrain and **Mr. Scott Steinback** of the NOAA Fisheries Northeast Fisheries Science Center described their efforts to passively collect data from recreational anglers in the Northeast through the Fish Rules/Fishbrain smartphone apps. Mr. Steinback illustrated how georeferenced search data from Fish Rules, which provides fishery regulation information based on the user's GPS location, can help scientists and managers better understand the spatial distribution of species-specific fishing effort by private anglers. This low-cost, high-resolution information can in turn be used to determine the impact of regulations on angler behavior and inform discussions around marine spatial planning, especially as new ocean uses such as offshore wind energy evolve. Eventually, they plan to use the data for potential development of angler offshore site choice behavioral models, which could help assess the value of certain areas to recreational anglers. Dr. Arrington then described how this approach could be extended to data from Fishbrain, where angler logs of catches and location are passively collected. He demonstrated the huge spatially explicit catch database that Fishbrain houses for species of interest to managers, including black sea bass, striped bass, and goliath grouper.

KEY DISCUSSION TOPICS FROM SESSION 6

The Benefits of and Advocacy for Innovative Data Collection Approaches

Participants were impressed with both the volume and the spatiotemporal resolution of catch-and-effort data that can be developed using smartphone apps as data sources. Many were excited at the potential application of such data for both economic and broader purposes. For example, Fishbrain-logged catch information for goliath grouper could be valuable for stock assessment purposes given that the species is rarely encountered in MRIP intercept surveys. A challenge

moving forward, however, is improving buy-in on these data sources from the fisheries science community, which can at times be hesitant to integrate new fishery-dependent information into their methodologies. To that point, participants discussed the need for strong advocates for these innovative data collection approaches. At the same time, NOAA Fisheries and other management entities should engage with app developers to communicate what data needs exist and in what format to facilitate uptake. In closing, Mr. Steinback reiterated that these non-invasive data collection approaches generally do not require Paperwork Reduction Act approval, reducing the significant time lags (often years) associated with the planning and execution of economic surveys.

Session 7: Emerging Tools and Methods

In the workshop's final session, participants learned about novel analytical and management approaches that economists are considering to facilitate the incorporation of recreational economic data into decision-making.

Improvements, Challenges, and Limitations to Modeling Recreational Fisheries

Dr. Jorge Holzer, Associate Professor at the University of Maryland, presented an overview of improvements, challenges, and limitations when it comes to modeling recreational fishing. He highlighted that understanding angler behavior is key for forecasting how regulations will impact angler effort, catch, and satisfaction, and for informing the design of effective and efficient regulatory strategies. Numerous factors can contribute to angler satisfaction (e.g., regulations, weather, species, cost, etc.), making it challenging to understand an angler's choice process that ultimately dictates whether or not to take a given fishing trip. For example, anglers may be considering a weighted average of sorts for all trip factors or could evaluate which alternative would be the best for a given attribute (for example, always selecting a trip that enables them to harvest the most of a certain species). If this information can be effectively modeled to understand angler behavior, then results can be incorporated into bioeconomic modeling and shared with managers to be considered in decision-making. However, understanding these kinds of preferences requires engagement with the recreational community, and it is important to recognize that such preferences are likely to change over time due to climate change and other factors. Tools from other fields, such as copula theory from finance, may ultimately be valuable approaches for tackling such questions.

Exploring New Approaches for Recreational Harvest Allocation

Dr. Zander Gordan, a contractor at the NOAA Fisheries Southeast Fisheries Science Center, discussed efforts to explore new approaches for allocating harvest to the recreational sector. Recreational fisheries are typically managed with one set of regulations across all anglers in a given jurisdiction, but the recreational community is diverse, and certain anglers or groups may have different preferences than others. Dr. Gordan described efforts to pilot alternative management approaches, such as harvest tags, day passes, and mandatory retention, that are tailored to different segments of the angling community to increase angler satisfaction and achieve other management goals (such as reduced discards). Each of these would require an angling self-reporting component (e.g., via smartphone or website) along with validation of that self-reported data. He shared that NOAA Fisheries will be pursuing the use of new, alternative management strategies through a grant-funded program in late 2023 to address discards in the region's snapper–grouper fishery. Lastly, he described efforts to address equity concerns in the

recreational sector; for example, ensuring that the ability to purchase harvest tags for a given species in an auction format is not restricted to higher-income anglers.

KEY DISCUSSION TOPICS FROM SESSION 7

Consideration of Diverse Angler Preferences

One participant asked Dr. Holzer how it is possible to account for diverse angler preferences in a single model. Dr. Holzer explained that generally the approach is to consider the relative contributions of these different groups to the angling population but emphasized that understanding the decision rules affecting how anglers make complex choices remains a persistent challenge. Determining how such choices are made is critical not only for forecasting the impact of regulations but also for maximizing angler welfare. A recreational stakeholder noted that one angler's decision-making may be based on information received from another angler and that social media plays a major role as a vehicle for such information exchange.

Closing Remarks

Dr. Lipton emphasized the importance of making progress as a community on the issues raised during the workshop in order to implement longer-lasting solutions. He described how changes to ocean conditions through impacts such as climate change and offshore wind development will have huge implications for the economics of recreational fisheries. Such issues make the challenge of improving the collection and application of recreational economic data all the more urgent. This workshop is one step in a longer-term initiative to accomplish those goals. Several attendees added that bringing the workshop's findings in front of regional councils will be important for maintaining momentum.

Key Workshop Themes

Over the course of the workshop, participants identified several major themes concerning opportunities and challenges for the improved integration of recreational fishery economic data into the decision-making process.

Economic Uncertainty as a Substantial Issue

How **uncertainty in economic data and analyses** is considered at the regional council level remains a substantial obstacle to their application to management. While uncertainty is an accepted component of the stock assessment process, uncertainty in an economic context is met with greater distrust by stakeholders and managers alike and can be a barrier to its consideration. More broadly, this lower prioritization of economic concerns can result in the allocation of fewer resources (funding and personnel) for such research, in turn leading to even fewer opportunities for management applications.

Inconsistent Economic Data and Analyses

Economic analyses are often one-off in nature and are not regularly updated in a manner similar to that of other inputs to management, such as fishery-dependent and -independent data used in stock assessments. NOAA Fisheries has made efforts to regularly collect angler expenditure information and for-hire cost-earnings data since the late 2000s, but no such programs exist for valuation studies. Federal studies are subject to significant time lags due to the need for survey data collection protocols to be approved by the Office of Management of Budget in accordance with the Paperwork Reduction Act. Resource and personnel limitations, meanwhile, limit the scope of work that can be conducted at a given time. As a result, economic valuation data for a given species, stock, or complex is often out-of-date, which is particularly problematic given the tendency of angler behavior and preferences to change over time. In addition, the inconsistent nature of many economic initiatives can make it difficult for economists to be aware of the different research efforts that have been conducted, hindering effective information exchange, collaboration, and collective advancement.

Inconsistent Use of Economic Information in Management Decisions

Management entities are inconsistent in their application of economic analyses to decision-making. While some regional councils may regularly consider economic data, others may do so inconsistently, including weighing economics differently in decision-making. Such an ad hoc approach can in turn serve as an additional barrier to new economic research initiatives if it is unclear if or how results and recommendations will be accepted or considered by managers. In addition, it can reduce recreational stakeholder participation in data collection efforts such as surveys if there is no clear connection between the information they provide and management outcomes.

Collaboration and Engagement with Partners and Stakeholders

In the cases where recreational economic analyses have been a substantive and consistent input to decision-making, economists have developed strong relationships with regional council staff and **engaged early and often with recreational stakeholders**. Such engagement is characterized not only by one-way communication from researchers to anglers but also from a collaborative and iterative process in which researchers meaningfully incorporate concerns and feedback from the recreational community. Examples of successes with this approach include the generation of the BLAST bioeconomic models for cod and haddock in New England and summer flounder, black sea bass, and scup in the Mid-Atlantic. A BLAST model for the Southeast is also nearing completion and holds similar promise.

Diverse Recreational Angler Preferences and Values

Workshop participants repeatedly highlighted **the broad diversity of recreational angler preferences and values**, even within a given region for a certain species or stock. Complicating matters further is the fact that any one individual angler's preference and values are not static but can evolve over time, particularly as ocean conditions change due to warming waters, offshore wind development, and other impacts. There are potential opportunities to tailor management approaches to account for these different angler typologies.

Major Findings, Needs, and Potential Areas for Collaboration

Participants broadly agreed on the need for more **timely and proactive collection of recreational economic data**. The pace of management actions is often faster than the pace of economic data collection and analyses, impeding their ability to impact decision-making. More regular data collection could in turn lead to consistent updates of economic information—particularly valuation information—for a given fishery. Recognizing the timing and resource constraints for NOAA Fisheries' recreational fisheries economic work, **identifying a system to prioritize which species/fisheries to evaluate** would be beneficial. Such an approach could be modeled after similar efforts for stock assessments, such as the Southeast Data, Assessment, and Review (SEDAR) process.

There is a **need for systematic guidelines, either from NOAA Fisheries or at a regional council level, regarding how to incorporate recreational economic information into management decisions** for relevant fisheries. Such guidelines should include the types of information to consider along with how to address the issue of uncertainty in economic findings. The development of such guidelines should be conducted in conjunction with both fishery economists and recreational stakeholders.

Additional resources should be dedicated to estimating optimum yield in recreational fisheries, especially for species with a significant catch-and-release component. Optimum yield is typically considered equivalent to maximum sustainable yield, but if anglers derive significant non-consumptive benefits from the opportunity to target, catch, and release a species, optimum yield may in fact be substantially lower.

Currently, recreational economic impact and valuation information for various fisheries is decentralized and can be difficult to locate for managers and members of the recreational community. **Development of a central clearinghouse/knowledgebase of past and ongoing recreational economic analyses and how they have been considered in management** would be helpful. For example, for data-poor species and fisheries, managers could locate valuation studies for similar species to serve as proxies.

There is often distrust and skepticism from anglers when it comes to sharing economic data. To overcome this challenge, **economists should seek out partnerships with recreational community leaders** such as industry associations, major brands, and social media personalities to more effectively communicate the need for such data and how it will ultimately be used. To ensure sustained engagement with anglers for future initiatives, every effort should be made to facilitate two-way communication and sharing of results and outcomes.

Electronic technologies such as smartphone apps can be cost-effective tools for both active and passive high-spatiotemporal-resolution collection of data on angler behavior, which in turn can be used for valuation analyses. The private sector can be a valuable partner to both NOAA Fisheries and regional councils in implementing such methods.

SUMMARY OF KEY NEEDS

1. More timely and proactive collection of recreational economic data.
2. Identification of a system to prioritize which species/fisheries to evaluate.
3. Need for systematic guidelines regarding how to incorporate recreational economic information into management decisions.
4. Additional resources dedicated to estimating optimum yield in recreational fisheries.
5. Development of a central clearinghouse/knowledgebase of past and ongoing recreational economic analyses.
6. Partnerships with recreational community leaders.
7. Use of electronic technologies, such as smartphone apps, for data collection.

Appendix A: Workshop Agenda

NMFS Recreational Economic Constituent Workshop
April 25-26, 2023
Location: Gulf of Mexico Fishery Management Council, 2nd Floor
4107 W. Spruce Street, Suite 200
Tampa, FL 33607

GoToWebinar Link: https://attendee.gotowebinar.com/register/7555175833425606747

Workshop Purpose

Identify how the community can collectively engage to improve economic data collection, analysis, reliability of estimates, and application to decisions.

Workshop Goals

- *Increase understanding of how economics plays a role in recreational fisheries management decisions, including what primary roles various contributors play, when in the decision-making process they participate, what from their vantage point is essential to consider/have when making management decisions, and what gaps currently exist.*
- *Understand constituents' perceptions of data, research gaps and/or deficiencies.*
- *Identify how participant groups can contribute to improving recreational fisheries economic data collection and analysis.*
- *Identify several tangible ways groups can collaborate to communicate about recreational fisheries economic data and analysis, and ways to support future information sharing and collaboration.*

DAY 1: Tuesday, April 25

1. **8:30 am:** Welcome & Workshop Goals (*Carrie Simmons, Gulf of Mexico Fishery Management Council and Doug Lipton, NMFS*)
2. **8:40 am:** The Role of Economics in Fisheries Management Decisions
   Setting the stage: How, or how could, economic analyses help inform management approaches for the recreational community?
   a. 8:40 am: Overview of Economic Analysis Methods (*John Whitehead, Appalachian State University*)
   b. 8:50 am: Conducting Economic Analysis at the Councils (*John Hadley, South Atlantic Fishery Management Council*)
   c. 9:00 am: Full group Q&A with speakers
3. **9:20 am:** Perspectives on Recreational Fishery Economic Data and Analysis

Manager and stakeholder perceptions of how recreational economic considerations are currently folded into management, and where there is room for improvement.

a. 9:20 am: Doug Lipton, NMFS
b. 9:30 am: Kellie Ralston, Bonefish & Tarpon Trust
c. 9:40 am: Spud Woodward, South Atlantic Fishery Management Council, Atlantic States Marine Fisheries Commission, and Georgia Department of Natural Resources (retired)
d. 9:50 am: Marc Gorelnik, Coastside Fishing Club/Pacific Fishery Management Council
e. 10:00 am: Full group Q&A with speakers

------10:30 am: Break (15 min)------

4. **10:45 am:** Understanding What Economic Analysis is Needed for A Regulatory Review
What analyses do economists conduct that contribute to the regulatory process? How do we make decisions with imperfect information?

a. 10:45 am: Economic Analysis at NMFS (*David Records, NMFS Southeast Regional Office*)
b. 10:55 am: Regional Needs and Opportunities at the Gulf of Mexico Fishery Management Council (*Matt Freeman, Gulf of Mexico Fishery Management Council*)
c. 11:05 am: A Council SSC Member's Perspective on Potential Improvements (*Scott Crosson, NMFS Southeast Fisheries Science Center*)
d. 11:15 am: Full group Q&A with speakers

------11:45 am -1:00 pm: Lunch (*On your own; here are some nearby options*) ------

5. **1:00 pm:** Bridging the Gap between Analysis and Decision-Making
Case studies in how recreational economic information has been brought to bear in the decision-making process.

a. 1:00 pm: An East Coast Perspective: Summer Flounder in the Mid-Atlantic (*Brandon Muffley, Mid-Atlantic Fishery Management Council*)
b. 1:10 pm An Industry Perspective on Improving Economic Data on Specific Fisheries (*Mike Waine, American Sportfishing Association*)
c. 1:20 pm: Full Group Q&A with Speakers
d. 1:30 pm: Day 1 Breakout Group Discussion (see handout for your group assignment)

Questions to keep in mind and help guide discussion:

i. Are the current type and amount of recreational fisheries economic data adequate? Are there certain types of data we need to improve?
ii. What can be done to improve the use of economic data in management contexts? What is missing, and what can we do collectively?

------**2: 15 pm: Break (15 min)**------

6. **2:30 pm:** Breakout Groups Report-Out & Facilitated Large Group Discussion

7. **3:00 pm:** Summary of Day 1 and Discussion (Doug Lipton and Facilitator)

8. **3:15 pm (*optional for workshop attendees)***: Southeast Recreational Fisheries Management Roundtable

9. **4:30 pm:** Adjourn

------**5:00 pm: Optional no-host social at Cigar City Brewery and Taproom, 3924 W Spruce St., Tampa, FL 33607 (five-minute walk from workshop location)** ------

DAY 2: Wednesday, April 26

1. **8:30 am:** Recap of Day 1 (Doug Lipton and Facilitator)

2. **8:45 am:** Improving Communication on Economic Issues
How can we better engage the recreational community when it comes to sharing economic information and identifying long-term two-way communication solutions?

a. **8:45 am**: Improving Communication with Constituents (*Kevin Blinkoff, On The Water Media*)
b. **8:55 am:** Full Group Q&A with Speaker
c. **9:00 am:** Day 2 Breakout Group Discussion (see handout for your group assignment)

Questions to keep in mind and help guide discussion:
i. What information does industry and/or anglers want from NMFS/Councils?
ii. What information does industry and/or anglers feel is important to share with fishery managers?
iii. Who/what are the most effective sources for sharing economic information?
iv. What are the most effective mechanisms and methods for sharing?

d. **9:45 am:** Breakout Groups Report-Out & Facilitated Large Group Discussion

------**10:15 am: Break (15 min)**------

3. **10:30 am:** Electronic Data Collection in Economic Studies
Electronic data collection is becoming increasingly common in fisheries management. How can we leverage technology to improve economic information for recreational fisheries?

    a. **10:30 am:** Is Electronic Data Applicable for Economic Research? (*Rich Woodward, Texas A&M University*)
    b. **10:40 am:** Use of Social Media Data on Recreational Fishing (*Scott Steinback, NMFS Northeast Fisheries Science Center, and Albrey Arrington, Fish Rules/Fishbrain*)
    c. **10:50 am:** Group Discussion
        i. What are some examples of electronic data methods being used?
        ii. What is the level of use by anglers, and what has the feedback from them been like? Have certain approaches been particularly successful?
        iii. How can these methods be improved or expanded? What can we do collectively to assist?

4. **11:20 am:** Emerging Tools and Methods
The next frontier: What approaches are economists considering and developing to facilitate the incorporation of recreational fisheries economic data into management?

    a. **11:20 am:** Improvements, Challenges, and Limitations (*Jorge Holzer, University of Maryland*)
    b. **11:30 am:** Using Field Experiments to Assess Alternative Mechanisms for Distributing Fish to the Recreational Sector (*Zander Gordan, NMFS Southeast Fisheries Science Center*)
    c. **11:40 am:** Group Discussion
        i. What questions/decisions should models be addressing?
        ii. Are there recommendations for expanding models to additional species or in different regions?
        iii. What examples from academics and/or industry would be helpful to examine?
        iv. How can constituents help with the development and use of these models, or communicate their results?

5. **12:00 pm:** Review Workshop Goals & Thank You (Doug Lipton and Facilitator)

------**12:15 pm: Adjourn**------

Appendix B: Workshop Participants

Name	Affiliation	In Person/Virtual
Albrey Arrington	Fish Rules/Fishbrain	In Person
Andrew Ropicki	University of Florida/Florida Sea Grant	Virtual
Andrew Scheld	Virginia Institute of Marine Science	Virtual
Andrew-Carr Harris	NOAA Fisheries	In Person
Andy Mezirow	Gray Light Fisheries, LLC, Seward, AK	Virtual
Andy Strelcheck	NOAA Fisheries	In Person
Assane Diagne	Gulf of Mexico Fishery Management Council	In Person
Ben Fissel	NOAA Fisheries	Virtual
Ben Scuderi	Southwick Associates	In Person
Bernie Roy	Gulf of Mexico Fishery Management Council	In Person
Brad Gentner	Coastal Conservation Association	In Person
Brandon Muffley	Mid-Atlantic Fishery Management Council	In Person
Brian Bennett	American Fly Fishing Trade Association	Virtual
Carrie Simmons	Gulf of Mexico Fishery Management Council	In Person
Chris Dumas	University of North Carolina, Wilmington	Virtual
Chris Horton	Congressional Sportsmen's Foundation	Virtual
Christopher Liese	NOAA Fisheries	Virtual
Cliff Hutt	NOAA Fisheries	In Person
Dan Lew	NOAA Fisheries	Virtual
Dave Monti	No Fluke Fishing Charters, Warwick, RI	Virtual
David Carter	NOAA Fisheries	In Person
David Records	NOAA Fisheries	In Person
Doug Lipton*	NOAA Fisheries	In Person
Eric Thunberg	NOAA Fisheries	Virtual
Jamie Cournane	New England Fishery Management Council	In Person
James Hilger	NOAA Fisheries	In Person
Jason Walsh	North Carolina Division of Marine Fisheries	Virtual
John Froeschke	Gulf of Mexico Fishery Management Council	In Person
John Depersenaire	Viking Yachts	Virtual
John Hadley*	South Atlantic Fishery Management Council	In Person
John Whitehead*	Appalachian State University	In Person
Jorge Holzer	University of Maryland	In Person
Justin Hospital	NOAA Fisheries	Virtual
Kellie Ralston	Bonefish & Tarpon Trust	Virtual
Kevin Blinkoff	On The Water Media	Virtual
Leif Anderson	NOAA Fisheries	Virtual
Lucas Bissett	American Fly Fishing Trade Association	Virtual
Marc Gorelnik	Coastside Fishing Club, San Mateo, CA	In Person
Martha Guyas	American Sportfishing Association	Virtual
Matt Freeman	Gulf of Mexico Fishery Management Council	In Person
Mike Travis	NOAA Fisheries	In Person
Mike Waine	American Sportfishing Association	In Person

Name	Affiliation	In Person/Virtual
Paul Hindsley	Everglades Foundation	Virtual
Rich Woodward	Texas A&M University	In Person
Richard Cody	NOAA Fisheries	In Person
Rob Southwick*	Southwick Associates	In Person
Russ Dunn*	NOAA Fisheries	In Person
Sabrina Lovell*	NOAA Fisheries	In Person
Sarah Marrinan	North Pacific Fishery Management Council	In Person
Scott Crosson	NOAA Fisheries	In Person
Scott Steinback	NOAA Fisheries	In Person
Spud Woodward	South Atlantic Fishery Management Council	In Person
Tara Scott	NOAA Fisheries	Virtual
Wayne Kotow	Coastal Conservation Association California	Virtual
Willy Goldsmith	Pelagic Strategies	In Person
Zander Gordan	NOAA Fisheries	In Person

*Steering Committee Member

U.S. Secretary of Commerce
Gina M. Raimondo

NOAA Administrator
Dr. Richard W. Spinrad

Assistant Administrator for Fisheries
Janet Coit

www.fisheries.noaa.gov

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Economics and Social Analysis Division
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