

Report of the South Atlantic dolphins management strategy evaluation stakeholder workshops

Cassidy Peterson, Mandy Karnauskas, Matthew McPherson, John Hadley, Suzana Blake, Julia Byrd



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Executive summary

The Southeast Fisheries Science Center, with collaboration from the South Atlantic Fishery Management Council, conducted a series of stakeholder workshops to inform a management strategy evaluation (MSE) for dolphin (*Coryphaena hippurus*, also known as dolphinfish or mahi) along the Atlantic coast of the US. Management strategy evaluation is a framework in which candidate management approaches are developed and stress-tested through closed-loop simulation.

In 2022 and 2023, nine in-person workshops were conducted in Florida, South Carolina, North Carolina, Virginia, New York, and Rhode Island and one virtual workshop was hosted for those who could not attend in person. The purpose of the workshop series was to: (1) introduce stakeholders to the management procedure approach and MSEs, (2) develop conceptual management objectives by exploring how stakeholders value the dolphinfish fishery, (3) identify relevant uncertainties to which the management procedure should be robust, (4) receive input on the type of management procedures to be explored, and (5) identify key participants for continued involvement in the MSE process.

Participation varied by region, ranging from 1 to 80+ participants. Stakeholders emphasized clear regional differences in stakeholder reliance of dolphin, stock and fishery dynamics, and attitudes towards conservation and management. Four regions along the US Atlantic coast where the dolphin fishery and stock dynamics were most similar were identified (Figure 1).

Conceptual management objectives were highly variable across regions. However, we were able to extract a few common fishery objectives, which included: (1) ensuring open-access opportunity and access to the fishery, (2) preventing fishery closures, (3) catching dolphin of large size, and (4) maintaining stability in fishery regulations. Preferences on management regulations (e.g., vessel limits, bag limits, and size limits) strongly varied by region.

Stakeholder input from these workshops will be used to inform the development of the MSE framework, the design of candidate management procedures, and the creation of performance metrics that reflect stakeholder-defined management goals.

Background

Dolphin-focused stakeholder participatory conceptual modeling efforts were conducted in 2020 and 2021 in the South Atlantic by the Southeast Fisheries Science Center (SEFSC) and the South Atlantic Fishery Management Council (SAFMC; McPherson et al. 2022). These workshops were designed to gather information related to SAFMC development of Amendment 10 to the Fishery Management Plan for the Dolphin and Wahoo Fishery of the Atlantic. From these workshops, factors that impact local availability of dolphin in different regions were identified, noting that many of these drivers of local abundance were out of domestic management control. Clear regional differences in use, reliance, and value of dolphin fisheries were also captured, and the perceived increase in utilization of the dolphin resource was highlighted (McPherson et al. 2022). These regional differences, coupled with increased exploitation of the resource has led to increased user conflicts. As such, it appears that there may be the potential to improve upon status quo management for this species.

Dolphin are an iconic species of significant demand in the southeast US, both commercially and recreationally. Dolphin are also a short-lived and highly productive stock, whose productivity is thought to be largely environmentally driven. This life history strategy results in sporadic abundance and availability from year-to-year.

As a highly migratory species, dolphin are subjected to international exploitation beyond US jurisdiction. Not only does this limit the capacity for the US to manage the entire stock, it also limits the available data that we are able to collect on the stock, since not all countries collect and report data on dolphin. Due to uncertainty related to whether a unit stock can be assumed and also because dolphin are so fast growing and potentially environmentally driven in their abundance and distribution, conventional stock assessments may not be the most effective tools to derive management advice.

Currently, dolphin are managed by the SAFMC throughout the US Atlantic coast from Maine through the Florida Keys by the Dolphin Wahoo Fishery Management Plan (<https://safmc.net/fishery-management-plans/dolphin-wahoo/>). The annual catch limit for dolphin is static (i.e., unchanging from year to year), and is defined based on the third highest catches observed between 1994 and 2007 for dolphin along the Atlantic coast. Considering the highly variable nature of the stock, this static limit may not allow the fishery to take full advantage of the stock in years when availability is high, but it also may not support opportunity access across regions and sectors in years when availability of the stock is low. Consequently, we propose considering the development of a more adaptive strategy that seeks to (1) predict the amount of dolphin that will be available each year, and (2) maximize the usage of those fish across sectors and regions.

Our goal is to design a new management approach that reduces conflicts, maximizes achievement of stakeholder-defined management objectives, and is appropriate for the life history strategy of dolphin.

Management strategy evaluation (MSE) is a way to stress-test a management approach before implementing it in the real world, similar to the way a vehicle is stress-tested by the manufacturer prior to dissemination to ensure that the vehicle is safe and effective across a variety of uncertain road and weather conditions. We conduct the MSE by simulation, where an adaptive management approach, termed a management procedure, is simulated under a variety of future scenarios. These future scenarios are specifically designed to encapsulate any uncertainties that we have or will have regarding the environment or dynamics of the dolphin stock and fishery. For example, will the management procedure protect the stock and fishery if the stock experiences a shift to a lower productivity regime? Will the management procedure still optimize allowable catch if the stock experiences changes in the timing of migration patterns?

The **management procedure** is a quantitative recipe for managing a fishery and defines:

- (1) What data are collected,
- (2) How those data are analyzed to inform us about the status or dynamics of the stock,
- (3) How management advice should be adjusted given the state of the stock, and
- (4) How that management advice is implemented for the stock and fishery.

The value of a management procedure is that it adaptively adjusts management advice based on the measured behavior of the stock, such that in years where stock availability is high, the fishery can adapt and equitably take advantage of the high abundance, and vice versa. We are proposing to develop an empirical, or indicator-based management procedure, where an indicator of annual availability is used to adjust management advice.

To determine whether a candidate management procedure performs well or performs poorly, we must first define the objectives for managing the dolphin fishery. The **management objectives** are defined by stakeholders, and reflect what the stakeholders' value in the fishery. Management procedure performance is also limited by the legal mandates underpinning US federal fisheries management (e.g., prevent overfishing and an overfished stock status). These stakeholder workshops were the first step in the MSE process, designed to identify conceptual management objectives.

The purpose of this communication is to report on the stakeholder perspectives of the dolphin fishery and the associated conceptual management objectives that were communicated during these stakeholder workshops. We report regional differences in the goals and reliance on the fishery and note uncertainties in the stock and fishery to which the management procedure should be robust. Note that the perspectives herein are representative of stakeholder comments and perspectives. We further note that stakeholder feedback is representative of the locations in which the workshops were held and may not necessarily hold constant across unsampled regions.

Methods

We conducted a series of in-person workshops and one virtual workshop designed to:

- (1) introduce stakeholders to the management procedure approach and MSEs,
- (2) develop conceptual management objectives by exploring how stakeholders value the dolphinfish fishery,
- (3) identify relevant uncertainties to which the management procedure should be robust,

- (4) receive input on the type of management procedures to be explored, and
- (5) identify key participants for continued involvement in the MSE process.

The workshops were open to the public and advertised in the Federal Register and by targeted outreach with potential interested attendees directly. We targeted participation in the range of 10-20 individuals per workshop location to optimize the clear and thorough information flow from stakeholders to the scientists (Babo et al. 2010). The workshops were hosted by the SEFSC, with collaboration from the SAFMC. Scientists from each agency, including social, ecosystem, MSE, citizen science, economic, and species management experts, served to organize, facilitate, and take notes during each workshop.

The in-person workshops took place in southern Florida (West Palm Beach, Fort Lauderdale, and Islamorada) in October 2022, the northeast (Montauk, NY and Narragansett, RI) in November 2022, and the Greater Carolinas (Charleston, SC, Wilmington, NC, Wanchese, NC, Virginia Beach, VA) in January 2023. A virtual workshop followed in May 2023, to allow individuals who were unable to attend an in-person workshop an opportunity to provide input. The number of attendees at each location is given in Table 1. These locations were chosen to reflect reported areas of substantial dolphin fishing activities, expand reach beyond previous participatory workshops (McPherson et al. 2022), and to fit within logistical constraints (e.g., travel time and allowance, space availability, budget).

The workshops were structured to begin with brief presentations on the background and need for an updated management approach, an overview of the management procedure process and MSE methods, and a description of the type of input that the analysts were seeking (see Appendix for workshop materials). We then asked a series of trigger questions designed to foster communication and participation, as well as to obtain some background on the details of the fishery in each region. The first round of trigger questions included:

- What makes your fishery unique?
- Why is it important for this area?
- What are some of the biggest challenges related to the fishery in this area?

A second round of trigger questions were designed to elucidate management objectives of the fishery:

- What are your preferences for this fishery?
- What should be the main objectives for the management of this fishery?
- What are the things you would want to see in terms of how the dolphinfish fishery is managed?

The workshop facilitators allowed for open discussion while attempting to keep the discussion focused on each trigger question. As participants made comments, their ideas were captured and transcribed on sticky notes that were posted at the front of the room so that attendees could judge whether we had accurately captured their sentiments and other attendees could react to those ideas. Additional MSE analysts and facilitators took note of participants' comments throughout the

workshop. For the purposes of the MSE, the facilitators particularly prioritized highlighting answers that were informative of management objectives and operating model uncertainties.

Results

Workshop attendance

Table 1. Location, number of participants, and composition of the stakeholder participants at each stakeholder workshop, grouped based on date of workshops.

Region	Location	Number of participants	Composition of stakeholder participants
Northeast (Nov 2022)	Narragansett, RI	2	management; scientist
	Montauk, NY	6	commercial, mixed commercial/charter, charter, and private recreational
Greater Carolinas (Jan 2023)	Virginia Beach, VA	12	private recreational, charter, headboat, managers, scientist
	Wanchese, NC	80+ (80 signed in)	charter, commercial, private recreational
	Wilmington, NC	14	private recreational, charter, managers, scientists
	Charleston, SC	16	private recreational, charter (including captains & mates), managers
South Florida (Oct 2022)	West Palm Beach, FL	6	private recreational
	Fort Lauderdale, FL	2	private recreational, enforcement
	Islamorada, FL	28	charter/commercial, journalist
Virtual (May 2023)	Boca Raton, FL; Long Island, NY	2	charter

Overall objectives

Common conceptual management objectives:

- Ensure opportunity / access to fishery
- Prevent fishery closures
- Large sizes preferred
- Stability in regulations preferred*
- Regional & sector differences in fishery goals and objectives

*Except in Wilmington, NC

Across all areas, stakeholders indicated a desire to ensure access to the fishery, preserve opportunity to catch dolphin, and prevent fishery closures. Catch of larger sized dolphin ('gaffers') was universally preferred. In all regions, except for some participants in the Wilmington, NC workshop, stakeholders preferred stability in management regulations

over maximizing allowable catch over the long-term. Other objectives varied significantly by region and fishing sector.

Regional areas

Following input from the stakeholder participants, we identified four distinct regions distinguishing the dolphin fishery and stock dynamics along the US east coast (Figure 1). The most northern region is Virginia and northward. Northern North Carolina was defined as the Outer Banks region including and northward of Morehead City, which was distinct from Wilmington and southern North Carolina. Southern North Carolina was most similar to South Carolina, Georgia, and northern Florida. Despite the lack of workshop locations in Georgia and northern Florida, stakeholders in South Carolina reported that fishing practices and stock behavior was similar throughout this region. Moreover, across regions, participants highlighted that south Florida and northern North Carolina were unique regions in terms of dolphin fishing dynamics. Southern Florida, including the Florida Keys, was the last distinct region identified from these workshops. The dynamics of the stock and fishery, the importance of the fishery, recent trends in availability and fish size, and management goals and objectives were generally conserved within each region, but varied across regions.

Northern area

Overview

Historically, availability or local abundance of dolphin was low and sporadic in these northern regions of the US Atlantic coast. Given the distance between land and the warm Gulf Stream water, fishermen reported having to rely on warm-core eddies to make dolphin more accessible. This dependence on the environment to access dolphin results in sporadic availability, which makes it challenging for stakeholders to gauge trends in abundance and fish size over time. However, it has been reported that the availability and catch rates of dolphin in these northern areas has increased in recent years, and that the seasonality of dolphin residency has shifted over time.

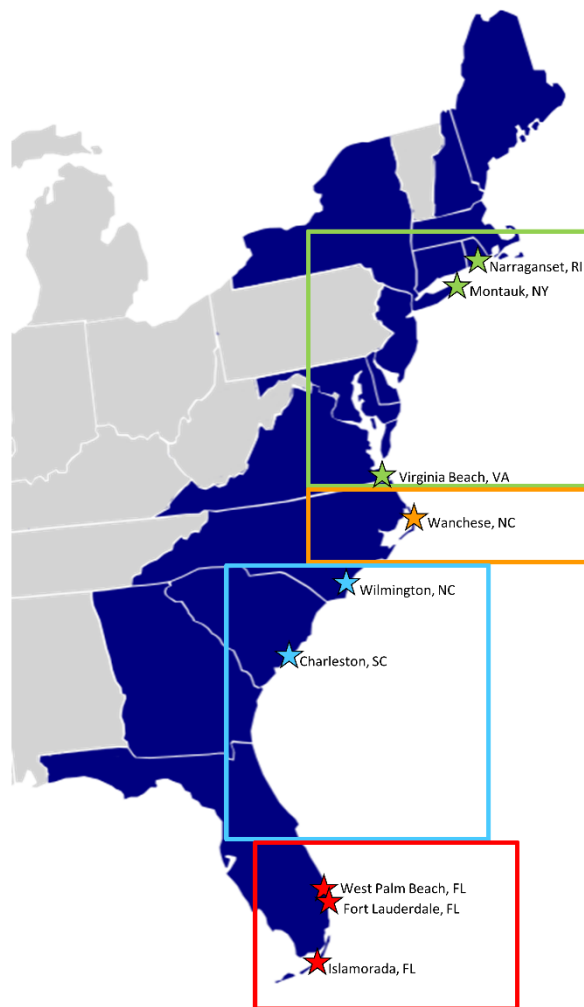


Figure 1. Approximate graphical representation of the regions in which dolphin fishing is most similar across the coast. Note that fishing activities, fishery objectives, and dolphin availability varies by region. Each region is identified by a colored box. Regions were defined based on feedback from stakeholder workshops and will be used to delineate spatial areas within the MSE. Note that regions may be impacted based on the workshop locations, which are indicated by color-coded stars.

Due to inconsistent availability and offshore distributions, fishing for dolphin in these areas is expensive, requiring long run times and considerable fuel. Further, the reported quality of the meat from dolphin caught in the northern areas was poor when compared to fish quality further south. Namely, it was noted that the meat consistency is grittier, individual fish are skinnier, and the meat has a gray tint. This comparatively poor meat quality reduces the market demand for locally caught dolphin. As such, dolphin are rarely targeted with regularity in the northern region and are often caught opportunistically, leading stakeholders to label the dolphin fishery a “niche” fishery in the region.

While dolphin are not directly targeted on tuna and swordfish trips, the ability to retain the species was deemed necessary to supplement catch of other target species. The high cost of fishing translates to a desire to bring home meat from fishing trips. Dolphin are regularly caught as bycatch or are secondary targets while tuna and swordfish fishing. As such, dolphin are still an important component of recreational and charter fishing portfolios in this region and are strongly important to many fishers, despite being a niche fishery overall in this region.

Moreover, as the prevalence of dolphin has increased, stakeholders have reported that they increasingly stop when they see floating debris (including sargassum weed lines, trash, lobster trap buoys, etc.) on the water to fish for dolphin directly. This low demand and infrequent targeting have led stakeholders to believe that dolphin may be underexploited in this region.

Conceptual fishery management objectives

Northern Region (Virginia and North)

Fishery Management Objectives:

- More consistent / reliable fishery
- Maintain current regulations
- Maintain fishery access
 - Prevent fishery closures
- Area-based management
- Ecosystem considerations

Stakeholders in the northern region generally indicated that setting and altering regulations for the northern region would have limited impact due to the limited and variable accessibility of dolphin. Stakeholders were generally satisfied and in agreement with the current regulations for dolphin.

Additional stakeholder goals were to maintain access to the fishery and prevent fishery closures. For example, the commercial dolphin fishery was closed early in the season in 2015 before the dolphin became available to the northern regions of the US, resulting in a functionally closed fishery for the northern region. Upon reflection, stakeholders proposed area-based management regulations, with region-specific closures and payback measures, such that behavior of one area would not impact the fishery in more northern areas. Further, since dolphin are caught as bycatch in tuna and swordfish fisheries, stakeholders highlighted the importance of larval and juvenile dolphin as an important ecosystem species, serving as prey for tuna and swordfish. Ultimately, the stakeholders expressed a preference for a more consistent or reliable dolphin fishery as a management objective.

Northern North Carolina

Overview

The dolphin fishery in northern North Carolina, generally including the Outer Banks and Morehead City, is highly important historically and is characterized by high charter, private recreational, and

commercial fishing activity. Due to longer run times compared to South Florida, the fishery exhibits higher trip costs, and fishermen in this area desire to take home large quantities of dolphin. Stakeholders further stressed how different the North Carolina dolphin fishery is compared to the fishery in South Florida, including North Carolina's lower human population, the higher fish quality, and more plentiful prey resources for dolphin.

While participants indicated that there has been an increase in private recreational effort, charter effort has remained relatively constant over time. The participants indicated mixed reports of trends in size and availability; most participants indicated that there had been no observable trend in size and availability given the variable nature of dolphin availability in this region. However, a few participants perceived a reduction in the average size of dolphin captured over time.

Participants noted a change in migratory timing, where fish are not as available in the late spring and early summer, like they used to be, which corresponds to a lack of healthy *Sargassum* weed for the fish to congregate. Instead, some dolphin availability has shifted to the fall. Participants also proposed that dolphin were using a new migratory pattern, where they were by-passing Florida and moving into the Carolina waters from the Bahamas in the East. This notion of a new migratory pattern was supported by the high quality of dolphin available in Carolina waters, which is consistent with that of dolphin from the Caribbean.

Shark depredation was also an important source of frustration in this region. High post-release mortality of dolphin led participants to propose a cost-benefit analysis of discarding versus retaining all caught dolphin in this region.

Conceptual fishery management objectives

Northern North Carolina Fishery Management Objectives:

- Reduce regulations: "The ocean regulates us"
 - High bag/vessel limits – needed to market and sell charter trips
 - Maintain no minimum size limit
 - Participants highlighted the limited ability to enforce regulations in this region, primarily size limits
- Large size

Stakeholders in Wanchese stressed that the importance of maintaining high recreational vessel and bag limits is not because they intend to keep all the dolphin they are allowed. Instead, high retention limits are attractive to charter clients, who desire to bring home meat in the cooler from their fishing trip. Charter fishermen indicated that they rarely keep their full bag/vessel limit's worth of dolphin during a single charter, but having the opportunity for clients to harvest higher retention limits helps with marketing charter trips.

Larger sized dolphin are preferred, and participants indicated that they generally try to avoid catching smaller dolphin when possible, since they do not yield much meat when fileted. However, participants were overwhelmingly against minimum size regulations, stating that selective targeting of larger individuals can be difficult in this region; thus, allowing charters to retain fish under 20" in

length was considered essential. Moreover, participants stressed the difficulty in measuring dolphin while they are alive and indicated that compliance would be low if minimum sizes were enacted.

Overall, participants expressed high levels of frustration with management, feeling that it was both unnecessary and unjust. There were sentiments that dolphin, as a stock with high environmental variability and sporadic local availability, was largely regulated by external forces and that local regulations had little impact on population regulation. Accordingly, stakeholders also expressed frustration that they had not perceived the intended benefits of management; for example, reducing trip limits was seen as unjust, when there was little perceived need for the restriction and no realized benefit (e.g., more future availability) resulting from the management action. Stakeholders highlighted the uncertainty in recreational data and participation as an area that should be considered within the MSE.

Southern North Carolina – Northern Florida

Overview

Similar to more northern regions, stakeholders indicated that the dolphin fishery is sporadic and opportunistic in this region. Dolphin often serve as incidental catch when highly migratory pelagic species, like tuna and billfish, are unavailable. Due to the long run times to reach the Gulf Stream (and therefore dolphin habitat), the fishery is expensive and driven by a desire to bring home large quantities of catch. In this region, the fishery is dominated by recreational fishermen and there are fewer commercial fishermen, such that there are fewer conflicts related to competing fishing sectors. Contrary to other regions, post-release mortality was reported to be low in this region. Stakeholders noted that the pelagic nature of the species does not lead to barotrauma experienced over the course of capture.

Stakeholders noted a decline in dolphin availability over the past 20 years and attributed that decline to both environmental factors and to increased fishing effort. Listed environmental changes include increased wind/bad weather, a shorter window of fish availability, and a shifting temporal fishing window. Moreover, participants indicated that the Gulf Stream had shifted further offshore, such that dolphin were more challenging to access, and fishermen instead had to rely on eddies that hold dolphin. One participant suggested that ‘there could be as many fish as ever, but we can’t get to them.’ Reportedly, the size of fish available to the fishery is also declining.

Increased private recreational fishing effort was reportedly driven by increases in the human coastal population, the number of boat owners, and the targeted effort on dolphin. However, despite increased recreational effort, the size of the charter fleet has remained relatively constant, and both private recreational and for-hire fishing for dolphin is at a much smaller scale compared to other regions, namely South Florida. Participants also noted the increase in catchability associated with new boating and fishing technologies (e.g., radar capabilities, fish-finding technology, increased horsepower, etc.).

Conceptual fishery management objectives

Southern North Carolina through Northern Florida Fishery Management Objectives:

- Willing to accept more restrictions
 - Open to reducing trip/vessel limits
 - Pro (or mixed) size limits – open to explore what is viable for the charter fishery
- Area-specific management
 - Mixed for sector-specific considerations (including private rec v. for hire)
- Maintain accessibility / opportunity
 - Fishery reliability
- Ecosystem considerations
- Fishery stability & maximize catches

Many stakeholders from this region were generally willing to accept stricter management regulations if it would translate to improved abundance. (Although, participants in this region explicitly stated that this could be a bias of those who attended these workshops). As such, bag limits exceeding 6 'nice-sized' dolphin were acceptable. In this region, charter fishermen noted that they likely could not fulfill their 54 fish trip limit in a single charter, but, like in northern North Carolina, higher trip limits sell charter trips. These participants also highlighted the difference between charter fishing activities and private recreational fishing catches, suggesting that regulations could vary based on the recreational fishing subsector (different limits for private recreational versus for-hire subsectors). Retention limits are insignificant to the private recreational sector, since these anglers likely average 1-2¹ landed dolphin per angler per trip. Stakeholders were generally in favor of minimum size limits, and trusted the scientists to explore various size limits and identify which limit would keep the charter fishery viable in this region.

Stakeholders in this region indicated a preference for increasing the availability of larger-sized fish, maintaining accessibility of dolphin and access to the fishery, increasing catch rates, maintaining reliable catch rates, stock conservation, and were interested in pursuing sector-specific and regionally-specific management measures. While some participants preferred maintaining stability of fishing regulations, others suggested that with a short-lived stock, like dolphin, it would be better to maximize catches at the expense of high variability in regulations from year-to-year. Stakeholders also considered the efficacy of gear restrictions, as catchability has increased with the advancement of technology. Lastly, participants stressed the importance of dolphin as ecosystem species, primarily as prey for other, more desirable, highly migratory species, like tuna and billfish. As such, maintaining a healthy prey population was an important objective.

South Florida

Overview

In South Florida, the fishery is much different from the northern areas, primarily due to the short distance to fishing grounds. Consequently, the drive to fish is driven by leisure, rather than to bring home coolers full of fish, with some West Palm Beach private recreational fishermen indicating that they would continue to target dolphin even if the fishery was catch-and-release. Combined with the

¹ Although, this number was estimated by a workshop participant and is uncertain.

easily accessible fishing grounds, high human population has resulted in perceived increases in exploitation and effort for dolphin over the past several years.

Participants noted a clear reduction in fish size and availability over the past 10 years, but particularly since Covid-19 in 2020 (also observed in Damiano et al. 2024). Participants proposed several mechanisms for this shift, which included climate change, inclement weather patterns, reduced *Sargassum* health, high post-release mortality, and overfishing by the commercial pelagic longline fleet. (Though notably, the area off the East coast of Florida is part of the East Florida Coast Closed Area, which is closed to pelagic longline fishing and prohibits retention of dolphin and wahoo year-round if pelagic longline gear is aboard the vessel; <https://www.fisheries.noaa.gov/resource/map/east-florida-coast-closed-area-fishery-management-area-map-gis-data>). As a result of this decrease in localized dolphin abundance, some charter fishermen have reported an inability to rely on dolphin as they did before these declines in availability.

Conceptual fishery management objectives

South Florida Fishery Management Objectives:

- Conservation
 - Reduce vessel/bag limits
- Mixed size limit
 - Pro size limit
 - Pro coast-wide size limit
 - Decrease size limit – or – maintain size limit but allow south Florida to retain some undersize fish
- Prefer stability
- Maintain opportunity to access dolphin resource
- Ecosystem considerations
- Reduce commercial fishing sector
 - Increased regulations on commercial longline gear, catch limits, and size limits

Participants from this region strongly favored more strict regulations to protect the fishery, explicitly stating that dolphin stock conservation was a priority. One participant suggested that dolphin catch limits should be 50-60% of the maximum annual catch limit. In particular, stakeholders were in favor of US-wide reduction in vessel and bag limits. Sufficient bag limits were reportedly as low as 5 fish per person and acceptable vessel limits varied, including reports of 30, 10, or 24 per vessel. However, participants noted a desire to prevent a fishery shut down, and would prefer a 1-fish bag limit over a closed fishery.

Charter fishermen, particularly those in attendance at the Islamorada workshop, further expressed a desire to sell their charter-caught catch commercially. If allowed, this may result in a desire to maximize catch in this region. Participants in West Palm Beach were supportive of regulations that would reduce the wholesale of small fish and maintain a small-scale commercial fishery that sells high-quality dolphin product.

Participants, particularly in Islamorada, were overwhelmingly in support of reducing the scale of the pelagic longline commercial fishery, either through additional gear restrictions, outright prohibition of longline fishing for dolphin, or by applying recreational trip limits or other more restrictive vessel limits to commercial fishermen. Stakeholders recommended formalizing a split in the commercial allocation through separate annual catch limits by commercial gear type (e.g., separate limits for

commercial pelagic longline versus commercial hook and line). When asked if private recreational and for hire sectors should have the same limits, opinions were mixed.

Opinions on size limit were mixed. Some individuals indicated that the size-limit should be determined based on scientific guidance, while others were in favor of a regional or coast-wide size limit, some even preferred an increase in minimum size (e.g., 24-30" fork length). Conversely others were in favor of a reduction in the existing size limit, or suggested maintaining the existing size limit (20" fork length) while allowing Southern Florida fishermen to retain some undersized fish, reflecting the length composition of dolphin availability in this region.

Overall, stakeholders clearly prioritized maintaining the opportunity to catch and keep dolphin. Larger fish were preferred. Participants preferred stability in regulations from year-to-year and worried that charter customers might otherwise try to 'game' the system and avoid hiring charters during years of low allowable catch. Stakeholders suggested implementing regionally-specific management measures. The importance of maintaining dolphin for ecosystem health was also stated.

Given that Florida state regulations on dolphin differ from federal regulations, several participants identified enforcement issues as a reasonable uncertainty that should be considered in our analysis. Further, unlicensed fishermen have reportedly been able to sell dolphin commercially. Uncertainty in recreational catch data was also listed.

Discussion

Across all regions, stakeholders prioritized ensuring opportunity to fish, maintaining access to the dolphin fishery, and preventing fishery closures. Catch of larger sized fish was universally preferred. Most participants indicated that they preferred to maintain stability in fishing regulations rather than potentially maximizing allowable takes by following year-to-year fluctuations in availability. Generally, stakeholders in all regions emphasized the desire to have their voices heard and would prefer to have a greater influence on how dolphin are managed throughout the US Atlantic.

Notably, we found that charter captains in northern regions favor higher trip limits, not necessarily with the intent of fulfilling the trip limit on each charter, but because higher regulations sell charter trips. Charter clientele are more likely to buy a charter trip, if they feel they may have the opportunity to take home more fish.

Regional feedback varied, and some common themes, not all of which can be addressed at the scale of the current project, included:

- mixed feedback on expanding the minimum size limit to all states,
- implementing area-specific management measures, with area-specific quota pay-backs and carry-overs,
- implementing sector- or gear-specific management measures, potentially separating private recreational regulations from those of for-hire fishermen,
- broader regional and international collaboration and coordination across the Gulf and Caribbean Fishery Management Councils and through international regional fishery management organizations (RFMOs), and

- regulate importing to improve economic conditions and market value of locally caught dolphin.

Based on participant feedback, it was clear that fishery dynamics vary by region, including differences in fishery effort and catch, availability, catchability, selectivity, market dynamics and economics, fisher behavior and targeting practices, depredation and post-release mortality, and fish quality.

Stakeholders also expressed their dissatisfaction with past management measures. Their sentiment largely reflected the idea that despite experiencing increasingly restrictive fishery management regulations, they have failed to perceive the intended benefits of those management actions. It is therefore important to demonstrate realistic trade-offs of different management measures to show the costs and benefits of alternate management approaches.

Patterns of feedback

Participant attendance itself was a useful metric that seemed to be largely reflective of the attitudes of stakeholders in each region. For example, participation was low in the northeast, where stakeholders indicated that they were largely satisfied with dolphin management and did not desire any changes. However, in the Florida Keys, where localized depletion has been observed in recent years and stakeholders have called for more restrictive regulations (e.g., see public comments for dolphin wahoo Amendment 10: <https://safmc.net/amendments/dolphin-wahoo-amendment-10/>), a greater number of participants attended the workshop. Participation was also reflective of the overall reliance on dolphin as a target species by region. Dolphin are largely important target species in northern North Carolina and south Florida, while they are primarily caught as bycatch or secondarily targeted in the northern region and southern North Carolina through central Florida waters. Workshop attendance correlated with general dolphin importance and regional reliance.

Participants generally advocated for stricter regulations in the southern regions (southern North Carolina and south), likely corresponding to concerns regarding the decline in dolphin available in these regions. Contrarily, participants in the northern regions (mid-North Carolina and north) prioritized bringing home fish. Stakeholders in the southern regions anticipated that localized action (e.g., their own actions, or those of a nearby longline vessel) would have noticeable impacts on local or total stock abundance. Contrarily, stakeholders from Wanchese seemingly had different expectations of the impact that localized management action would have on the stock, where such effects were expected to be negligible. This difference in perception may explain the conflicting opinions on fishery regulations and their impact, or lack thereof, on stock conservation.

The northern regions did not reportedly see strong declines in dolphin availability, and fishing for dolphin is much more expensive in these regions. In regions where dolphin fishing was more expensive, the desire to take home meat was stronger. In south Florida, where dolphin are readily accessible close to shore, anglers targeted dolphin more for sport and leisure, preferring to catch and release or catch only enough dolphin to eat fresh, rather than freezing their catch.

Overall, participants reported a reduction in the availability of dolphin in the southern regions, while less clear patterns were observed in the northern regions; likely, any trend is obscured by the sporadic nature of the fishery in these northern regions. The seasonality of dolphin availability has also shifted throughout regions. Though not universally observed (particularly not in the northern regions), participants frequently noted a reduction in size of available dolphin.

Across regions, participants reported that private recreational fishing effort has increased. This overall increase in recreational effort is driven by both an increase in the number of anglers and the increased catchability of those anglers (reflecting increased boat horsepower, advances in fish-finding technology, increased sharing of information through social media, etc.).

In regions where dolphin are less accessible due to their far offshore fishing grounds, including the northern region and south NC - north FL region, stakeholder participants suggested that dolphin in these regions are likely under-exploited. Particularly, the cost of fishing for dolphin is becoming increasingly more expensive. In areas where dolphin are caught mainly as bycatch when fishing for other highly migratory species, like tuna or billfish (northern region and south NC - north FL region), participants were more likely to highlight the ecosystem role of dolphin, which serve as a prey source for other large pelagic species.

Uncertainties

In these workshops, we also requested that stakeholders report on uncertainties within the dolphin fishery management system that should be incorporated into the MSE exercise. The following uncertainties were identified by the meeting participants:

Removals - Participants highlighted the uncertainty in total removals and exploitation rate, in both the magnitude and quality of private recreational catch data and the overall magnitude of international exploitation of the stock.

Alternate movement patterns - Dolphin movement is generally expected to follow the Gulf Stream from the Caribbean up the US east coast and around the Atlantic Ocean basin back to the Caribbean. Over the past several years, the dolphin population has experienced changes in movement and seasonal residency patterns. Participants suggested that dolphin may be following alternate movement patterns, wherein (1) Caribbean fish are bypassing south Florida as they follow the Gulf Stream, (2) dolphin are moving south from southern New England rather than following the clockwise Atlantic Ocean gyre, and (3) there are populations of resident dolphin in southern New England and off the coast of South Carolina. Participants provided supporting evidence for movement pattern (1), noting that the fish available to North Carolina and surrounding waters match that of dolphin that are caught in Caribbean waters, the clear reduction of dolphin available in south Florida, and the clear increases in water temperature observed off south Florida in recent years.

Changing availability and catchability - Several mechanisms for past and future changes in availability and catchability were postulated by stakeholders. Some participants suggested that climate-driven changes in temperature, shifts in the location of the Gulf Stream, and declines in the

health of Sargassum weed and changes in abundance and clustering of Sargassum weed may lead to changes in availability and catchability across regions. For example, an offshore shift in the Gulf Stream would reduce availability of dolphin to fishermen off the coast of South Carolina, increasing distance of dolphin from shore and forcing fishermen to rely on eddies rather than the main Gulf Stream where the fish may be more abundant, but inaccessible to many fishermen.

Further, anthropogenic changes are expected to impact the availability and catchability of dolphin in the future. In the northern region, fishermen often rely on lobster pot buoys to catch dolphin, which, like fish aggregating devices (FADs), congregate dolphin. However, there is a push to move towards lobster pots with ropeless technology to prevent whale entanglements. This shift would likely impact catchability of dolphin in these affected regions. Contrarily, offshore wind farms are being developed or are planned in several regions along the US east coast. These wind farms will result in increased structure out on the water which will undoubtedly congregate dolphin and their forage. The development of these large offshore wind farms will likely increase the catchability of dolphin in the northern region.

Economic fishery drivers - The cost of fishing is increasing in all regions, primarily driven by increasing fuel prices. This increasing cost is also exacerbated by dolphin moving further offshore as reported in Wilmington, NC. This strain has certainly been felt across all sectors of the fishery. Further, the demand for locally caught dolphin varies regionally (is particularly low in the northeast region of the U.S. region) and is highly impacted by imported dolphin. Imported dolphin are primarily Pacific-caught, and imported dolphin account for the vast majority of U.S. dolphin consumption (McPherson et al. 2022). However, stakeholder participants suggested that importing has resulted in a reduction in demand and price for locally caught dolphin across regions. While we can measure and analyze these economic trends from the past, it is much more challenging to predict trends in the cost of fishing and demand for charter trips and locally caught dolphin in the future. Unknown future economic drivers will correspondingly impact future fishing effort.

Post-release mortality and depredation - The at-vessel and post-release mortality reportedly varies substantially by region and is particularly related to areas of high shark abundance. Shark depredation has been increasing over time, particularly in south Florida and northern North Carolina, and this has strong implications for at-vessel and post-release mortality of dolphin in these regions.

Enforcement challenges - Participants highlighted challenges with enforcement, particularly related to: unlicensed fishermen selling their product to local restaurants, challenges enforcing stricter state regulations in Florida as compared to federal regulations, and for the implementation of size limits in regions where no size restrictions are currently applied. In particular, in the northern North Carolina region, some feedback included the challenges associated with measuring live dolphin and some indicated that any minimum size limit would be disregarded in practice.

Next steps

The information obtained from these workshops is being used to develop an MSE framework for dolphin in the Atlantic. In December 2023, a small stakeholder working group was selected by the

SAFMC appointment process to assist the MSE analysts moving forward to ensure that the management procedures developed through the MSE are adequately meeting management objectives and the legal requirements for federally managed fisheries. We anticipate that the MSE results will be used to inform the adoption of a MP for dolphin. Essentially, the MSE results will serve as the scoping for fishery management alternatives, on which the Council would formally vote to enact the new MP. For more information, please refer to the SEFSC dolphin MSE webpage at <https://www.fisheries.noaa.gov/southeast/atlantic-highly-migratory-species/dolphinfish-management-strategy-evaluation-us-atlantic>.

References

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- Damiano, M. D., Karnauskas, M., Merten, W., Cao, J. (2024). Spatiotemporal dynamics of common dolphinfish (*Coryphaena hippurus*) in the Western Atlantic Ocean. Fishery Bulletin. 122(1-2): 26-43.
- McPherson, Matthew, Mandy Karnauskas, Julia Byrd, John Hadley, Skyler Sagarese, Cassidy Peterson, Kevin Craig, Anthony Mastitski, Scott Crosson. 2022. Participatory modeling of dolphin and wahoo fisheries in the U.S. South Atlantic: Final report from a workshop series. NOAA Technical Memorandum NMFS-SEFSC-755, 14 p. [https://doi: 10.25923/7eg6-9856](https://doi.org/10.25923/7eg6-9856)

Appendix

Appendix includes materials presented and handouts from the stakeholder workshops and an update on the dolphin MSE presented to the South Atlantic Fishery Management Council (SAFMC) in their June meeting.

- Workshop materials: 2-page informational handout. *Note figures within the handout were produced following allocations prior to Dolphin Wahoo Amendment 10. (See Figure A1 below for updated regional allocation following Dolphin Wahoo Amendment 10.)
- Workshop materials: workshop introductory presentation.

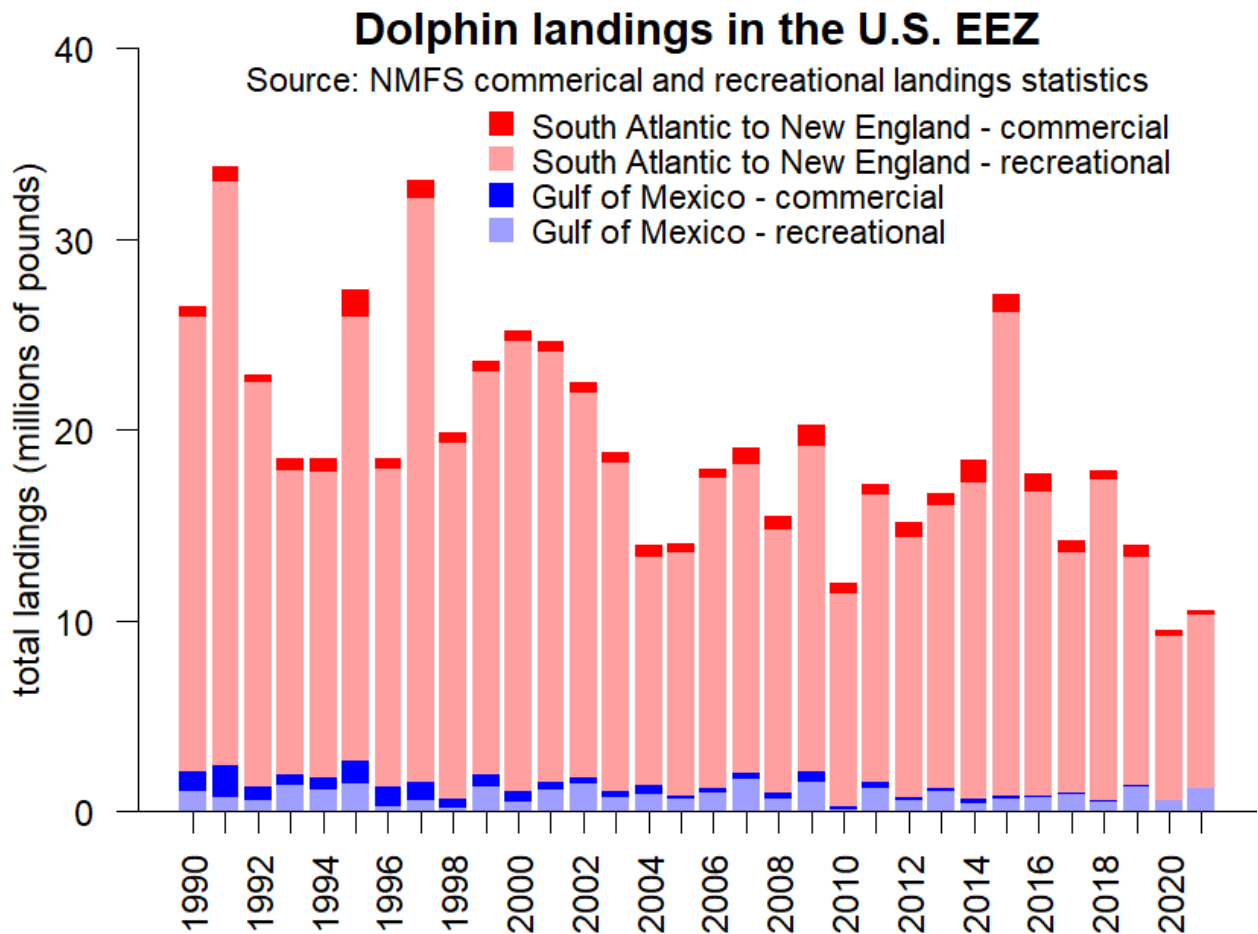


Figure A1. Commercial and recreational dolphin landings in millions of pounds from the US exclusive economic zone (EEZ) for the U.S. Atlantic coast and Gulf of Mexico. Note that these data are reflective of the allocation scheme implemented by Dolphin Wahoo Amendment 10 (effective May 2, 2022).

Informational handout

Project Overview

Scientists from the South Atlantic Fishery Management Council, NOAA’s Southeast Fisheries Science Center and North Carolina State University are undertaking a **management strategy evaluation (MSE)** to develop an **empirical management procedure** that best achieves the management objectives for dolphin (a.k.a. dolphinfish or mahi-mahi) in the South Atlantic U.S. fishery.

Current Dolphin Management

Allowable Biological Catch is based on the third highest landings from 1994 - 2007.

“The Dolphin Wahoo Fishery Management Plan was developed to maintain existing harvest levels of dolphin, including the historical allocation between recreational and commercial fisheries, and ensure that no new fisheries develop.” (<https://safmc.net/fishery-management-plans/dolphin-wahoo/>)

Allowable Biological Catch = Annual Catch Limit = 24,570,764 pounds whole weight (Amendment 10)

Recreational allocation = 93% of total Annual Catch Limit (sector ACL = 22,850,811 pounds whole weight)

Commercial allocation = 7% of total Annual Catch Limit (sector ACL = 1,719,954 pounds whole weight)

Recreational Regulations:			
Area	Minimum Size	Bag Limit	Vessel Limit
Atlantic EEZ (NC - ME)	None	10 fish per person; not to exceed vessel limit	54 fish (excluding headboats)
Atlantic EEZ (FL - SC)	20 inches fork length		

Commercial Regulations:		
Area	Minimum Size	Trip Limit
Atlantic EEZ (NC - ME)	None	<ul style="list-style-type: none"> No initial trip limit. Trip limit once 75% of commercial sector ACL is landed = 4,000 lbs ww for permitted vessels. Trip limit for non-permitted vessels N of 39° N = 200 lbs dolphin and wahoo combined.
Atlantic EEZ (FL - SC)	20 inches fork length	

The dolphin fishery is federally unregulated within the U.S. Gulf of Mexico.

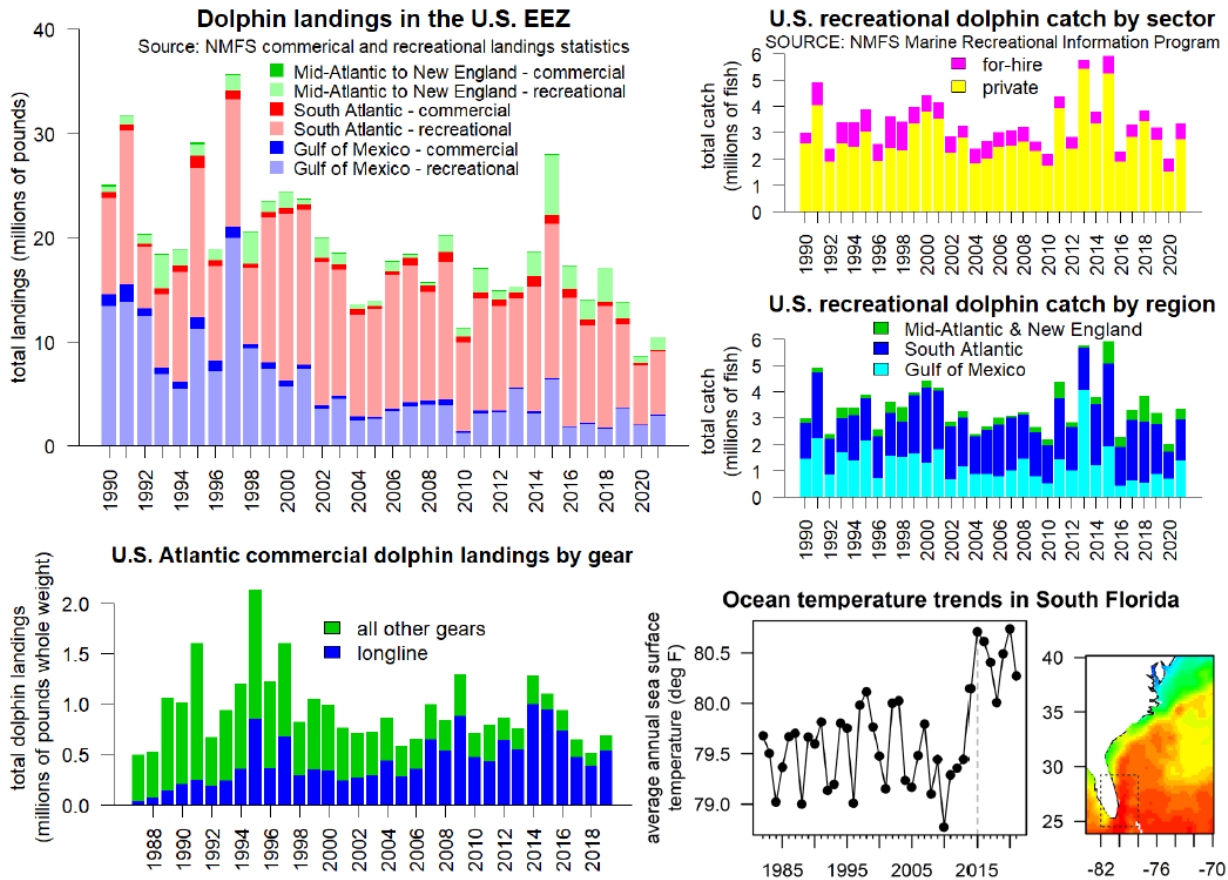
Challenges with current management approach

- Highly migratory; international distribution
- Data limited with no stock assessment
- Short-lived and environmentally driven productivity
- Static management
- Regional differences in management objectives
- U.S. management limited to the U.S. EEZ Atlantic Coast

Proposed solutions

- **Empirical (indicator-based) Management Procedure** will allow for adaptive management
- In years where more dolphin are available to the fishery, catch limits should increase. In years where less dolphin are available to the fishery, catch limits should decrease.
- Spatial management options for equitable opportunity across states or regions
- Allocation options to achieve multiple competing objectives

Fishery Landings Statistics and Environmental Trends



Definitions

Management procedure — a predefined decision rule that adaptively specifies how a resource is managed as the size of the resource changes as measured by ongoing data collection

Empirical management procedure — empirical (or indicator-based) management procedure uses an indicator of stock abundance, usually an index of abundance, to adjust catch advice. This is in contrast to a model-based management procedure, wherein population dynamics models (stock assessment and projections) are used to estimate stock status and thereby determine management advice

Management Strategy Evaluation (MSE) — a framework in which management procedures are developed and “torture-tested” to ensure that they are robust to stock and fishery uncertainties and maximize the management objectives of the system

Management objectives — quantitatively defined management goals of the stock and fishery that are typically stakeholder-defined and used to measure the performance of candidate management procedures

For More Information

<https://www.fisheries.noaa.gov/event/workshops-discuss-dolphinfish-mahi-mahi-management-strategy>

Contact Cassidy Peterson at cassidy.peterson@noaa.gov or (910) 708 - 2686



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South Atlantic Fishery Management Council
"To Conserve and Manage"

Welcome to the Dolphin Stakeholder Workshop



Agenda

6:00-6:45 - Introductions and Overview Presentation

6:45-7:40 - Breakout Groups

7:40-7:45 - Break

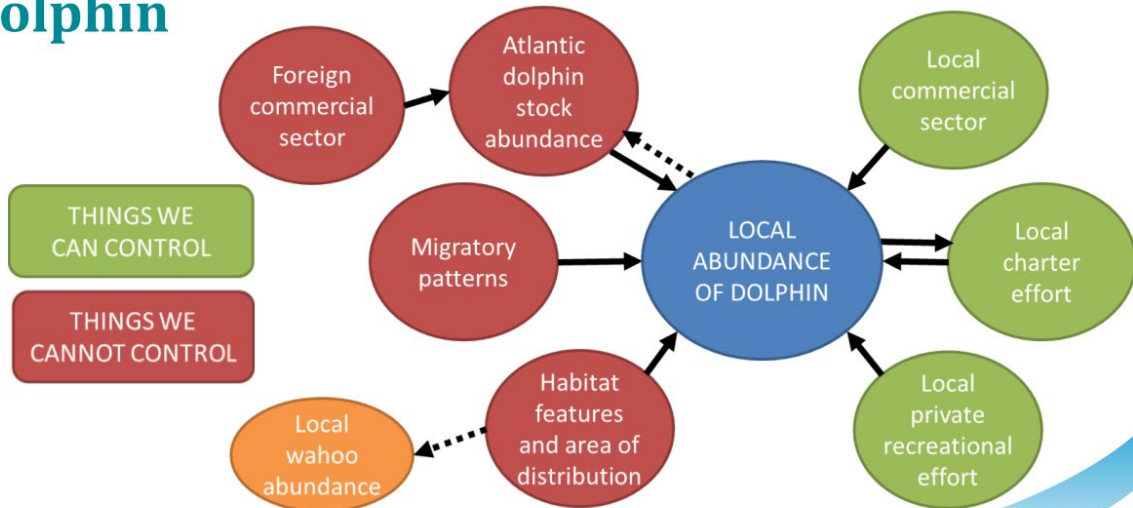
7:45-8:15 - Reconvene in Big Group

8:15-8:30 - Wrap-up and Next Steps

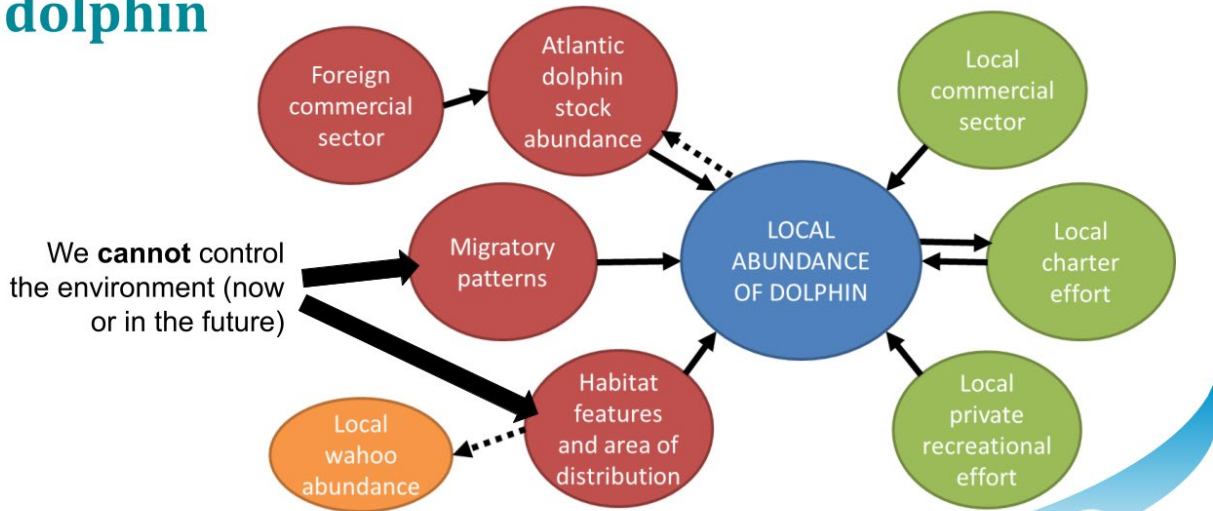
What we learned from participatory workshops



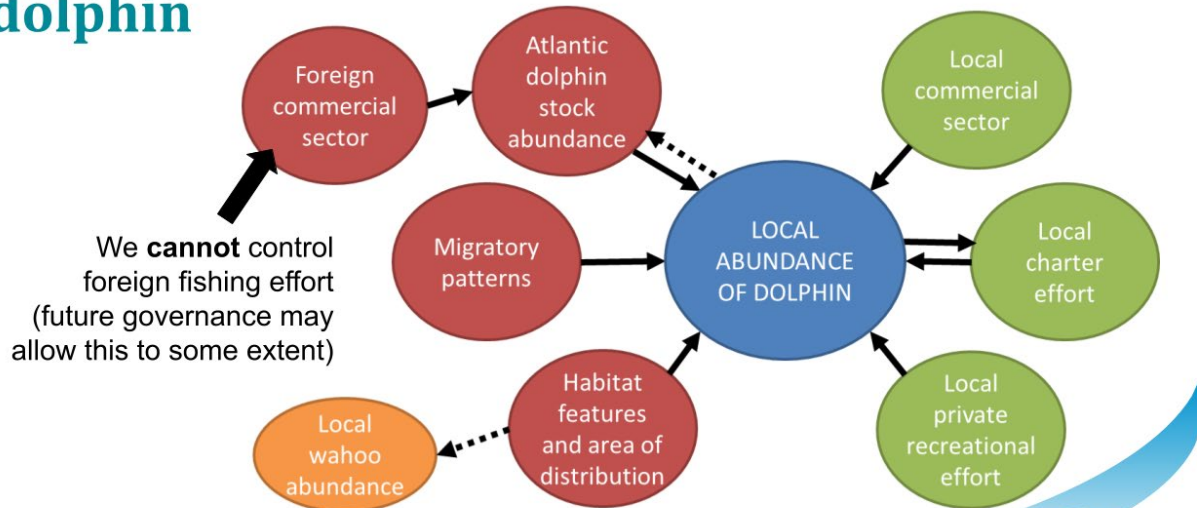
Discussion focused on local abundance of dolphin



Discussion focused on local abundance of dolphin



Discussion focused on local abundance of dolphin



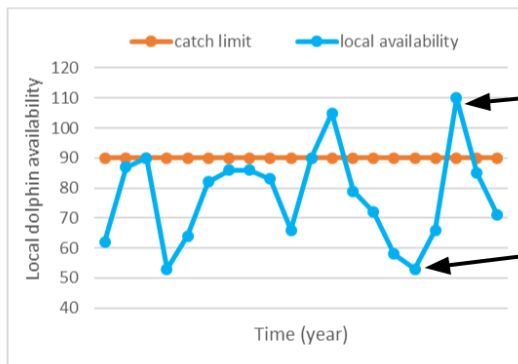
Other insights from participatory workshops:

- Perceptions that a variety of factors are increasing commercial and recreational pressure on dolphin → potential for increased conflicts
- Differences in reliance on the species across the region
- Differences across the region in how the species is valued

Need management method to reduce local conflicts and account for diverse objectives and preferences

Problem with current management

Current management is a static catch limit based on the third highest catches observed between 1994-2007



In years where stock is plentiful, static catch limits do not allow fishery to take advantage of fish

In years where fish are scarce, management does not ensure access across all sectors and regions

Given that many factors controlling abundance in local waters are out of domestic management control....



and many conflicts are related to local usage patterns....



We need a management method that allows us to:

1. predict the amount of dolphin the SAFMC will have each year

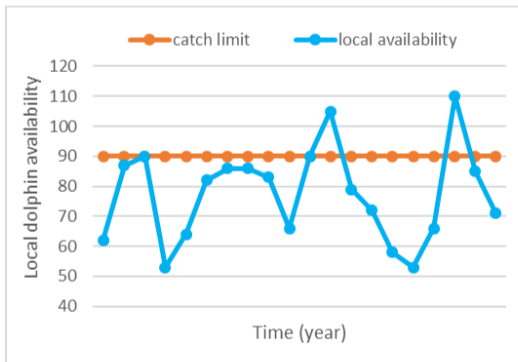


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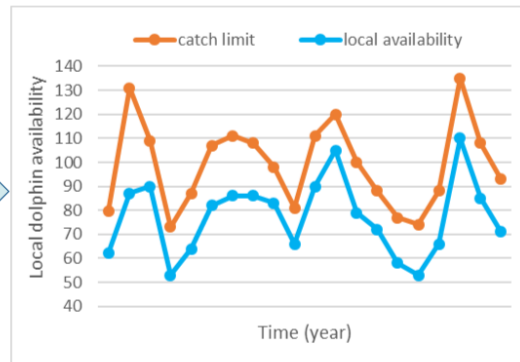
2. maximize the usage of those fish across sectors and region



Management solution



Fishery cannot take advantage of good years; inequities in distribution by area and sector during bad years



All sectors and areas able to profit from good years; equally unhappy in bad years



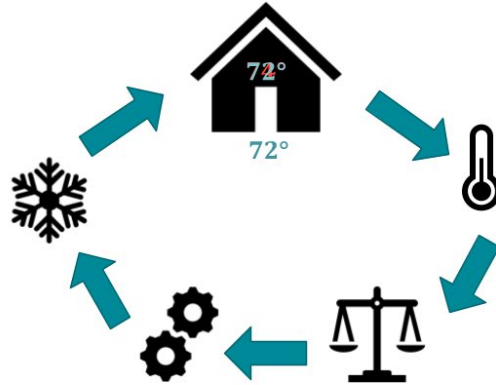
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Developing Management Procedures for dolphin in the South Atlantic



Management Procedure (Harvest Strategy) Approach

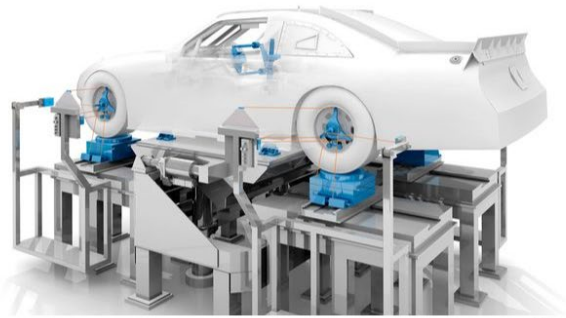


Management Procedure (Harvest Strategy) Approach



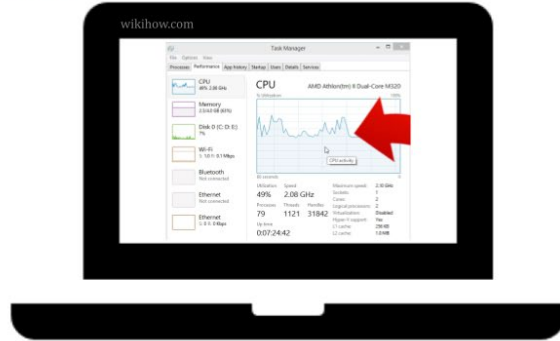
Torture / Stress Testing

□ Simulation Analyses



caranddriver.com

✓ Identify uncertainties in the stock and fishery dynamics

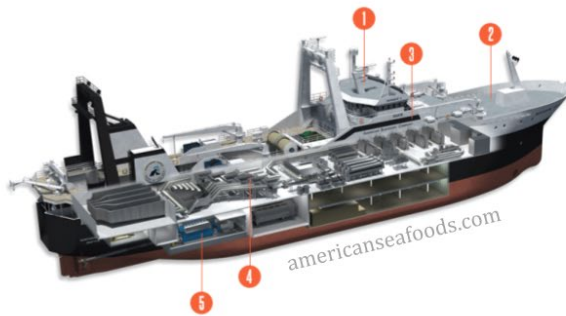


Management Strategy Evaluation



What defines a good management procedure?

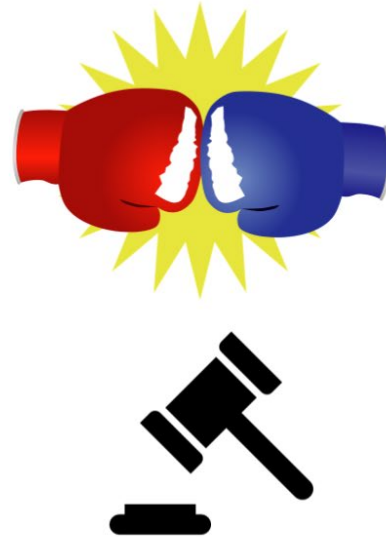
- Depends on the management objectives of the fishery.
- Management objectives depend on what you want to get out of the fishery now and in the future.



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Balancing trade-offs



Management objectives

✓ Define management objectives for dolphin

• **Conceptual management objectives** – identify broad objectives for the system (e.g., maximize catch)

- How can we measure catch to maximize fishery objectives
 - Total catch summed across 10 years?
 - Catch every year?
 - Size/quality of catch?
 - Allowable trip/bag limits?

Management objectives

✓ Define management objectives for dolphin

• **Conceptual management objectives** – identify broad objectives for the system (like maximize catch)

- Be comfortable
- Stay within budget
- Environmentally friendly

• **Operational management objectives** – operationalize management objectives for analyzing MSE results

- Ensure internal temperature stays between 69° - 75° at least 70% of the time
- Ensure internal temperature does not exceed 80°
- Keep gas/electricity bill less than \$50/mo at least 90% of the time



Agenda

6:00-6:45 - Introductions and Overview Presentation

6:45-7:40 - Breakout Groups

7:40-7:45 - Break

7:45-8:15 - Reconvene in Big Group

8:15-8:30 - Wrap-up and Next Steps

Thank you!

<https://www.fisheries.noaa.gov/event/workshops-discuss-dolphinfish-mahi-mahi-management-strategy>

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[Link to June 2023 SAFMC dolphin MSE update presentation](#)

An update on the dolphin MSE presented to the SAFMC in their June 2023 meeting can be found at the following link: https://safmc.net/documents/dw_a1_dolphinmseupdate_202306-pdf/

doi: 10.25923/f628-n174