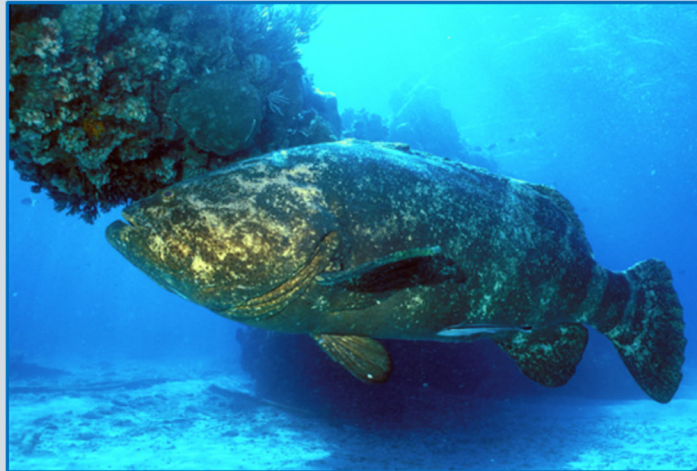


# Goliath Grouper



Review and Discussion  
May 12, 2021



Florida Fish and Wildlife Conservation Commission

Version 2

At recent FWC meetings, Commissioners requested an update on goliath grouper management and expressed interest in discussing potential future harvest. This is a review and discussion of goliath grouper, including an overview of the species' biology and management; a review of the current FWC management goals and metrics; updates on ongoing research; and a review of stakeholder feedback. This presentation also includes a staff recommendation for limited, highly regulated harvest of goliath, which would provide another means of access to this fishery in addition to catch-and-release fishing and dive viewing.

\*\*\* UPDATED PRESENTATION: This presentation has been updated to address public comment received on the topic since April 16, 2021. Additional updates were made to the slides presenting studies from the University of Florida (slide 17) and the University of Miami (slide 18). \*\*\*

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Report date: May 8, 2021

Unless otherwise noted, images throughout the presentation are by FWC.

## Outline

- Overview
- Biology
- Fishery and management
- FWC management goals and metrics
- FWC research update
- Stakeholder feedback on limited harvest
- Staff recommendation regarding harvest



This presentation provides an overview and information on goliath biology; management history of goliath grouper; FWC's management goals and metrics that were adopted in lieu of traditional methods in 2018; an update on Fish and Wildlife Research Institute's (FWRI) research; and stakeholder feedback from extensive 2017 public workshops on a limited harvest proposal. It will conclude with a staff recommendation regarding harvest of goliath, and a request for Commission direction on whether to prepare a draft rule for limited harvest.

## Goliath Require a Different Approach

- Abundance is increasing; positive trend expected to continue
- Vulnerable due to biology
- Rebuilding progress increasing goliath-stakeholder interactions
  - Goliath occur at common fishing sites like artificial reefs
  - Varying stakeholder views are strongly held
- Alternative management goals, metrics and approaches needed
- FWC management philosophy
  - Recognize role in ecosystem
  - Allow access while promoting rebuilding



The goliath grouper fishery is different than other fisheries managed by FWC and, thus, requires a unique management approach for conservation success. Goliath abundance is increasing and this positive trend is expected to continue. However, management approaches must be tailored to address goliath's vulnerability to natural mortality events and overfishing due to their life history characteristics and behaviors. As the population continues to rebuild, interactions with goliath will continue to increase for both anglers and divers. Fishermen, particularly in south Florida, are likely to have more frequent interactions because they fish at many of the same locations where goliath occur and aggregate, like artificial reefs. Stakeholder perceptions of these interactions vary widely across user groups and their views on goliath are strongly held.

FWC evaluates goliath's relative stock status using alternative goals and metrics because the goliath fishery is not suited to traditional fisheries stock assessments for reasons that will be discussed later.

FWC's management of goliath is guided by a two-pronged philosophy. First, the agency recognizes goliath's role in the ecosystem as a large and important predator, and a component that helps maintain healthy, resilient natural reef ecosystems. Second, FWC allows users access to goliath while also promoting continued population rebuilding. Currently, access is provided to anglers through catch-and-release fishing, sightseeing opportunities for recreational divers, and dive ecotourism. In line with the need for alternative management approaches tailored to this stock, unique approaches would be needed to allow limited harvest and provide an additional form of access to this fishery.

The following slides provide context as to why goliath grouper require a unique approach and additional considerations for management based on their life history.

## Distribution and Biology

- Historical range: Florida to Brazil
  - Currently concentrated in south Florida
- Long-lived (37+ yrs)
- Juveniles dependent on mangrove nursery habitat
- Adults have high site fidelity
- Opportunistic feeders
  - Crustaceans and small, non-reef fish make up most of diet
- Susceptible to red tide and cold-weather kills



Historically, goliath ranged from Florida to Brazil, throughout the Gulf of Mexico and Caribbean, with seasonal movements farther north up the U.S. Atlantic Coast. Currently goliath populations are concentrated in south Florida and are uncommon to absent in much of their historical range.

Goliath are long-lived fish, with the oldest documented in 1984 at 37 years old. By that time, larger fish were very rare in the population; thus, it is likely goliath live longer than 37 years, perhaps significantly longer.

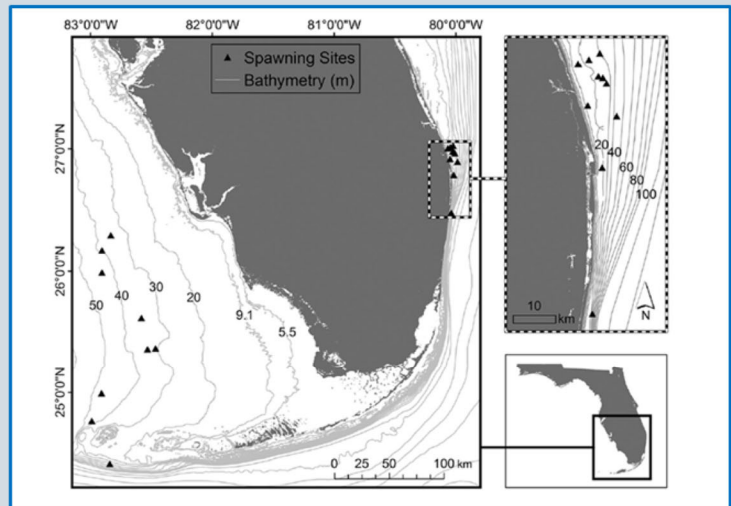
This species is dependent upon estuaries and mangrove habitats for juvenile growth and development. Thus, rebuilding of the stock is reliant upon access to suitable habitat. Adults associate with structure (natural and artificial). Individuals are sedentary and typically inhabit only a small area, like a single reef, which makes them susceptible to over exploitation. This has increased as technology advancements (GPS, sonar) make locating preferred goliath habitat easier for people.

Though they are opportunistic predators, goliath primarily consume crustaceans and fish at lower trophic levels. Benthic invertebrates (mostly crabs, but also lobster in the Florida Keys), and small, non-reef fish comprise the major part of their diet. Snappers and groupers represent less than 1% of their diet.

Goliath are also particularly susceptible to large-scale mortality events caused by red tide and cold weather.

## Reproduction and Spawning Behavior

- Sexual maturity between 3-6 yrs
- Might be hermaphroditic
- Aggregate to spawn July – Sept.
- SE sites attract fish from far away (e.g., south GA)
- Older, larger females particularly important



Source: Koenig et al. 2016



Goliath mature between the ages of three and six years and emigrate from juvenile nursery habitats to offshore waters. Recent research indicates goliath may be like many other groupers in that they begin life as females and some of them later switch to males. This is known as protogynous hermaphroditism. However, further research is needed to confirm these preliminary results.

Like many fishes, goliath form spawning aggregations, which can make them more vulnerable to fishing. These aggregations occur from July through September. Multiple spawning aggregation sites have been identified off Florida. Some spawning sites are present in state waters off Florida's southeast coast. All spawning sites identified off the southwest coast are in federal waters. These spawning sites and aggregations likely attract fish from far distances; in one instance, a goliath was identified as having traveled from southern Georgia to a spawning site off southeast Florida.

Spawning habitats consist of relatively high-relief rocky reefs and artificial reefs (including wrecks and towers) in water depths of 50-165 feet. Researchers found no spawning sites on or near coral reefs along the Florida Keys reef tract, an area where the abundance of goliath seems to be relatively low.

As is the case for many other fishes, older, larger females produce more eggs of higher quality and, thus, are particularly important to stock productivity and resilience. In recent years, researchers have estimated the age of goliath grouper at spawning aggregation sites to be between four and 20 years of age. This indicates a general lack of older females in the population.

## Fishery Background

- Managed by FWC and federal councils
- Severe decline 1950s-1980s caused by:
  - Popular fishing target
  - High catchability
  - Declining juvenile habitats
- Harvest closed in 1990



Photos courtesy of Florida Keys Public Libraries

FWC manages goliath grouper in Florida state waters. The Gulf of Mexico Fishery Management Council (Gulf Council) and the South Atlantic Fishery Management Council (South Atlantic Council) manage goliath in federal waters.

Prior to 1983, there were no regulatory measures specific to the harvest of goliath. In the absence of regulations, the population began declining in the 1950s, which worsened in the 1980s when the fishery expanded quickly and dramatically.

Numerous factors contributed to the decline of goliath, including their increasing popularity as a target species and their tendency to form large aggregations at predictable times, which made them easy to target and catch. The decline of goliath through the 1980s coincided with loss and degradation of juvenile habitat, particularly mangroves. In 1990, managers responded to the decline in abundance by closing harvest of goliath in U.S. state and federal waters.

## Population Rebuilding

- Managers and fishermen observe increasing numbers of goliath
- Attempted to measure rebuilding progress through federal assessments
  - 2004, 2010 and 2016 assessments rejected for use in federal management
- Rebuilding progress has resulted in status changes
  - 2006: Removed from NOAA's Species of Special Concern list
    - Never listed under Endangered Species Act
  - 2018: IUCN status improved from “critically endangered” to “vulnerable”



Managers, researchers, and fishermen have and continue to observe increasing numbers of goliath in Florida. Scientists have attempted to quantify rebuilding progress for goliath since the closure in 1990 through the federal stock assessment process three times (2004, 2010, and 2016). Each assessment was rejected by independent expert reviewers. The federal fishery management councils' scientific advisors also rejected the assessments for use in federal management. Some of the reasons why the assessments were rejected include unknowns about life history (e.g., uncertainty about maximum age), the absence long-term datasets (e.g., landings), uncertainty regarding historical landings, and lack of information about the stock outside the southeastern U.S.

Even though the population could not be assessed through a traditional stock assessment, the available information about stock rebuilding in the U.S. has resulted in two groups changing their status, or categorization, of goliath.

In 2006, NOAA Fisheries removed goliath from their Species of Special Concern list when a status report showed a significant increase in abundance in the U.S. population, with goliath re-establishing themselves throughout their historical range. The Species of Special Concern list was created to identify marine species scientists have concerns about. Goliath has never been listed under the U.S. Endangered Species Act.

In 2018, the International Union for the Conservation of Nature (IUCN), an independent organization, improved their listing of goliath from “critically endangered” to “vulnerable” on their Red List of Threatened Species.

## Recent FWC Discussion and Actions

### 2017

- Reviewed 2016 stock assessment
- Extensive public workshops and online survey

### 2018

- Reviewed public feedback
- Decided to forego harvest at the time
- Adopted alternative management goals and metrics

### Today

- Review recent research
- Consider harvest



*Direction requested*

In 2017, staff provided the Commission a review of goliath grouper biology and the 2016 FWRI stock assessment. The Commission directed staff to hold public workshops gathering feedback about goliath and a potential limited harvest opportunity. FWC held 16 in-person workshops throughout the state, hosted an online workshop, and collected comments through an online survey.

At the April 2018 Commission meeting, staff presented a review of stakeholder feedback from 2017 and early 2018. Public opinion was divided between those who support limited harvest and those who support maintaining a catch-and-release-only fishery. The Commission decided not to pursue a limited harvest at the time, and instead directed staff to develop a plan to improve research on goliath and improve our ability to assess the health of the population.

In December 2018, staff presented and the Commission adopted new management goals and metrics for goliath grouper, which would allow FWC to evaluate the stock through ongoing research. These goals and metrics provide a way to assess goliath without conducting a full-scale traditional fisheries stock assessment.

Since then, goliath has remained a topic of high interest. The Commission has remained engaged in the progress of this fishery and FWC continues to receive requests from stakeholders to allow harvest.

Today, staff will review recent research and data collected since the FWC goals and metrics were adopted. Staff will also present a recommendation for harvest for Commission consideration and request direction on development of a proposed draft rule.

## Current FWC Goliath Management and Assessment

- Unique management addresses
  - Risk of overfishing
  - Natural mass mortality events
- Management philosophy
  - Recognize role in ecosystem
  - Allow access while promoting rebuilding
- Alternative management goals and metrics
  - Not suited to traditional fisheries assessments



As previously mentioned, FWC adopted a unique management approach for goliath. The current abundance of goliath, and its life history characteristics and behaviors put the species at high risk of overfishing, except under a limited, highly regulated harvest scenario. Goliath are also susceptible to natural mass mortality events. For example, the 2009-2010 cold-kill events and the recent 2017-2019 prolonged red tide event likely slowed goliath rebuilding.

FWC's management of the stock is guided by a management philosophy with two major components. First, the agency recognizes goliath's role in the ecosystem as a large and important predator, and as a component that helps establish and maintain healthy, resilient natural reef ecosystems. Second, FWC allows users access to goliath while also promoting continued rebuilding of the population. Although no harvest is allowed at this time, recreational anglers have the opportunity to enjoy catch-and-release fishing for goliath. Dive viewing opportunities for recreational divers and dive ecotourism is maximized and generates value for these participants. As the population continues to rebuild, interactions with goliath will continue to increase for both anglers and divers.

Alternative management goals and metrics were adopted in 2018 because goliath is not suited to traditional fisheries stock assessments. This is due largely to traditional fisheries assessments relying heavily on harvest, and the goliath population having been unable to sustain open-access harvest since 1990. Also, maximum age is an important part of traditional stock assessments, but that information is unknown. Instead, FWC uses five metrics to benchmark goliath's performance against five management goals.

## Measuring Stock Status: Summary of Metrics

Metric	Goal
Relative indices of abundance	Long-term stability or increase for juveniles and adults
Abundance on natural reefs	Increased adult density on natural reefs
Genetic diversity	Increased genetic diversity, low level of inbreeding
Population size	Increased genetic “effective population size” for Atlantic and Gulf stocks
Population age structure	Expanded presence of fish in older age classes



The first metric used to evaluate goliath stock status is relative indices of abundance, with a goal for long-term stability in or increase of juvenile and adult abundance.

The second metric is abundance on natural reefs, with a goal for increased adult density in this habitat.

Genetic diversity is the third metric, with a management goal of increased genetic diversity with low levels of inbreeding.

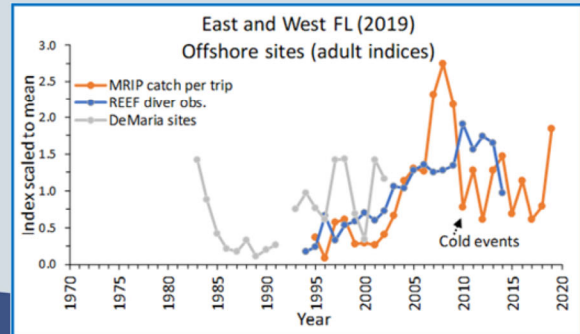
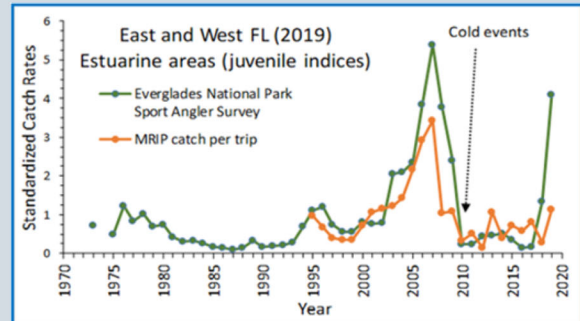
The fourth metric, population size, has a goal of an increased genetic “effective population size” (i.e., minimum ideal population size from a genetic perspective) for Atlantic and Gulf stocks of goliath.

The final metric is population age structure. FWC’s management goal for the population is the expanded presence of fish in older age classes.

This following slides will review current research related to these metrics.

## Measuring Stock Status: Relative Abundance Indices

- Recreational catch rates are a reliable measure of relative abundance
- Juveniles: recreational catch rates
  - Recovery from 2009/2010 cold kill
- Adults: recreational catch rates and diver observations
  - Recovery from cold kill and red tides
- Indices available annually
  - Reviewed at least every 3 years



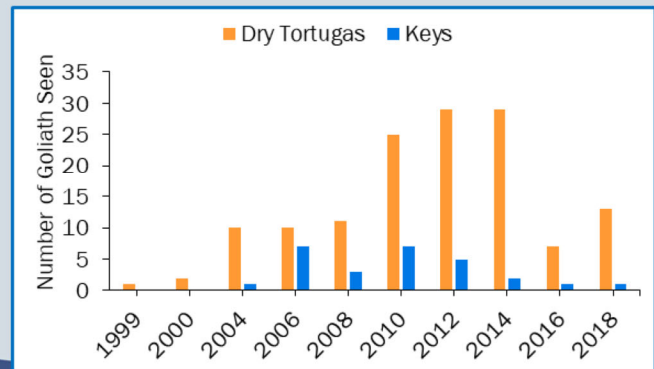
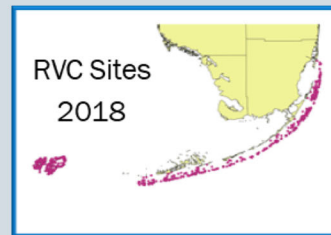
Abundance of juvenile goliath grouper is monitored using the Everglades National Park (ENP) creel survey and the Marine Recreational Information Program (MRIP). Adult abundance is based on catch rates from MRIP and standardized diver observations obtained through Reef Environmental Education Foundation (REEF) programs. These programs provide a longer-term perspective on goliath grouper abundance and allow better evaluation of when the population reaches an equilibrium, steady state.

Juvenile abundance appears to be recovering following the 2009/2010 cold kill event. Adult abundance is also recovering following the cold kill, the prolonged 2017-2019 red tide event, and other less severe red tide events.

Data to generate these indices are available annually and are reviewed at least every three years.

## Measuring Stock Status: Reef Visual Census

- Reef visual census (RVC) conducted on natural reefs
- Recolonization of natural habitats key indicator of rebuilding
- Very low numbers on natural reefs
- Other studies have shown higher numbers on artificial reefs
- RVC data collected every other year, reviewed at least every 5 years



FWC has conducted a reef visual census (RVC) of fish communities in the Florida Keys and Dry Tortugas since 1999. The top figure map on this slide shows the reefs surveyed in 2018 (in pink) as an example.

Recolonization of natural reefs is a key indicator of stock rebuilding. Throughout the RVC survey, goliath have been relatively rare and the mean occurrence rate for the Keys is 2.0% while the Dry Tortugas is slightly higher at 4.5%. Ninety-five percent of stations where goliath occurred consisted of a single individual. These data confirm goliath continue to be fairly rare on what we would expect to be suitable natural habitat.

Other research has shown the abundance of goliath grouper is higher on artificial reefs compared to natural reefs. A study off the central west coast of Florida, completed in 2010, found the mean number of goliath observed at artificial reefs sites was 4.53 versus 0.45 over natural habitat.

The RVC is conducted every other year. This metric is reviewed at least every five to seven years.

## Measuring Stock Status: Genetic Diversity and Population Size

- Genetic samples from fin clips
- Useful for tracking rebuilding and population size
- 850+ fish genetically analyzed to date
  - Low to moderate levels of genetic diversity
  - Goal: collect 250 samples from juveniles and adults on each coast for 5 yrs (2500 total)
- More complete results expected in 5-7 yrs



Angler Fin  
Clip Kit



FWC Reporter  
App



The metrics of genetic diversity and population size are closely linked. Both are evaluated using genetic samples taken from fin clips, a non-lethal sampling method.

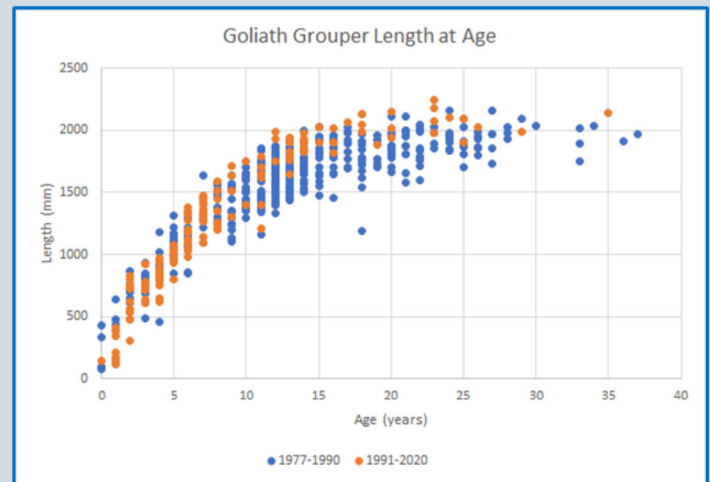
Samples from over 850 fish have been analyzed and show low to moderate levels of genetic diversity. These preliminary findings are consistent with a population that was fished down to relatively few individuals and is in the process of rebuilding. However, more genetic samples from a wider area are needed to further evaluate this issue.

FWC is also testing the feasibility of using close-kin analysis, a novel approach to ecological assessment, to estimate goliath population size since this species is not amenable to traditional fishery stock assessments. This analysis will require a total of 2,500 genetic samples (250 per year for juveniles and adults on each coast for a 5-year period). Genetic sample collection and analysis should be complete to inform population modeling efforts after five to seven years.

Finally, the goliath grouper reporting module in the FWC Reporter App allows fishers and divers to provide georeferenced data/photos on goliath grouper sightings.

## Measuring Stock Status: Population Age Structure

- Long-term rebuilding requires rebuilding of older age classes
  - By 1990 moratorium, very few older fish
- Current age structure of population is missing older age classes
- Long-term goal: keep survival high so older age classes can rebuild over time
- Older age classes likely not rebuilt for at least another 10 years



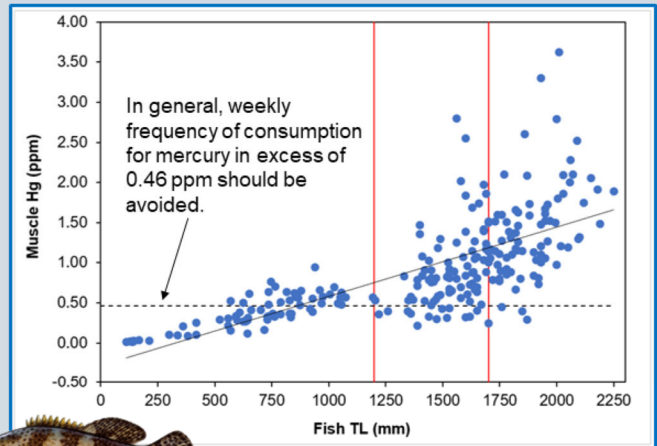
Long-term rebuilding requires the rebuilding of fish in older age classes. By the time harvest was closed, there were very few old fish left in the population. The oldest known fish was harvested in the late 1980s and was aged to be 37 years old. The true maximum age for goliath is likely much older. Fish spawned during the first year of the moratorium would be 31 years old today.

The current age structure of the population is missing fish in the older age classes. Only three goliaths aged after 1990 have been older than 25 years. To achieve the long-term goal of having older fish in the population, survival rates must be high.

Since there are currently few older fish in the population (i.e., most fish at spawning aggregations are between four and 20 years old), no improvement toward this goal is expected for at least 10 years.

## Goliath Consumption and Mercury

- Florida Department of Health (DOH) issues fish consumption advisories
- Current advisories for many snapper and grouper species open to harvest
- Advisories likely needed if goliath were open to harvest
- Risk depends on frequency of consumption, size of fish consumed and other factors (such as pregnancy)



Data from FWC and Malinowski, 2019

In past discussions, many stakeholders asked about mercury levels in goliath. Like many large-bodied fish in Florida, mercury levels in larger goliath are elevated and if harvest was allowed, FWC would need to work with the Florida Department of Health (DOH) on potential consumption advisories. Currently, the DOH has consumption advisories for several marine fish species open to harvest, including groupers, snappers, mackerels, and tunas. In general, mercury levels above 0.46 parts per million (ppm) are considered a threshold above which consumption advisories may be warranted. The risk of negative human health affects from mercury consumption depends on several factors such as frequency of consumption, age, and other factors like pregnancy.

The figure on the slide displays results of mercury testing in goliath. The x-axis corresponds to fish length and the y-axis corresponds to the level of mercury detected. Each blue point represents a goliath that was sampled for mercury. The horizontal dashed line indicates the 0.46 ppm mercury concentration. The vertical red lines in the graph shown on the slide correspond to a slot size of 47-67 inches, which was presented at public workshops conducted in 2017.

## Stakeholder Perspectives

- Values and perceptions of goliath vary
  - Catch-and-release
  - Harvest
  - Nuisance
  - Ecotourism
  - Important for ecosystem
  - Conservation a priority



Goliath is a high-interest topic for many stakeholders. These stakeholders value the fish differently and have strongly held, widely varying perspectives and opinions about its management. This was evident in a 2013 University of Florida and Florida Sea Grant study, the 2017 FWC statewide public workshops and survey, and in public comments made to FWC.













Some anglers may place high importance on the value of the current catch-and-release fishery, and thus they support status quo management. Other anglers desire the unique opportunity to recreationally harvest goliath. For some, the interest in harvest is linked to their perspective that goliath is a nuisance species competing with them for catch and taking hooked fish off lines at their desired fishing grounds.

There are many people, especially in the dive community, who want to preserve goliath for ecotourism. Diving to view goliath is a popular activity for recreational divers and part of the business model for some dive charter operators. Divers are attracted to goliath because they are large, sedentary fish and they tolerate divers in close proximity, even while in spawning aggregations.

Others think goliath should be preserved for their role as a large predator in the marine ecosystem. Some have concerns about the absence of goliath from its historic range outside Florida, which includes the Gulf of Mexico, Caribbean, and the northern part of South America. The population of goliath off Florida may contribute recruits to the historical range and help seed rebuilding in other areas.

Many who value goliath grouper for reasons not related to harvest feel that goliath grouper should be a conservation priority of the agency.

## 2013 Stakeholders Perspective Study by UF

	Perceived impact of goliath on environment	Opinion on limited harvest	View of interactions with goliath
Recreational anglers			
Recreational spearfishers			
Commercial spear and hook-and-line harvesters			
Sightseeing divers/charters			



The 2013 University of Florida and Florida Sea Grant study, which was sponsored by FWC, used an in-depth stakeholder survey and stakeholder workshops with invited participants to attempt to better understand and manage stakeholder conflict surrounding goliath. Almost 6,000 people participated in the survey and all stakeholder groups were represented.

As mentioned, this study found stakeholder experiences and attitudes toward goliath were diverse, particularly within recreational fishing groups.

Recreational anglers who participated in this study had moderately few interactions with goliath and most viewed interactions with the fish as positive or neutral. Only 11% of anglers surveyed said they actively target goliath for catch-and-release fishing. Recreational anglers' attitudes toward reopening the fishery were very diverse and, on average, only moderately supportive of reopening the fishery due to personal interest in harvesting goliath caught incidentally and resource-use oriented beliefs.

Recreational spearfishers tended to have frequent interactions resulting in lost catch and gear damage and more people in this group viewed interactions with goliath as negative. This perception was shared by commercial spear and hook-and-line fishermen. These three groups reported attempting to avoid interactions by choosing different fishing locations or modifying fishing techniques, with mixed success. They also believed goliath had a negative impact on the ecosystem. These groups were strongly supportive of reopening goliath to harvest.

Almost all sightseeing divers and dive charter operators viewed interactions with goliath as positive and many actively sought out the fish. They perceived goliath as contributing to biodiversity. Thus, they were strongly supportive of keeping the fishery closed. Non-fishing conservation organizations shared this perception. Also of note, most dive charter operators view goliath as having a positive impact on their business and, therefore, see economic benefit to maintaining the closure.

# University of Miami Willingness to Pay (WTP) Studies

## WTP for open-access harvest tags

- Recreational anglers = \$34 to \$79

## WTP for dive trips with goliath encounters

- Florida residents
  - Single goliath = \$103
  - 40 goliaths = \$202
- Non-residents
  - Single goliath = \$156
  - 40 goliaths = \$336



Researchers with the University of Miami conducted two studies on goliath grouper that included an examination of willingness to pay (WTP) in an attempt to put a dollar figure on how recreational anglers and sightseeing divers value goliath. WTP is the maximum price at or below which a consumer will definitely buy a product or service.

Their 2015 study focused on recreational anglers and attempted to quantify their beliefs concerning goliath. It included an examination of their WTP for an open-access tag to harvest a single goliath. The mean WTP was estimated to be between \$34 and \$79 for an individual harvest tag. The study's authors suggest WTP could be higher if only a limited number of tags were available to harvesters.

Their 2016 study focused on sightseeing divers and the dive industry in east Florida. It examined WTP for dive trips during the goliath spawning season (August – October) that featured various attributes, including encountering one or 40 goliath groupers. The study found Florida residents' WTP to be around \$103 for a single goliath and \$202 for a dive trip with 40 goliaths. Non-residents were estimated to have a higher WTP at around \$156 for a single goliath and \$336 for a dive trip with 40 goliaths.

## 2017 FWC Public Workshops

**Goal:** Gather public input on goliath management and a limited harvest scenario

- 16 in-person workshops with survey
  - 520 attendees and 470 took survey
- Virtual workshop with survey
  - 1,100 views and 340 surveys completed
- Participants included fishers and non-fishers
  - Reported interactions with goliath throughout the state
- Additional 5,000+ comments received



When FWC sought public input on goliath, management of the fishery, and a potential limited harvest scenario in 2017, the effort was extensive. Staff held in-person workshops at the following 16 locations: Pensacola, Panama City, Carrabelle, Tallahassee, Crystal River, Pinellas Park, Port Charlotte, Naples, Key West, Marathon, Key Largo, Lake Worth, Davie, Stuart, Titusville, and Jacksonville. At these public workshops, participants could provide comments anonymously by submitting responses to a survey using the iClicker system. Approximately 520 people attended the workshops, and 470 attendees took the survey.

The public also had the opportunity to attend a virtual workshop and take the survey online. The virtual workshop was viewed almost 1,100 times (as of Feb. 27, 2018). The online survey was completed 340 times.

Participants in the workshops and survey were a diverse group, including recreational anglers, recreational spearfishers, for-hire captains, commercial fishermen, sightseeing divers (non-harvesters), and concerned citizens. They reported interacting with goliath grouper from Crystal River through the Keys and up to Cape Canaveral. The most common types of interactions reported by survey respondents included trying to keep goliath from taking fish off their line, sightseeing dive trips for goliath, and targeting the fish for catch-and-release.

Over 5,000 additional comments on goliath were received through FWC online commenting portals, email, phone calls, and traditional mail.

Again, these comments revealed highly varied personal management philosophies for goliath among stakeholders. They ranged from support for a limited harvest and support for maintaining status quo (catch-and-release only).

## Limited Harvest Scenario for 2017 Workshops

- State waters and recreational hook-and-line harvest only
- Limited to 100 fish per year for four years
- Administered through harvest tags
  - Random draw
  - Charge up to \$300 per tag
- Slot limit: 47–67 inches
- Harvest not allowed during spawning months or at spawning aggregation sites



In 2017, staff presented a possible limited, highly regulated harvest scenario to the Commission, and then the public during the 2017 workshops and survey.

In the scenario, the limited harvest of goliath would be allowed while the population continued rebuilding. Possibilities for the limited harvest scenario presented in 2017 were:

- State waters only (FWC does not have authority to allow goliath harvest in federal waters).
- Limited to hook-and-line gear and for recreational purposes (i.e., no commercial harvest or sale).
- Harvest limited to 100 fish per year for four years.
- Administered as a harvest tag program.
  - Tag recipients could be selected via random draw.
  - Once selected, tag recipients could be charged a fee up to \$300 per week, per 379.354(8)(f), Florida Statutes. Fees could be used for goliath research.
  - Tag recipients could be required to obtain a recreational fishing license.
- Limited to fish within a 47 to 67-inch slot limit. Fish within this slot would range from 70 to 200 pounds.
- Harvest prohibited during spawning months of July – September or from spawning aggregation sites.

The 2017 FWC in-person and online survey found similar results as the 2013 University of Florida and Florida Sea Grant survey and workshops. Stakeholder opinions about goliath grouper and reopening of the fishery were highly varied.

## Stakeholders Supporting Status Quo (No Harvest)

### Feedback for why they support no harvest

- Important part of the ecosystem
- Valuable recreational dive viewing opportunity
  - Significant economic benefit through dive tourism
- Consumption could be harmful due to high mercury levels
- Rebuilding not complete throughout historic range
- Harvest should never be allowed
- Because they are vulnerable to overfishing, more conservative management needed



*Public feedback in 2021 is similar*



The 2017 FWC survey found stakeholders who supported maintaining status-quo (no harvest) viewed goliath as an important part of the reef ecosystem, helping increase species diversity and density around reefs. Many of these stakeholders valued goliath for sightseeing dive opportunities and noted the species provides a significant economic benefit through dive tourism.

Some who supported status quo noted human health concerns regarding consumption of goliath due to high levels of methylmercury in large grouper. (Note: Mercury in goliath is addressed on slide 22.)

Additionally, many stakeholders felt goliath rebuilding is not complete throughout their historic range, and the species should still be considered endangered and overfished. There were also some who thought harvest should never be allowed. The majority of this group of stakeholders stated that because goliath are vulnerable to overfishing, goliath should have more stringent management than other species.

The respondents who opposed harvest self-identified as recreational anglers and spearfishers, commercial fishermen, charter captains, recreational divers, environmental NGOs, and concerned citizens.

Public feedback received in 2021 from those who support status quo management is similar to the feedback heard in 2017.

## Stakeholders Supporting Limited Harvest

### Feedback for why they support harvest

- Moratorium achieved goal and population rebuilt in Florida
- Overpopulated and harming ecosystem
  - Harvest is needed to increase reef health
- Nuisance and/or aggressive to fishers
- Want people to have the opportunity to harvest
- Should be open if science supports a harvest



*Public feedback in 2021 is similar*



The 2017 FWC survey found stakeholders who supported a limited harvest opportunity believed the current harvest moratorium had achieved its goal and the population has rebuilt in Florida. In their opinion, goliath was now overpopulated in Florida and contributing to the decline of reef ecosystems and biodiversity.

Some who supported harvest viewed goliath as a nuisance, because they steal fish off fishing lines or spears, making it difficult to catch other fish. Some felt goliath are aggressive on reefs and pose a danger to divers.

Others felt harvesting goliath would allow a unique fishing opportunity and a way to land a true trophy fish. Some respondents believed the fishery should reopen to harvest if science shows it would be sustainable.

The respondents who supported limited harvest self-identified as recreational anglers, spearfishers, charter captains, and divers (including recreational and commercial).

Public feedback received in 2021 from those who support harvest is similar to the feedback heard in 2017.



# Future of Goliath Management



## Federal management

- Councils have no immediate plans to consider harvest in federal waters
- Acceptable Biological Catch (ABC) remains zero
  - Includes state and federal waters

## FWC management

- Monitor stock relative to FWC management goals and metrics
- FWC can allow harvest in state waters



Stakeholder interest in goliath remains high. These stakeholders want to know what future management actions will be taken for this fishery in federal and state waters.

The federal councils have no plans to consider allowing harvest of goliath in federal waters. It is unlikely the federal councils will revisit the Acceptable Biological Catch (ABC), or the amount of fish the federal councils deem can sustainably be harvested from the population each year, any time soon. Thus, the federal ABC remains at zero and the councils cannot allow harvest in federal waters.

FWC will continue to utilize the alternative management goals and metrics adopted in 2018 to monitor the status of the goliath stock. FWC could allow harvest of goliath grouper in state waters, even if the fishery remains closed in federal waters.

## Considerations for Including Harvest in Future Management

- Stock becoming more abundant, especially on artificial reefs
  - Increased interactions expected
- Vulnerable to overfishing
- Limited harvest would provide a new opportunity while continuing rebuilding
  - Rebuilding strategies typically include harvest
  - Stakeholder opinions highly variable
  - Population monitored with new metrics



Management of goliath remains controversial and challenging due to many factors. The following points are considerations for next steps in management of this fishery, particularly regarding potential harvest.

Goliath is a rebuilding stock, becoming more abundant in parts of Florida, especially on artificial reefs. As abundance increases, fishermen and divers are expected to have more frequent interactions and conflicts with goliath. Even though goliath primarily feed on crustaceans and bait fish, they are opportunistic predators and will continue taking advantage of hooked or speared fish.

Goliath are vulnerable to overfishing under open-access harvest scenarios because they are easy to locate, the population remains relatively small, and they are slow growing and long lived. Goliath can also be impacted by natural events and cold kills.

Though an open-access harvest is not advised, a limited harvest is possible while the population continues rebuilding and would provide a unique recreational fishing opportunity in Florida state waters. In fisheries management, rebuilding strategies typically include harvest (e.g., red snapper, king mackerel). If allowed, harvest would be another means of providing access to the fish in line with the agency's management philosophy for goliath. However, it is unlikely to reduce goliath conflicts with fishers as harvest would need to be very limited. Also, it likely will satisfy very few stakeholders given their highly variable opinions regarding harvest.

Lastly, FWC will continue monitoring the population through the metrics adopted in 2018. A traditional stock assessment is not needed to advise or allow a limited harvest. Standard fisheries management goals, like spawning potential ratios (SPR), are not suitable for goliath, nor are they required to inform our management of this fishery. While a limited harvest could provide some useful data, it will not gather the data needed for a traditional stock assessment that can pass expert review for use in federal management.

## Staff Recommendation

- **Continue ongoing efforts to:**
  - Recognize goliath's role in ecosystem
  - Promote stock rebuilding
  - Allow catch-and-release opportunities
  - Preserve ecotourism and dive viewing opportunities
  - Monitor stock status using alternative metrics
- **Add access opportunity via limited harvest**

*If directed, staff will return with a draft rule for limited harvest at a future meeting*



Staff recommends the Commission continue following the management philosophy of recognizing goliath's role in the ecosystem as a large and important predator and component that helps establish and maintain healthy, resilient natural reef ecosystems, and allowing users access to goliath while also promoting continued population rebuilding. This would mean continuing to allow catch-and-release opportunities, dive viewing opportunities, and ecotourism for goliath. Staff also recommends and plans to continue monitoring the status of goliath grouper using FWC's alternative metrics.

Staff also recommends providing an additional access opportunity for the public through a limited, highly regulated harvest, similar to the scenario presented to stakeholders at workshops in 2017. This would be in line with FWC's goliath management philosophy.

This strategy would allow FWC to manage this fishery for a diversity of values.

If directed, staff will develop a draft rule for limited harvest of goliath for the Commission's consideration at a future FWC meeting.