

Goliath Grouper Awareness

Distinctive Specialty Course

Student
Guide

Goliath Grouper Awareness

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Introduction

The Atlantic Goliath Grouper is a very important and conspicuous member of reef communities throughout the western Atlantic and Caribbean. This species is found in shore, reef, mangrove, seagrass, and estuarine habitats. The Goliath Grouper is totally protected from harvest and is recognized as a “Critically Endangered” species by the World Conservation Union (IUCN). The IUCN concludes that the species has been “observed, estimated, inferred or suspected” of a reduction of at least 80% over the last 10 years or three generations.

This Study Guide takes you down with the Atlantic Goliath Grouper. Read on to discover what makes Atlantic Goliath Grouper unique and find out that, they play a crucial role in keeping our shallow reef healthy.

This Study Guide takes you through the management strategies that can help protect Atlantic Goliath Grouper and, best of all, the many actions you can take to give Atlantic Goliath Grouper a fighting chance.

You will learn about Atlantic Goliath Grouper in Florida region and the local issues that may be harming them. Complete the course to receive PADI certification as a [Goliath Grouper Awareness Diver](#).

Not a diver? No problem! Everyone can help the Atlantic Goliath Grouper through their personal actions and purchase decisions, this Study Guide shows you how. You will receive a certificate of participation and who knows, perhaps be inspired to become a diver!

So read on and discover why the Atlantic Goliath Grouper deserve your friendship. We hope this Study Guide will inspire you to take action.

Let's know more about our friends!

Biology

Appearance

Goliath grouper are the largest members of the sea bass family in the Atlantic Ocean. The body is robust and elongate; its widest point is more than half its total length. The head is broad with small eyes. The dorsal fins are continuous with the rays of the soft dorsal longer than the spines of the first dorsal fin.

The membranes between the dorsal fin elements are notched. Pectoral fins are rounded and noticeably larger than the pelvic fins. Bases of the soft dorsal and anal fins are covered with scales and thick skin. The caudal fin is rounded.



Picture by Alejandro E. Otero

Coloration

Atlantic Goliath Grouper is generally brownish yellow, gray, or olive with small dark spots on head, body, and fins. Large adults are somber-colored.

Three or four irregular faint vertical bars are present on the sides of individuals less than 3 feet (1m) in length.

The rear half of the caudal peduncle of these small individuals is covered by another similar bar. The tawny colored juveniles, although not as colorful as some grouper species, are attractively patterned; exhibiting a series of dark,



Picture Alejandro E. Otero

irregular, vertical bands and blotches. Groupers try to avoid their predators by using their coloration to their advantage and hiding.

They can do this by changing their coloration quickly according to the environment and mood that they are in, by moving into an area that is inaccessible by their prey and by using their coloration as camouflage.

Dentition

Goliath grouper have three to five rows of teeth in the lower jaw. The presence of a number of short weakly developed canine teeth is useful in distinguishing this species from other North Atlantic groupers.

Age and size

The oldest verifiable goliath grouper on record is 37 years old. However, this specimen was sampled from a population of individuals depressed by fishing pressure and it is projected that goliath grouper may live much longer, perhaps as much as 50 years.

Males achieve sexual maturity at four to six years of age and lengths of 43-45 inches (110-115 cm), females at six to seven years of age and 47-53 inches (120-135 cm).

Growth rates are slow, averaging approximately four inches (10 cm) per year until the age of six years. Growth declines to about 1.2 inches (3 cm) per year at age 15, and less than 0.4 inches (1 cm) per year after 25 years.

Geographical Distribution

The goliath grouper occurs in the western Atlantic Ocean from Florida south to Brazil, including the Gulf of Mexico and the Caribbean Sea. It is also found in the eastern Atlantic Ocean, from Senegal to Congo although rare in the Canary Islands.

The goliath grouper prefers shallow areas, inshore waters to depths of 150 feet (46 m), areas of rock, coral, and mud bottoms. Strikingly patterned juveniles inhabit mangroves and brackish estuaries, especially near oyster bars. The goliath grouper is notable as one of the few groupers found in brackish waters. This fish is



Picture Alejandro E. Otero

solitary by nature, with the adults occupying limited home ranges. It is territorial near areas of refuge such as caves, wrecks, and ledges, displaying an open mouth and quivering body to intruders.

Additional warning may be delivered in the form of the goliath grouper's ability to produce a distinctly audible rumbling sound generated by the muscular contraction of the swim bladder. This sound travels great distances underwater and is also used to locate another goliath grouper.

Goliath Groupers are also present in the eastern Pacific Ocean from the Gulf of California to Peru.



Picture by Jerome Israel

Distribution MAP



Map by iucnredlist.org

Food Habits

Goliath grouper feed largely on crustaceans (*in particular spiny lobsters, shrimps and crabs*), fishes (*including stingrays and parrotfishes*), octopus, and young sea turtles. Prey is ambushed, caught with a quick rush and snap of the jaws. The sharp teeth are adapted for seizing prey and preventing escape although most prey is simply engulfed and swallowed whole.

Reproduction

Many groupers are protogynous hermaphrodites – (*a condition in which individuals first mature as females only later to become males*) And although goliath grouper are assumed to conform to this reproductive mode. However, the significance of this finding is of diminished value when one considers that transitional individuals are known to be rare amongst confirmed species of protogynous hermaphrodites, such as other grouper species.

Additionally, exceptions to the rule of protogyny within a species may be common. There are three potential exceptions that may explain why some sexually mature male goliath groupers are smaller than some mature females: a scenario that at first would seem to be contradictory for a protogynous hermaphrodite.



Picture by Jerome Israel

*Coral bottoms are a preferred habitat of the
Goliath Grouper*

- 1) An individual's failure to recognize certain environmental cues or the absence of those environmental cues altogether may mean that sex change is never initiated.
- 2) Some females may transition to the male condition prematurely, i.e., they never attain sexual maturity as a female.
- 3) The size at sex reversal may vary amongst populations.

Spawning occurs during the months of August through mid-October throughout the goliath grouper's range. The females release eggs while the males release sperm into the open offshore waters. After fertilization, the eggs are pelagic, dispersed by the water currents. Upon hatching, the larvae are kite-shaped, with the second dorsal-fin spine and pelvic fin spines greatly elongated. These pelagic larvae transform into benthic juveniles at lengths of one inch (2.5 cm), around 25 or 26 days after hatching.

Predators

Predators of groupers include large fish such as barracuda, king mackerel and moray eels, as well as other groupers. The sandbar shark (*Carcharhinus plumbeus*) and the great hammerhead shark (*Sphyrna mokarran*) are also known to feed on groupers. Large adults of this species likely have very few natural predators.

Conservation Status

The large size, slow growth, low reproductive rate, and spawning behavior have made the goliath grouper especially susceptible to overfishing. The goliath grouper is totally protected from harvest and is recognized as a “**Critically Endangered** (*Very Highly Vulnerable to Extinction*)” species by the World Conservation Union (IUCN).

Furthermore, the IUCN concludes that the species has been “observed, estimated, inferred or suspected” of a reduction of at least 80% over the last 10 years or three generations. [Click here](#)



Vulnerability

In U.S. waters, this species experienced a two-generation length time period of severe decline from the 1950s to the early 1990, during which the population declined to near-zero or by at least 84%.

Take of this species has been prohibited since 1990, and the species has been protected in the Caribbean since 1993 and the population has been mostly increasing as a result but is not yet fully recovered.

Historical exploitation of goliath grouper annual spawning aggregation sites greatly reduced the number of reproductive adults.

Outside of U.S. waters, conservation measures are not sufficient to allow recovery or to prevent continued declines. This species is suspected to have declined on a global level by at least 30% or more which covers a time period of about three generation lengths (at least 64.5 years). As goliath grouper are slow growing and require several years to reach sexual maturity, recovery for this species is expected to be slow.

Abundance declined after 2007 until 2011, and despite some upward trends, abundance remains low overall. A severe red tide event on the West Florida shelf in 2005 and cold kills in 2008 and 2010 in South Florida estuaries are thought to be the drivers of these declines.

Fisher compliance to the moratorium, however, was found to be lower than 90%, which led to a prediction of less than a 40% chance that the population would recover to the 50% population recovery benchmark by 2020. You can check the [Summary statistics of the vulnerable biomass and spawning stock biomass](#).

A study conducted in Florida reported that mean mercury concentrations in individuals of this species were within the range known to cause direct health effects in fish after long-term exposure and concluded this could cause stress on their populations.

Aggregations:

In the southeastern U.S., spawning aggregations occur at the same localities in relatively shallow 3ft – 165ft (10-50m) water from August through mid-October and is strongly influenced by the lunar cycle. *Spawning goliath grouper form impressive offshore aggregations of up to 150 or more individuals.* Shipwrecks, rock ledges, and isolated patch reefs are preferred spawning habitat and there is no evidence that spawning occurs outside of aggregations.



Picture by Alejandro E. Otero

In the 1980's these aggregations reached a low of less than 10 individuals per site as fishing pressure greatly impacted this species. Since receiving legislative protection, the spawning aggregations of goliath grouper have risen to 20-40 individuals per location. Aggregations have been detected during the austral summer (December to March), with peaks in January and February in shallow waters <99ft (<30 m depth) in many regions around southeastern Caribbean.

Many spawning aggregations sites have been identified in the U.S. Atlantic and Gulf.

Extinction

Human activities threaten the sustainability of reef fish populations either directly by intense exploitation, or indirectly by affecting habitat quantity and quality. The synergy of these activities has had a pronounced impact on the Atlantic goliath grouper, causing economic extinction in the United States, endangerment throughout the rest of its range in the western Atlantic, and probable biological extinction in west Africa.

Overfishing is a major threat to this species, and its susceptibility to rapid population decline is increased due to heavy exploitation of spawning aggregations. Mangrove coverage, which is responsible for biomass production of this species, has been reduced by at least a third since the 1970s to 1990s, and much more of the habitat is unsuitable as juvenile habitat because of anthropogenic impacts.

Most common threats:

- Residential & commercial development	- Housing & urban areas
- Commercial & industrial areas	- Biological resource use
- Fishing & harvesting aquatic resources	- Natural system modifications
- Other ecosystem modifications	- Climate change & severe weather
- Temperature extremes	

[For further information read supplementary material](#)

Some facts about Goliath Grouper

- The Goliath Grouper, *Epinephelus itajara*, is the largest Grouper in the western hemisphere, and can reach **8 feet in length and more than 1,000 pounds**.
- These adaptable fish can live in brackish water and tolerate low oxygen levels.
- A 4.6-foot-long female caught at a spawning aggregation contained **57 million eggs**.
- Individuals can travel **100 miles to spawn**.
- Goliath grouper is a “**no take**” species in the United States.

Can you eat Goliath Grouper?

Goliath grouper is a protected species. FWC rules stipulate that harvest and possession of Goliath Grouper is prohibited. 40% of goliath grouper caught in the Southern Caribbean had mercury levels exceeding the U.S. - recommended levels for human consumption.

Are Goliath Grouper dangerous?

Anything in the wild can be dangerous. Groupers won't bother you if you don't bother them. Large individuals of this species should be treated with caution. As far as science says groupers are only dangerous if you eat them. Large groupers in the Caribbean are linked to increased risk of *Ciguatera** poisoning.

** **Ciguatera fish poisoning** is an illness caused by eating fish that contain toxins produced by a marine microalgae. Symptoms of ciguatera poisoning generally begin six to eight hours after eating the contaminated fish. Symptoms include: Nausea, vomiting, diarrhea, muscle pain, numbness, tingling, abdominal pain, dizziness, and vertigo.*

Environmental guidelines for diving with Goliath Grouper.

When diving with Goliath Grouper avoid actions that may disrupt natural behavior or damage the environment. When you see Goliath Grouper they may be feeding, resting or courting. Disrupting these natural behaviors may affect their health and may subject divers to risk of serious injury.

Follow these environmental guidelines when diving with Goliath Grouper:

- Follow AWARE's Ten Ways A Diver Can Protect the Underwater Environment. [Visit Project aware web page](#)
- Follow AWARE's Ten Tips for Underwater Photographers. [Click here](#)
- Complete further training such as [Peak Performance Buoyancy](#) or [Underwater Naturalist](#) courses to improve your skills and expand your knowledge of underwater environments.
- Be always an AWARE diver
 - ° Do not block their movement by swimming in front of them, allow them to move away
 - ° Do not block their exit if they are inside a cave or overhang.
 - ° Be familiar with and follow local regulations and protocols.
 - ° Do not get close to Goliath Grouper.



How to protect Goliath Grouper – Conservation actions.

Actions include a focus of attention on vulnerable life history stages, such as spawning aggregations or nursery areas, and promotion of marine reserves to protect spawning biomass and critical habitats. Focused campaigns are being developed for the most vulnerable species. Spawning aggregation sites should be a priority for conservation.

This species has been recorded in several marine protected areas. Offshore wrecks might be associated with spawning sites. If they were spawning sites and goliath grouper actually migrate to them, then they might be more reflective of the population in a broader area.

Improvements in fisheries monitoring and management are needed outside U.S waters, and the closure of the U.S. fishery should remain in place, especially since we suspect that at least an 80% population reduction could occur within the next three generations should the current management be removed.

Spawning Goliath groupers aggregation sites and mangrove preservation/restoration should be priorities for conservation. The change in status from the previous assessment reflects an improved application of the IUCN Red List Categories and Criteria, as well as a better understanding of available data.



Picture by @fercas_films

What you can do:

- Spread the word about the importance of Goliath conservation
- Encourage friends to take this program
- Share with others everything you learned in this program
- Support genuine ecotourism operations
- Be an AWARE diver
- Join campaigns
- Learn more about marine life. Expand your knowledge of underwater environments by additional programs such [AWARE – Coral Reef Conservation](#) or [Project AWARE specialist](#).
- Support Project AWARE Join the Movement: Join thousands of divers around the world protecting our ocean. Visit www.projectaware.org



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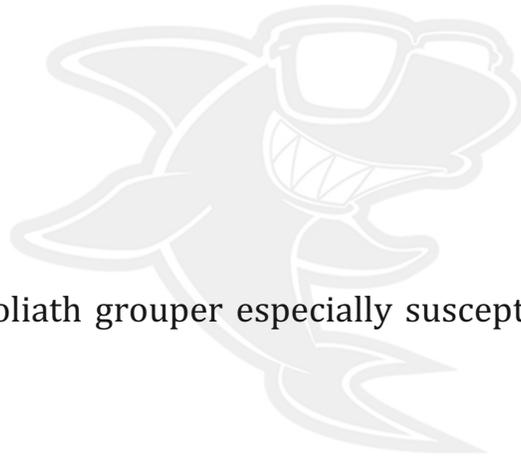


Goliath Grouper Awareness Knowledge Review

Answer the following questions. Your instructor will review your answers with you.

1. How Goliath Groupers avoid their predators?
2. What disting Goliath Grouper from other groupers in North Atlantic?
3. The oldest verifiable goliath grouper on record is?

4. which are the three exceptions that may explain why some sexually mature male goliath groupers are smaller than some mature females?



5. What may the goliath grouper especially susceptible to overfishing?

SQUALO
D I V E R S

6. Why Goliath Grouper was recognized by the World Conservation Union (IUCN) Goliath Grouper as a “Critically Endangered (*Very Highly Vulnerable to Extinction*)” Specie?

7. When Goliath Grouper spawning aggregations occur?

8. List what is the major and the common threats to the Goliath Groupers?

9. List at least 4 environmental guidelines for diving with Goliath Grouper?

10. List at least 6 conservation activities that can help to protect and preserve this specie.

1.	4.
2.	5.
3.	6.

Student Statement: I've completed this Knowledge Review to the best of my ability and any questions I answered incorrectly or incompletely I've had explained to me, and I understand what I missed.

Name: _____ Date _____

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Guide to Impacts on Goliath Grouper

Use this guide to assess your dive location for features and characteristics that may have **positive or negative impacts on Goliath Grouper**. These are only some of the potential impacts to Goliath Grouper; add additional impacts to this list that are found in your location.

POSITIVE Impacts	How
Marine Protected Areas	MPAs give Goliath Groupers a safe place to replenish their populations
National Parks	National Parks protect coastlines and also protect mangroves a youth Goliath Groupers habitat.
Sewage and wastewater treatment plants	Reduces the amount of nutrients entering in the ocean
Waste management facilities	Gross Pollutant traps prevent rubbish/litter in streams and stormwater drains from entering the ocean
Litter education programs	Reduction in public littering on land leads to less marine debris
Dive tourism	Places an economic value on protecting Goliath Grouper and increases public awareness of threats.
Ecotourism	<ul style="list-style-type: none"> - Reduced environmental impacts through waste reduction and sewage management. - Educates guests about conservation issues.

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Guide to *Impacts on Goliath Grouper*

POSITIVE Impacts	How
Conservation groups	<ul style="list-style-type: none"> - Raises public awareness of environmental concerns. - Builds community support for environmental conservation. - Lobbies government to increase protection.
Mooring lines	Protects substrates from anchor damage
Active dive community	<ul style="list-style-type: none"> - Strong voice in campaigns for marine protected areas. - Divers can improve public awareness of Goliath Grouper issues through stories and photographs - Improve Goliath Grouper through underwater marine debris removal - Divers become advocates for marine conservation. - Increased diver knowledge of issues through training courses and dive trips
Land-based volunteer groups	<ul style="list-style-type: none"> - Complete foreshore cleanups resulting in a cleaner ocean. - Complete mangrove and other habitat restoration work resulting in healthier coastal habitats.

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Guide to Impacts on Goliath Grouper

NEGATIVE Impacts	How
Fishing (all types including dynamite)	<ul style="list-style-type: none"> - Decrease in potential prey as fishing reduces fish populations - Disturbance to marine ecosystems results in less healthy habitats
Coastal development	<ul style="list-style-type: none"> - Removal of mangroves destroys Goliath Grouper habitats and spawning aggregation sites. - Decrease in ecosystem health through increased sedimentation, nutrients and pollution
Human population growth	<ul style="list-style-type: none"> - Increased demand for seafood - Increased demand for coastal developments - Increased recreational fishing activity - Disturbance to normal behavior through increased boat traffic
Aquaculture Farms	<ul style="list-style-type: none"> - Removal of mangroves to make way for aquaculture farms - Pollution of ecosystems from antibiotics used to keep fish stocks healthy - Increased nutrients from feed and feces - Reduction in marine ecosystem health - Decrease in potential prey as wild fish are caught to feed aquaculture animals

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Guide to Impacts on Goliath Grouper

NEGATIVE Impacts	How
Offshore mining	- Potential for a major impact from oil spill (or other substance)
Heavy industry	- Increased ocean pollution - Goliath Grouper have concentrations of mercury in their bodies
Farming	- Pollution of water due to pesticide run off
Swimmer protection devices	- They also catch and kill potential prey species such as barracudas, lobsters, rays, octopus, and young sea turtles
Global climate change	- Increased sea temperatures, changing ocean currents and increased storm ferocity will have many negative impacts on marine ecosystems
Coral bleaching (due to increased sea temperatures)	- Reduction in coral reef health - Reduction in coral reef ability to support a large and diverse marine life community
Marine debris	- Goliath Grouper ingest or become entangled in marine debris

Web-based Resources

OCEANA - Protecting the World's Ocean

<https://oceana.org>

Oceana is the largest international advocacy organization focused solely on ocean conservation.

Ocean Conservancy

<https://oceanconservancy.org>

Ocean Conservancy work is focusing on solving some of the greatest threats facing our ocean today.

Sport Diver Magazine

<https://www.sportdiver.com>

Scuba Diving Magazine

Florida Museum of Natural History

<https://www.floridamuseum.ufl.edu>

The Florida Museum actively researches endangered species and their habitats, as well as invasive species. They work with other institutions and organizations to understand how to strengthen and restore fragile ecosystems, support species on the brink, and offset the human impact on our environment. **Reference: DISCOVER FISHES by: Robert H. Robins**

NOAA Fisheries

<https://www.fisheries.noaa.gov>

The Southeast Fisheries Science Center conducts multidisciplinary research to inform natural resource management in the Southeast United States.

SEDAR – Southeast Data, Assessment, and Review

<http://sedarweb.org>

SEDAR is the cooperative process by which stock assessment projects are conducted in NOAA Fisheries' Southeast Region.

Project Aware

<https://www.projectaware.org>

Project Aware is a global movement for ocean protection powered by a community of divers. Further Project AWARE resources to help you protect our ocean planet including

[Ten Ways A Diver Can Protect the Underwater Environment](#)

and [Ten Tips for Underwater Photographers](#)

IUCN Red List of Threatened Species

<http://www.iucnredlist.org>

You can find in the International Union for Conservation of Nature's Red List of Threatened Species the conservation status of Goliath Groupers on the IUCN Red List of Threatened Species including distribution, habitats and threats.

https://cdn.shopify.com/s/files/1/0266/5305/files/Goliath_Grouper-Epinephelus-itajara_iucnredlist.pdf?749

Worldwide Fund for Nature

<http://wwf.panda.org>

The Worldwide Fund for Nature is an international non-governmental organization working in the field of wilderness preservation, and the reduction of human impact on the environment.

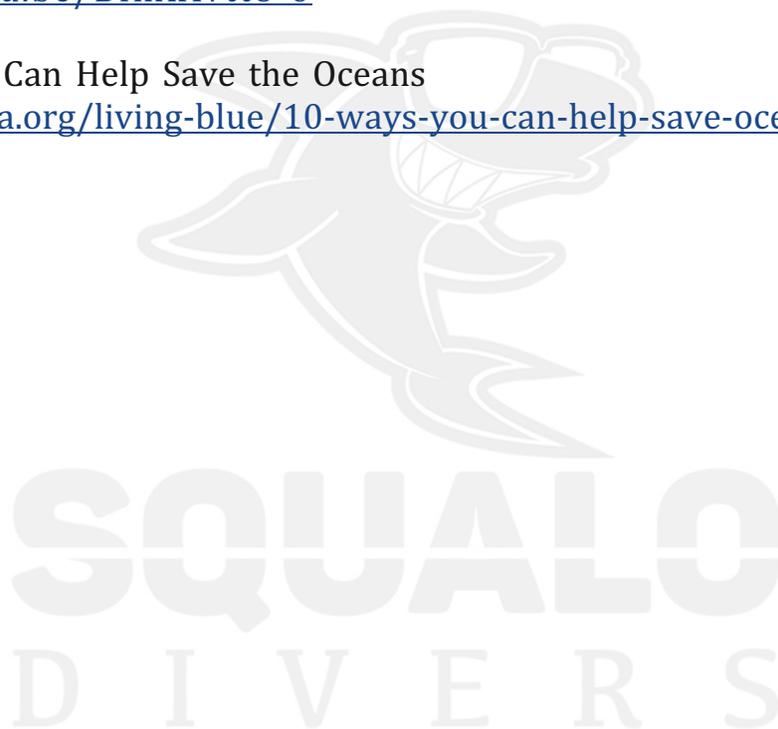
Additional References

Five facts about Ocean Plastic that you need to know

<https://youtu.be/BInXAvtt8-o>

10 Ways You Can Help Save the Oceans

<https://oceana.org/living-blue/10-ways-you-can-help-save-oceans>



Selected References

Assessment by: Bertoncini, A.A., Aguilar-Perera, A., Barreiros, J., Craig, M.T., Ferreira, B. & Koenig, C.

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The IUCN Red List of Threatened Species: *Epinephelus itajara* – (errata version published in 2019). *The IUCN Red List of Threatened Species 2018: e.T195409A145206345*.

<http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T195409A145206345.en>

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[https://cdn.shopify.com/s/files/1/0266/5305/files/Goliath Grouper-Epinephelus-itajara_iucnredlist-Assessment.pdf?749](https://cdn.shopify.com/s/files/1/0266/5305/files/Goliath_Grouper-Epinephelus-itajara_iucnredlist-Assessment.pdf?749)