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Communication

West African Goliath Grouper: Where Are They between Senegal and Angola?

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Abstract: The Atlantic Goliath Grouper *Epinephelus itajara* (Lichtenstein, 1822) occurs on both sides of the Atlantic, from the Carolinas (USA) to Brazil in the western Atlantic and historically from North Senegal to North Angola off of West Africa in the eastern Atlantic. While there are relatively good data on their distribution in the western Atlantic, confirmed occurrences, population status, fishing reports, and trade data are almost non-existent for West Africa. Part of the problem is that tropical West African countries largely lack the wherewithal to fund the research needed to evaluate this species, nor do they have laws, management plans, or viable enforcement measures that might lead to effective population recovery or protection for essential juvenile mangrove habitats. Given the lack of published studies on this species in West Africa, the primary objectives of this paper are (1) to describe all known historical and current anecdotal information available on this species and (2) to encourage the increased monitoring of habitats where viable populations might still occur (i.e., mangroves, oil rigs, and oil platforms).

Keywords: Atlantic Goliath Grouper; *Epinephelus itajara*; extirpation; overfishing; enforcement; monitoring; oil platforms; anecdotal information; protection

Key Contribution: This paper highlights the conditions existing in West Africa that thwart collection of data on Goliath Grouper. It is the first to present information on its occurrence and survival status within this species' historical West African distribution, and it encourages increased monitoring in remote areas rarely sampled.

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Citation: Barreiros, J.P.; Coleman, F.C. West African Goliath Grouper: Where Are They between Senegal and Angola? *Fishes* **2023**, *8*, 318. https://doi.org/10.3390/fishes8060318

Academic Editor: Manuel Otilio Nevárez Martínez

Received: 26 April 2023
Revised: 9 June 2023
Accepted: 14 June 2023
Published: 16 June 2023

1. Introduction

The Atlantic Goliath Grouper *Epinephelus itajara* (Lichtenstein, 1822)—hereafter referred to as "Goliath Grouper"—is the largest grouper in the western Atlantic where it occurs from the Carolinas (USA) to Brazil and is presumed to occur in the eastern Atlantic from North Senegal to North Angola off of West Africa [1,2]. Throughout its lifespan, this species spends its post-larval and juvenile stages in mangrove habitats [3,4], moving offshore to home and spawning sites on natural and artificial reefs (including oil rigs and platforms) as individuals mature [5,6]. Their diet is primarily composed of invertebrates, particularly crabs off the coast of Florida from which these fish accumulate heavy loads of methyl mercury that is accompanied by health and reproductive consequences [7–9]. Goliath Groupers are protected in the USA, with the exception of a current (2023) limited harvest for juveniles in Florida's state waters [10], and protection is enforced. This is not the case for this species in areas extending from Belize to the Caribbean and Brazil, where there is little to no enforcement as populations dwindle [11].

While the data are relatively robust for the western Atlantic—more so for the Northern Hemisphere than the Southern Hemisphere—confirmed occurrences, population status,

fishing reports, and trade data are virtually non-existent off the coast of West Africa. Despite this, it remains best understood that the distribution of the Goliath Grouper is continuous along the eastern tropical Atlantic, from Senegal southwards to north Angola, as noted in the last International Union for Conservation of Nature (IUCN) assessment in which the species' global population status was rated as vulnerable (VU) [11].

The objectives of this short communication were (1) to put together all known anecdotal information on the distribution of Goliath Groupers in West Africa in one paper and (2) to suggest where monitoring programs are best developed (e.g., at the mouths of rivers supporting mangrove habitat and on offshore oil and gas platforms) in an attempt to determine whether and where this species continues to exist along the West African coast.

2. Material and Methods

Because published literature on Goliath Grouper is virtually non-existent for most countries in West Africa, the first author (JPB) focused on gathering anecdotal information from the following sources: (1) interviews with fishers and traders conducted in Gabon (1990, 1993, and 2016); (2) trusted individuals known to JPB who can confirm catches and sightings; (N = 50; 30 from São Tomé e Príncipe, 6 from Angola, and 14 from elsewhere); (3) photographs from sport and professional photographers (N = 50); and (4) the first author's personal sightings, catches, and photographs taken while diving and visiting fish markets. The time span for gathering that information ranged from 1989 to 2016. The most visited locations by JPB were Gabon (1990, 1993, and 2016) and the archipelago of São Tomé and Príncipe (1991, 1992, 1993, 2009, and 2015) 350 km west of Gabon in the Gulf of Guinea.

3. Results and Discussion

3.1. Summary of Anecdotal Information

The map shown in Figure 1 summarizes the known or last known locations of Goliath Groupers off the west coast of Africa between 1989 and 2016. The descriptions of anecdotal data for each location are presented below and summarized in Table 1.

On both the Canary Islands and Cape Verde, Goliath Groupers are known only as vagrants (i.e., one or more individuals in sites outside of their geographic range) from a few isolated reports provided for JPB. The last time they were consistently found, captured, or observed by video and photography dates back to the early 1980s. Indeed, on the island of Tenerife in the Canary Islands, only two captures and one observation of very large individuals are known [12].

The published literature confirms its occurrence in the early 2000s from Guinea-Bissau [13] based on its synonym *E. esonue* (Ehrenbaum, 1914) rather than *E. itajara*.

In countries bordering the Gulf of Guinea from Sierra Leone to Cameroon, this species was known by local fishers but rarely reported either in the field or in fish markets. In fact, to the best of the first author's knowledge, nothing has been published regarding Goliath Groupers inhabiting areas located between Senegal and Cameroon (including Equatorial Guinea). Trustworthy personal communications on the occurrence of Goliath Grouper were quite rare in Ghana, Togo, Nigeria, and the Republic of the Congo. No cases surfaced during the first author's visits to fish markets and dive sites in these countries, and interviews with local fishers rarely led to documented Goliath Grouper sightings. They are apparently also rare in the Gulf of Guinea islands; one specimen was speared in Sao Tomé in 2009, and two juveniles were observed in 2015 (JPB pers. obs.).

Gabon provides the only well-documented information on regular Goliath Grouper catches from West Africa. The most recent (2020) information confirms an apparently stable population of the Goliath Grouper there, although sporadic anecdotal reports come from the Republic of Congo, São Tomé e Príncipe, and South Angola where they were observed at the mouth of the Congo River (formerly the Zaire River) (1989, 2009, 2011, and 2015) (pers. comm, JPB).

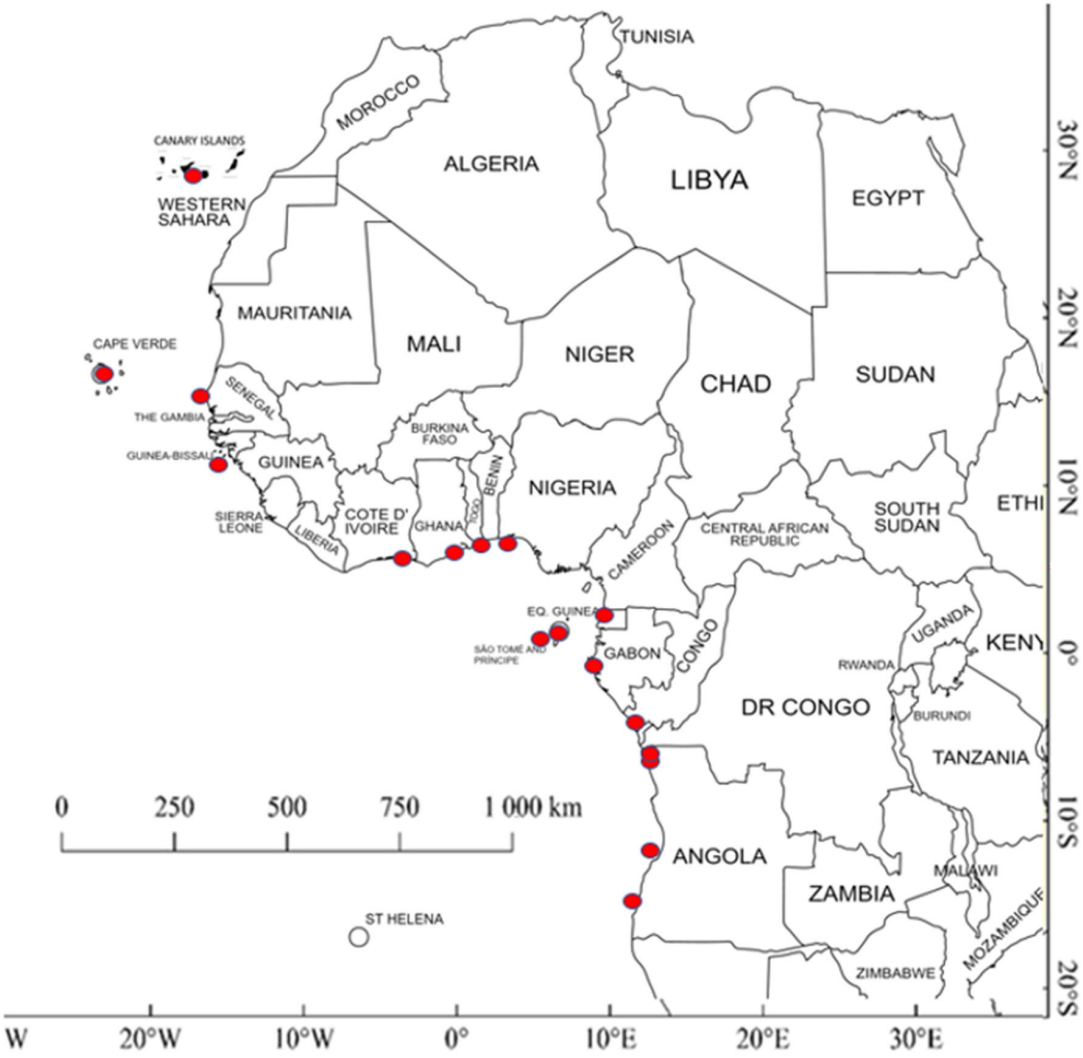

Figure 1. Map of West Africa indicating coastal locations where confirmed occurrences of the Atlantic Goliath Grouper *Epinephelus itajara* were established (time frame 1989–2016).

Two specimens were caught via spearfishing in Benguela, southern Angola, in 2011 (J. de Sousa, pers. com. to JPB, 2016, Figure 2). One specimen, roughly estimated to weigh 250 kg, was observed in a fish market in Libreville, Gabon (JPB pers. obs. 2016). Confirmed reports (pers. observ., photographs, and communications from trusted sources) are presented in Table 1.

While we found one paper suggesting that a single Goliath Grouper had been sighted on Ascension Island in the South Atlantic, it appeared that this sighting might not have been a valid one [14].

The West African coast is dotted with many oil and gas operations (Figure 3) [17]. While divers and fishers have reported seeing Goliath Groupers associated with these platforms in the past, reports are rare (pers. comm, a French spearfisher, 1996) and come only from Abidjan in Côte d'Ivoire (Ivory Coast), Gabon, and Angola [15]. However, several articles in spearfishing magazines and books from the late 1980s and early 1990s describe fishing activities on oil platforms, focusing on the routine capture of very large Goliath Groupers by Mr. Marc-Antoine Berry [16]. Whether the present-day situation on oil platforms differs markedly from what it was back then is unknown. However, Friedlander et al. [18] suggest that because of the high security associated with these industries off of West Africa, these sites may well serve as de facto marine protected areas (MPAs). It suffices to say that Mr. Berry was still catching enormous Goliath Grouper in Gabon in 2017, as demonstrated in Figure 4.

Figure 2. A 62 kg Atlantic Goliath Grouper *Epinephelus itajara* captured in Benguela, South Angola (12°34′ S, 13°24′ E), West Africa, in 2011. Photo courtesy of J. de Sousa.

Table 1. Summary of anecdotal information obtained by the first author indicating the location, population status, date information obtained, and source of information for this short communication on the presence of the Atlantic Goliath Grouper *Epinephelus itajara* off the West African coast. Rare = Diminished from a previous common occurrence in a given region. Vagrant = One or more individuals in a site outside of its geographic range. Common = Regularly seen and/or caught. Pers.Com. = Personal communication. Pers. Obs. = Personal observation of the first author (JPB).

Location	Population Status	Dates	Source
Canary Islands	Vagrant	2002	Brito et al., 2002 [12]
Cape Verde	Vagrant	1989, 1994, 2019	Trustworthy Pers. Comm.
Senegal	Rare	1993	Trustworthy Pers. Comm.
Guinea-Bissau	Rare	2002	Reiner 2002 [14]
Guinea	Rare	2009	Trustworthy Pers. Comm.
Côte d'Ivoire (Ivory Coast)	Rare	1989, 1996	Rampal 1989 [15] Trustworthy Pers. Comm.
Ghana	Rare	2012	Trustworthy Pers. Comm.
Togo	Rare	2012	Trustworthy Pers. Comm.
Nigeria	Rare	2012	Trustworthy Pers. Comm.
Equatorial Guinea	Rare	2009, 2015	Trustworthy Pers. Comm.
São Tomé & Príncipe	Rare	1989, 2009, 2015	Pers. Obs. JPB (visits to fish markets and dive sites)
Gabon	Common	1989, 2009, 2015	Berry, 1989 [16] Pers. Obs. JPB (visits to fish markets, dive sites, and while fishing (catches))
Republic of Congo	Rare	1989, 2009	Trustworthy Pers. Comm.
Angola	Rare	1996, 2011	Trustworthy Pers. Comm. Photos and catches (Benguela only)

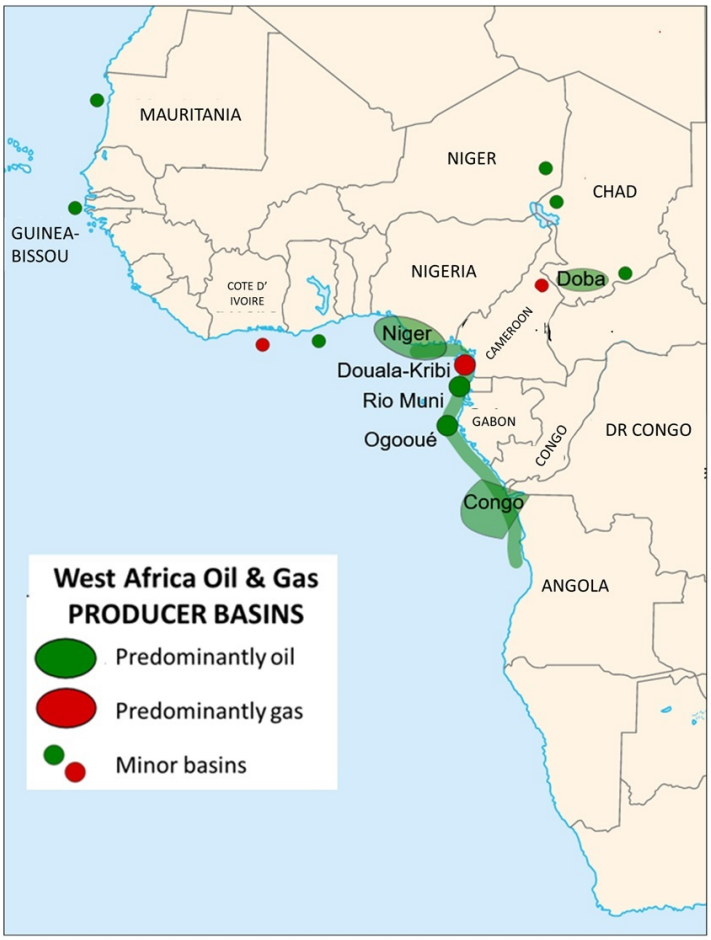

Figure 3. Locations of oil and gas operations in West Africa in 2008. Image obtained from Wikimedia, June 2023. Modified by F. Coleman.

Figure 4. Marc-Antoine Berry and ~250 kg Atlantic Goliath Grouper *Epinephelus itajara*. Port Gentil, Gabon (0°40′ S, 8°45′ E), West Africa, in 2017. Public domain.

3.2. Providing Avenues for Recovery

This anecdotal survey strongly suggests that the distribution of Goliath Groupers along the coast of West Africa is poorly known and probably decreasing, with extirpations of virtually all healthy or viable populations [11] in natural habitats. The reality is that there are few published papers that verify this phenomenon, and adults may well be limited to areas near Gabon, offshore Equatorial Guinea, and Angola, which are associated with oil platforms and rigs [18]. Certainly, rigorously collected scientific data on the presence and abundance of Goliath Groupers at such sites would give us critical information on the status of this species along the vast stretch of the West African coastline. Additionally, tissue sample collection for genetic testing would be useful in verifying if or by how much this species differs from West Atlantic or Eastern Pacific populations (see Craig et al. [19]).

Most overfishing that occurs along the coast of West Africa can be attributed to illegal and unreported fishing carried out by foreign fishing vessels [20]. This has depleted fish stocks available to West Africans living along the coast and may have made them more dependent on species such as Goliath Groupers for food. That said, fishing is not the only impediment to the survival of this species. Pollution and rapid urbanization [21] have had extremely negative effects on both the people of West Africa and Goliath Groupers, resulting in poor water quality and the destruction of essential mangrove habitats for juvenile fish [3]. These continue to be major factors negatively affecting the overall presence of Goliath Groupers in West Africa [22,23], and these issues must be addressed before the recovery of populations in this region can occur.

Bertoncini et al. [11], however, remind us that the Goliath Grouper may still inhabit the shallow waters of mangrove swamps and near the mouths of the Congo (Democratic Republic of the Congo), Ogooué (Gabon), and Sanagá (Cameroon) rivers and their tributaries. It is plausible that some populations in fact still exist in remote areas, either as juveniles in mangroves or as adults on offshore oil rigs and platforms, shipwrecks, artificial reefs, and other human-made structures where Goliath Groupers are known to aggregate [6], warranting increased monitoring efforts in promising regions of West Africa.

Furthermore, the areas in which they are found should be protected via properly enforced fishing prohibitions, including the development of coastal MPAs that could help preserve their essential habitats. Another idea is to shift the pressure from lethal fishing to non-consumptive ecotourism, wherein divers visit West Africa to observe these fish underwater in their natural habitat [24–26]. However, this is easier said than done. Indeed, the lack of data, protection, and enforcement is largely due to poor funding sources coupled with the severe political and humanitarian crises from which most West African countries suffer.

Author Contributions: Conceptualization, data curation, methodology, investigation, and resources: J.P.B.; writing—original draft preparation, J.P.B.; writing—review and editing, F.C.C. and J.P.B.; visualization, F.C.C. and J.P.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding. The APC was waived by Fishes.

Institutional Review Board Statement: Ethical review and approval were waived for this study due to the fact that all results presented here come from anecdotical information collected ad lib during a long time frame and not under a projected protocol or similar source of information.

Data Availability Statement: No applicable.

Acknowledgments: We are indebted to the fishermen, sports/trophy spear fishers, and traders from Senegal to Angola that provided first-hand information for JPB about Goliath Grouper in their areas of activity. Many thanks also to Luís M.D. Barcelos (University of the Azores, Faculty of Agrarian and Environmental Sciences) for developing the map appearing in Figure 1 (modified by the second author) and José de Sousa for providing Figure 3. Christopher Koenig (Florida State University), Christopher Malinowski (Ocean First Institute), and three anonymous reviewers kindly provided comments on the manuscript that helped us improve the content considerably.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Heemstra, P.C. A Taxonomic Revision of the Eastern Atlantic Groupers (Pisces: Serranidae). Boletim do Museu Municipal do Funchal. 1991, Volume 43, pp. 5–71. Available online: https://publications.cm-funchal.pt/jspui/bitstream/100/1105/1/Bolmmf-1991-art226.pdf (accessed on 24 May 2023).
2. Heemstra, P.C.; Randall, J.E. *FAO Species Catalogue: Groupers of the World (Family Serranidae, Subfamily Epinephelinae): An Annotated and Illustrated Catalogue of the Grouper, Rockcod, Hind, Coral Grouper and Lyretail Species Known to Date*; FAO: Rome, Italy; UN: New York, NY, USA, 1993.
3. Koenig, C.; Coleman, F.C.; Eklund, A.M.; Schull, J.; Ueland, J.S. Mangroves as essential nursery habitat for goliath grouper (*Epinephelus itajara*). *Bull. Mar. Sci.* **2007**, *80*, 567–586. Available online: https://www.reef.org/news/publications/mangroves-essential-nursery-habitat-goliath-grouper-epinephelus-itajara (accessed on 24 May 2023).
4. Damasceno, J.; Farro, A.P.; Bertoncini, A.; Hostim-Silva, M. Mangroves as Essential Habitats for the Atlantic Goliath Grouper. *Fishes* **2023**, *in review*.
5. Koenig, C.C.; Bueno, L.S.; Coleman, F.C.; Cusick, J.A.; Ellis, R.D.; Kingon, K.; Locascio, J.V.; Malinowski, C.; Stallings, C.D. Diel, lunar, and seasonal spawning patterns of the Atlantic Goliath Grouper, *Epinephelus itajara*, off Florida, United States. *Bull. Mar. Sci.* **2017**, *93*, 391–406. [CrossRef]
6. ELLIS, R.D.; Koenig, C.C.; Locascio, J.; Malinowski, C.; Coleman, F. Spawning migrations of the Atlantic Goliath Grouper. *Fishes* **2023**, *in review*.
7. Malinowski, C.R. High mercury concentrations in Atlantic Goliath Grouper: Spatial analysis of a vulnerable species. *Mar. Pollut. Bull.* **2019**, *143*, 81–91. [CrossRef] [PubMed]
8. Malinowski, C.R.; Perrault, J.R.; Coleman, F.C.; Koenig, C.C.; Stilwell, J.M.; Cray, C.; Stacy, N.I. The Iconic Atlantic Goliath Grouper (*Epinephelus itajara*): A Comprehensive Assessment of Health Indices in the Southeastern United States Population. *Front. Vet. Sci.* **2020**, *7*, 635. [CrossRef] [PubMed]
9. Malinowski, C.R.; Stacy, N.I.; Coleman, F.C.; Cusick, J.A.; Dugan, C.M.; Koenig, C.C.; Ragbeer, N.K.; Perrault, J.R. Mercury offloading in gametes and potential adverse effects of high mercury concentrations in blood and tissues of Atlantic Goliath Grouper *Epinephelus itajara* in the southeastern United States. *Sci. Total Environ.* **2021**, *779*, 146437. [CrossRef] [PubMed]
10. FWC. Goliath Grouper Harvest Permit. 2022. Available online: https://myfwc.com/license/recreational/saltwater-fishing/goliath-grouper-harvest-permit/ (accessed on 18 May 2023).
11. Bertoncini, A.A.; Aguilar-Perera, A.; Barreiros, J.; Craig, M.T.; Ferreira, B.; Koenig, C. *Epinephelus itajara Atlantic Goliath Grouper: IUCN Red List of Threatened Species*; International Union for Conservation of Nature: Gland, Switzerland, 2018; pp. 1–18. Available online: https://www.iucnredlist.org/species/195409/145206345#assessment-information (accessed on 20 May 2023).
12. Brito, A.; Pascual, P.J.; Falcón, J.M.; Sancho, A.; González, G. *Peces de las Islas Canarias: Catálogo Comentado e Ilustrado*; Francisco Lemus: La Laguna, Spain, 2002; ISBN 84-87973-16-7.
13. Reiner, F. *Peixes da Guiné-Bissau*; Centro Português de Estudo dos Mamíferos Marinhos: Lisboa, Portugal, 2002; ISBN 972-98180-1-0.
14. Wirtz, P.; Bingeman, J.; Bingeman, J.; Fricke, R.; Hook, T.J.; Young, J. The fishes of Ascension Island, Central Atlantic Ocean–new records and an annotated checklist. *J. Mar. Biol. Assoc. U. K.* **2017**, *97*, 783–798. [CrossRef]
15. Rampal, J.-L. Fabuleuses Rencontres au Large d'Abidjan. In *Chasse Sous-Marine n°1*; Attard, J., Mauriés, R., Eds.; Plaisancier-Vagnon Éditions: Paris, France, 1989; pp. 8–14. ISBN 2-9504175-0-7.
16. Berry, M.-A. *Grand Chelem à Port-Gentil Chasse Sous-Marine n°1*; Attard, J., Mauriés, R., Eds.; Plaisancier-Vagnon Éditions: Paris, France, 1989; pp. 43–57. ISBN 2-9504175-0-7.
17. Raminagrobis, Petroleum Regions—West Africa map-fr.svg. 2008. Available online: https://commons.wikimedia.org/wiki/File:Petroleum_regions_-_West_Africa_map-fr.svg#file (accessed on 22 May 2023).
18. Friedlander, A.M.; Ballesteros, E.; Fay, M.; Sala, E. Marine Communities on Oil Platforms in Gabon, West Africa: High Biodiversity Oases in a Low Biodiversity Environment. *PLoS ONE* **2014**, *9*, e103709. [CrossRef] [PubMed]
19. Craig, M.T.; Graham, R.T.; Torres, R.A.; Hyde, J.R.; Freitas, M.O.; Ferreira, B.P.; Hostim-Silva, M.; Gerhardinger, L.C.; Bertoncini, A.A.; Robertson, D.R. How many species of goliath grouper are there? Cryptic genetic divergence in a threatened marine fish and the resurrection of a geopolitical species. *Endanger. Species Res.* **2009**, *7*, 167–174. [CrossRef]
20. Gates, N. The Effects of Overfishing in West Africa. 2019. Available online: https://www.borgenmagazine.com/overfishing-in-west-africa/ (accessed on 20 May 2023).
21. Croitoru, L.; Miranda, J.J.; Sarraf, M. *The Cost of Coastal Zone Degradation in West Africa: Benin, Cote d'Ivoire, Senegal, and Togo (English)*; World Bank Group, Ed.; The World Bank: Carroll, NH, USA, 2019; p. 36. Available online: https://documents1.worldbank.org/curated/en/822421552504665834/pdf/The-Cost-of-Coastal-Zone-Degradation-in-West-Africa-Benin-Cote-dIvoire-Senegal-and-Togo.pdf (accessed on 20 May 2023).
22. Feka, Z.N. Sustainable management of mangrove forests in West Africa: A new policy perspective? *Ocean. Coast. Manag.* **2015**, *16*, 341–352. [CrossRef]
23. USAID. Mangroves in West Africa: A Policy Brief. 2014. Available online: https://pdf.usaid.gov/pdf_docs/PA00KJZQ.pdf (accessed on 17 May 2023).
24. Koenig, C.C.; Coleman, F.C.; Malinowski, C.R. Atlantic Goliath Grouper of Florida: To Fish or Not to Fish. *Fisheries* **2020**, *45*, 20–32. [CrossRef]

25. Shideler, G.S.; Carter, D.W.; Liese, C.; Serafy, J.E. Lifting the goliath grouper harvest ban: Angler perspectives and willingness to pay. *Fish. Res.* **2015**, *161*, 156–165. [CrossRef]
26. Shideler, G.S.; Pierce, B. Recreational diver willingness to pay for goliath grouper encounters during the months of their spawning aggregation off eastern Florida, USA. *Ocean. Coast. Manag.* **2016**, *129*, 36–43. [CrossRef]