

One fish, two fish, twelve years of huge fish: An overview of the Great Goliath Grouper Count in Florida

Un pez, dos peces, doce años de peces enormes: Un resumen del gran recuento de meros Goliath en Florida

Un poisson, deux poissons, douze ans de poissons énormes : un aperçu du décompte des mérous du Grand Goliath en Floride

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EXTENDED ABSTRACT

Goliath grouper (*Epinephelus itajara*) are large, long-lived fish with life history characteristics that make them vulnerable to exploitation (Bullock et al., 1992). In 1990, following decades of overfishing, harvest of Goliath grouper was prohibited in United States (US) waters, and the species currently remains protected in the US and much of the Caribbean. The Goliath grouper population in Florida has responded well to protective measures and numbers have been rebounding in Florida since the moratorium (Koenig et al., 2011). Although the degree of recovery throughout their geographic range is not fully understood, the state of Florida is presently considering options for limited harvest in state waters (FWC, 2021).

Comprehensive population assessment remains complicated, and the lack of landings data confound traditional stock assessment efforts (SEDAR, 2016). Fisheries scientists therefore rely on observational and fishery-independent data related to general abundance, spatial and size distributions to inform regulatory policy, and management agencies utilize a suite of non-traditional methods to track the status of the population. In 2010, the University of Florida IFAS/Extension, Florida Sea Grant and the Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute (FWC/FWRI) initiated The Great Goliath Grouper Count (GGGC) to track abundance and size distribution of this species at specific sites through time. This annual citizen science event coordinates scientists with trained volunteer divers to collect data at designated reefs throughout Florida. During each survey, Goliath grouper abundance and size estimates are recorded, along with information on reef characteristics and water conditions. This project was designed to engage stakeholders in the collection of fisheries data and create a supplemental dataset that can be useful to the management process.

The GGGC began as an annual regional effort in southwest Florida in 2010 but has expanded over the past twelve years to include sites throughout the state (Fig. 1). Trained divers complete standardized data reports, which are compiled by Florida Sea Grant before being submitted to management at FWC. By design, the GGGC surveys target nearshore and offshore reef habitats – specifically artificial reefs – where adult Goliath grouper are known to aggregate (Collins et al., 2015). The event occurs annually during the first two weeks of June, when water clarity is normally good and underwater temperatures encourage diver participation. June is also well before resident fish begin aggregating in preparation for the spawning season (August – September). Fish are therefore expected to be generally sedentary at their resident sites, making the likelihood of double counting the same individuals at multiple sites over a two-week period relatively slim.

Participating divers are trained in data collection protocol and record their underwater observations on a standardized data sheet. Analyses include only data from surveys lasting >15 minutes and performed in underwater visibilities >5 m. During each survey, divers note the total number of Goliath grouper observed during a one-way roving diver survey of the site. Each fish observed is estimated for total length and designated as small (<1 m TL), medium (1 – 1.5 m TL), or large (>1.5 m TL). Water visibility, reef type (artificial or natural), reef material (e.g., ship, concrete rubble, modules) and reef height (relief) are noted for each surveyed site.

To date, over 150 volunteers have submitted 768 surveys and spent over 350 hours under water. The majority of surveyed sites were nearshore or offshore artificial reefs, ranging in depth from 5 – 40 m. On average, approximately 60 surveys are performed during this 2-week period each year. As would be expected, years with a greater number of surveys performed typically yield greater total numbers of reported fish, but overall trends do not indicate a significant increase or decrease in overall abundance since 2010 (Fig. 2). The largest numbers of Goliath grouper were observed at artificial reefs off the coast of southwest Florida (Fig. 1), which was where the GGGC program originally began (and is historically and currently the center of abundance for this species). Notably, southwest Florida is also where the most extensive nursery habitat for juvenile Goliath grouper remains. Like many reef fishes, juvenile Goliath groupers spend their first few years in estuaries (until they are about 1 m TL), and they are dependent upon healthy mangrove habitats. The relatively undeveloped shoreline of the Ten Thousand Islands and Everglades National Park serve as important juvenile habitat that are critical to the Goliath grouper population in Florida (Koenig et al., 2007).

Collaboration with citizen scientists allows for coordinated data collection over a broad geographic area within a relatively short time frame, providing an efficient and cost-effective way to obtain information. Long standing programs

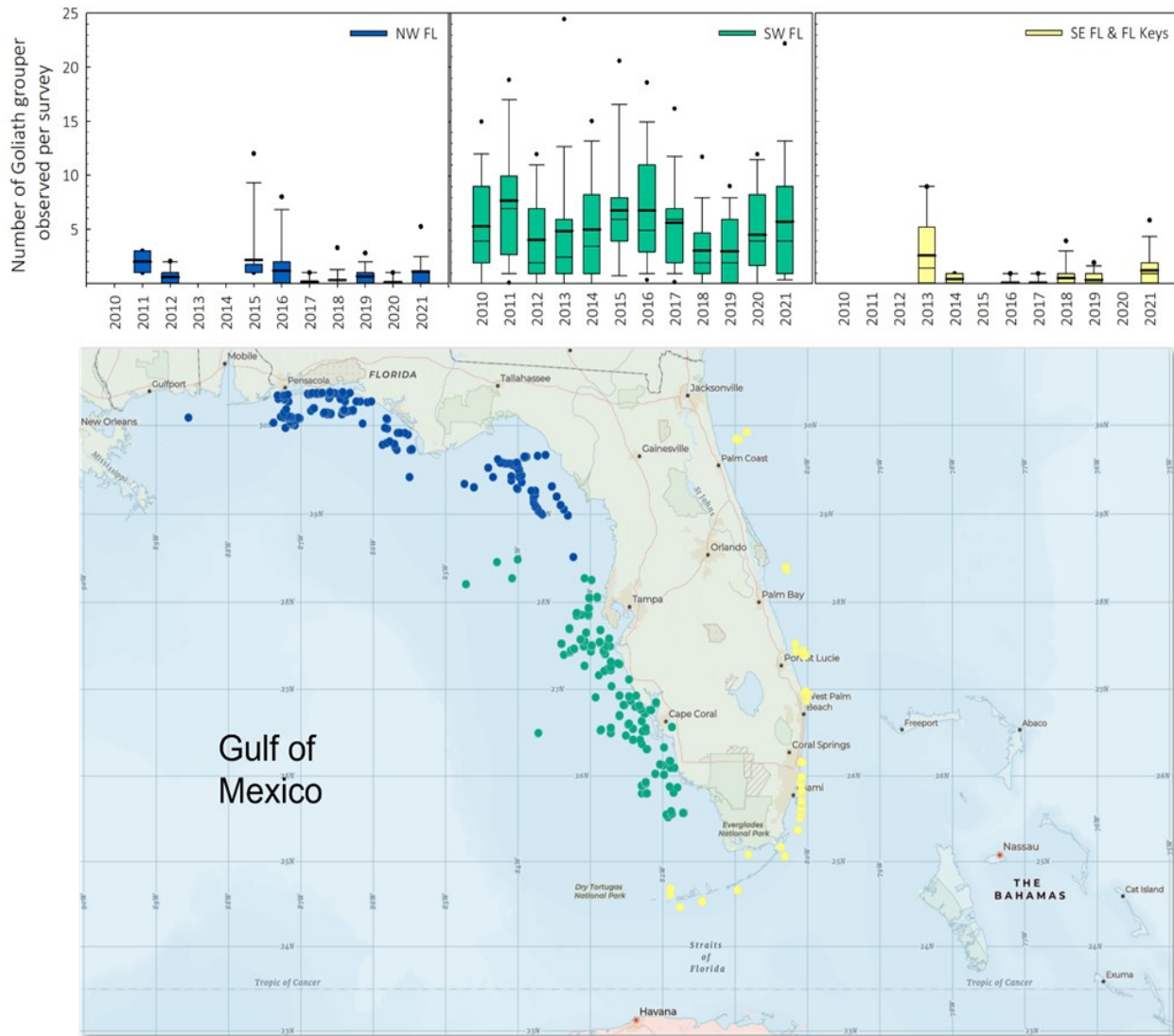


Figure 1. Top panel: Box plots demonstrate the range in Goliath grouper abundance across three regions in Florida, U.S. Box plots indicate median (thin line), mean (bold line) and 10, 25, 75, and 90th percentiles of data. Bottom panel: Map of survey sites for the Great Goliath Grouper Count, 2010 – 2021.

such as the Great Goliath Grouper Count promote stakeholder engagement and can provide policy makers with valuable data that may assist future management efforts related to this species.

KEYWORDS: citizen science, Goliath grouper, *Epinephelus itajara*, artificial reefs

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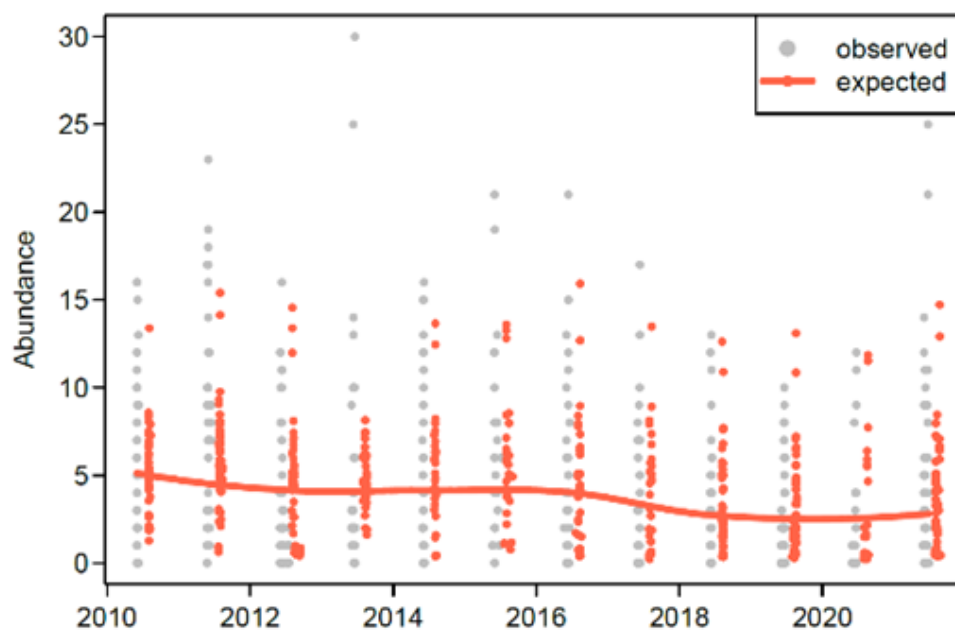


Figure 2. Observed and expected abundance of Goliath grouper recorded during diver surveys of reef sites (mostly artificial reefs, but including some natural habitats), as indicated by data collected during the annual Great Goliath Grouper Count in Florida, United States. Data do not indicate a significant increase or decrease in overall abundance for the time frame 2010 – 2021.

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