Recent publications on Nassau grouper critical habitat

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Spatial distribution of spawning groupers on a Caribbean reef from an autonomous surface platform

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ABSTRACT

Many commercially important groupers (Epinephelidae) form fish spawning aggregations (FSA) at specific sites where the spawning stock is concentrated to spawn within a couple of months each year. The concentrated nature and short duration of these FSAs render these species susceptible to fishing pressure leading to their disappearance or decrease in the number of spawning fish. As a result of directed fishing during FSAs many large-bodied groupers are now International Union for Conservation of Nature (IUCN) Red-listed. Puerto Rico within the US Caribbean is where protective measures have been designated for the recovery of grouper species that aggregate to spawn, in particular the threatened (Endangered Species Act) Nassau grouper (*Epinephelus striatus*) and sustainability of the red hind (*Epinephelus guttatus*). The regulations at three marine managed areas (MMAs) off the west coast of Puerto Rico, have been focused on reproductive seasons, through seasonal closures. However, these management zone boundaries may fail to fully encompass fish migration paths and temporal variability in FSAs, exposing threatened species like the Nassau grouper to incidental fishing and poaching. In addition to traditional methods used to study FSAs, passive acoustics represent a relatively new approach to assess the presence and spatio-temporal distribution of aggregating species. Sound production is common among many fishes, including the Nassau and red hind groupers, and is most often associated with courtship and spawning behavior. In this study, we present the results from the deployment of an autonomous surface vehicle equipped with a passive acoustic monitoring system along the insular shelf break that surveyed the MMAs during their peak spawning season. Our observations suggest that known FSA sites are critical habitat for both species and the existence of potential, previously unknown FSAs for multiple grouper species as well, highlighting the importance of spatial and temporal expansion of existing regulations.

Nassau grouper and Red hind produce stereotyped sounds during reproductive behaviors of spawning aggregations

Simultaneous passive acoustic recordings by seafloor fixed and surface glider-mounted instruments

Applied an algorithm (FADAR) to classify the courtship associated sounds in space and time by species

Wave glider surveys during February 2017 detected sounds produced by both species from the surface

Evidence confirmed the benthic habitat areas used for spawning at Abrir la Sierra and Bajo de Sico

Both marine managed areas include significant critical habitats for the reproduction of these two species

Additional areas along the shelf-break also had sound evidence of Red hind aggregated to spawn

This study highlights the need of spatial and temporal expansion of critical habitat protections

Potential spawning habitat (where conditions are suitable) changes affect the distribution and phenology

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RESEARCH ARTICLE

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Spatial and temporal dynamics of a Nassau grouper fish spawning aggregation located on an isolated seamount in Puerto Rico

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Abstract

1. The Nassau grouper, *Epinephelus striatus*, is a slow-growing, late-maturing, long-lived reef fish widely distributed throughout the south-western North Atlantic. Known for forming large spawning aggregations, numbering tens of thousands, they are now listed as Critically Endangered by the International Union for Conservation of Nature (IUCN). Recently, the only Nassau grouper spawning aggregation in Puerto Rico was documented at Bajo de Sico, a seamount and seasonally closed marine protected area.
2. Studies elsewhere on the spatio-temporal dynamics of Nassau grouper aggregations have documented how, and how far, fish move from home sites to the spawning site, and have shown the tight link between aggregation formation and the lunar cycle. However, these studies have not evaluated the potential impacts of the reduced spatial extent represented by a seamount, nor have they addressed the impacts of local seasonal protection relative to the size of the closed area and the timing of aggregation formation.

Nassau grouper (N=26/29) with internal acoustic tags at Bajo de Sico were tracked over 3 reproductive seasons

Detection array of acoustic receivers (16) throughout the shallow (30-75 m) areas of the seamount 2014 - 2016

Evidence confirmed the occupation of benthic habitats less than 100 m depth by Nassau grouper

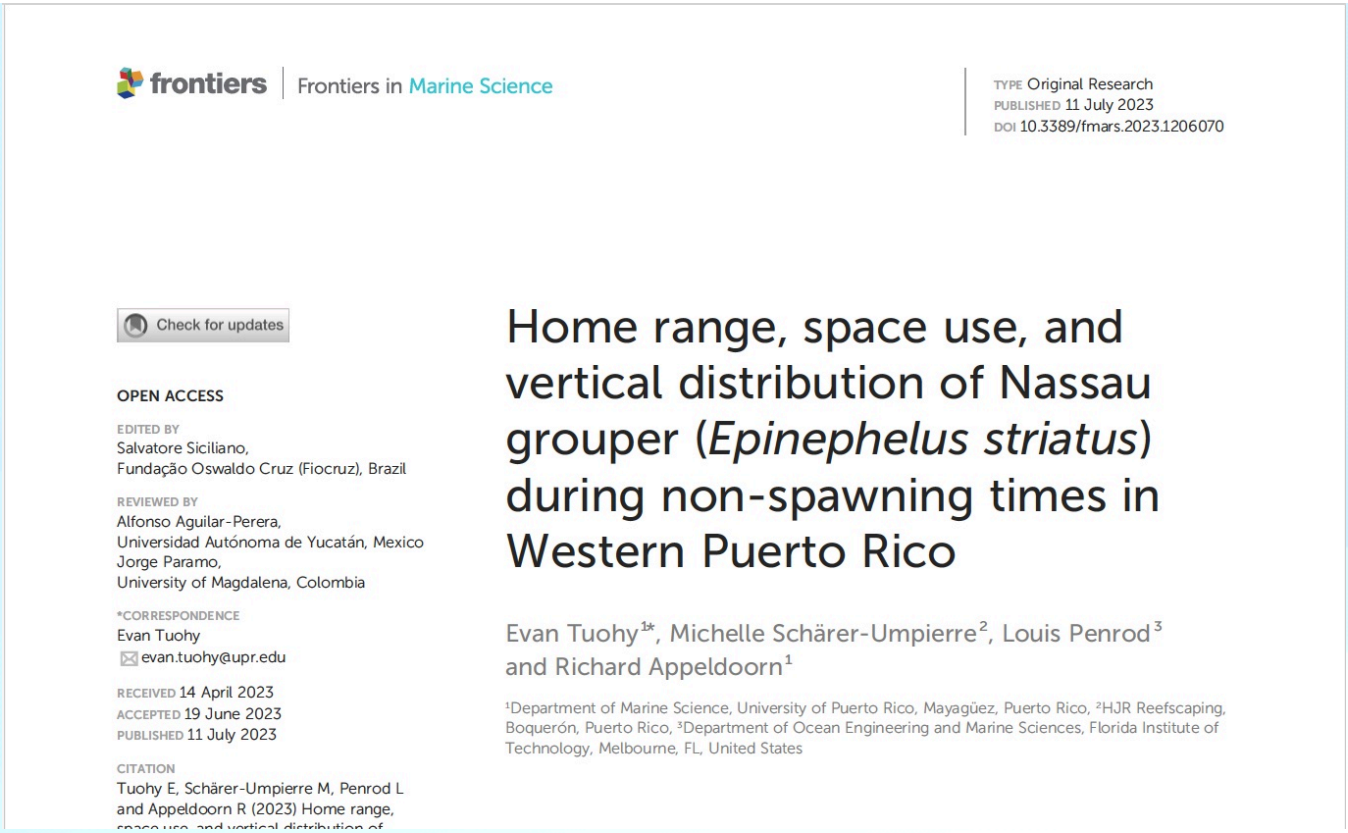
Detected spawning related movements from January to March (2014) and to April (2015 & 2016)

Nassau grouper's spawning core area measured 0.87 and home range 2.31 km^2

Over half (54%) of the tagged groupers were residents on the seamount throughout the rest of the year

Depths of habitats occupied varied between 16 and 100 m, deeper during the aggregation days

The current seasonal closure should be extended to the end of June for spawning stock protection



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Home range, space use, and vertical distribution of Nassau grouper (*Epinephelus striatus*) during non-spawning times in Western Puerto Rico

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Acoustic telemetry employed to quantify non-spawning area use patterns of Nassau grouper at Bajo de Sico

Nassau grouper (N=14 of 29) with internal acoustic tags at Bajo de Sico were tracked over 3 years

High site fidelity to home reef locations with spatial overlap, but differences in vertical distribution and relocation

All fish migrated back to the same home reef site they occupied prior to the spawning

Nassau grouper non-spawning core area (50% UD) and home range (95% UD) measured 0.11 and 0.48 sq. km

Critical habitats provide year round residence in depths between 21 and 74.7 m

The current six-months seasonal closure is insufficient for the non-spawning habitats

Bajo de Sico, seamount located 27 km off the west coast of Puerto Rico