A multidisciplinary approach to monitoring fish spawning aggregations: an example in the Florida Keys and Dry Tortugas.

Un enfoque multidisciplinario para el seguimiento de las agregaciones de desove de peces: un ejemplo de los Cayos de Florida y Dry Tortugas

Une approche multidisciplinaire de la surveillance des agrégations de poissons reproducteurs : un exemple dans les Florida Keys et les Dry Tortugas.

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EXTENDED ABSTRACT

Identifying and protecting fish spawning aggregations (FSAs) is a major step in managing future generations of many commercially and recreationally important reef fish species. Although FSAs are documented to be predictable in time and space, that is not always the case. To effectively assess a spawning aggregation status and identify changes over time following fishing or management changes, a robust sampling protocol is essential (Colin et al. 2003, Sadovy de Mitcheson et al. 2020). However, this is something that is easier said than done. The aims of the present study were to investigate the ecological and socioeconomic effects of a seasonal spatial closure to protect annual spawning aggregations at Western Dry Rocks in the Florida Keys.

To determine efficacy of this spatial closure, a multi-disciplinary approach was used to monitor change over time. This monitoring focused on three main objectives: (1) documenting changes in behavior, abundance, and size structure of Western Dry Rocks fish aggregations over time, (2) determining changes in age and reproductive output from Western Dry Rocks over time, (3) quantifying how the Western Dry Rocks seasonal closure is affecting stakeholders. For objective 1, underwater visual census (UVC) surveys were used to track changes in fish abundance and length frequency inside and outside the closure, and at aggregation sites.

UVC data were complemented by additional technologies to generate a more complete picture of these aggregation

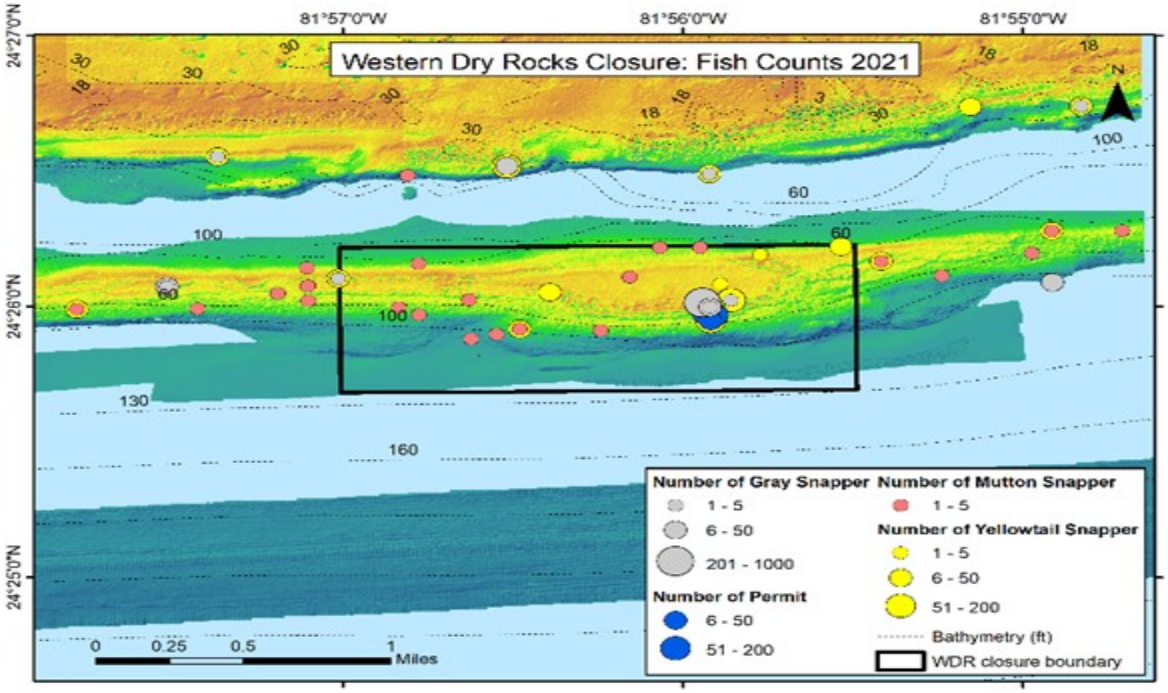

Figure 1. Numbers of target fish species counted at each site surveyed in 2021, averaged by diver buddy pairs. Fish counts were conducted inside and outside the closure area (marked by the black rectangle).

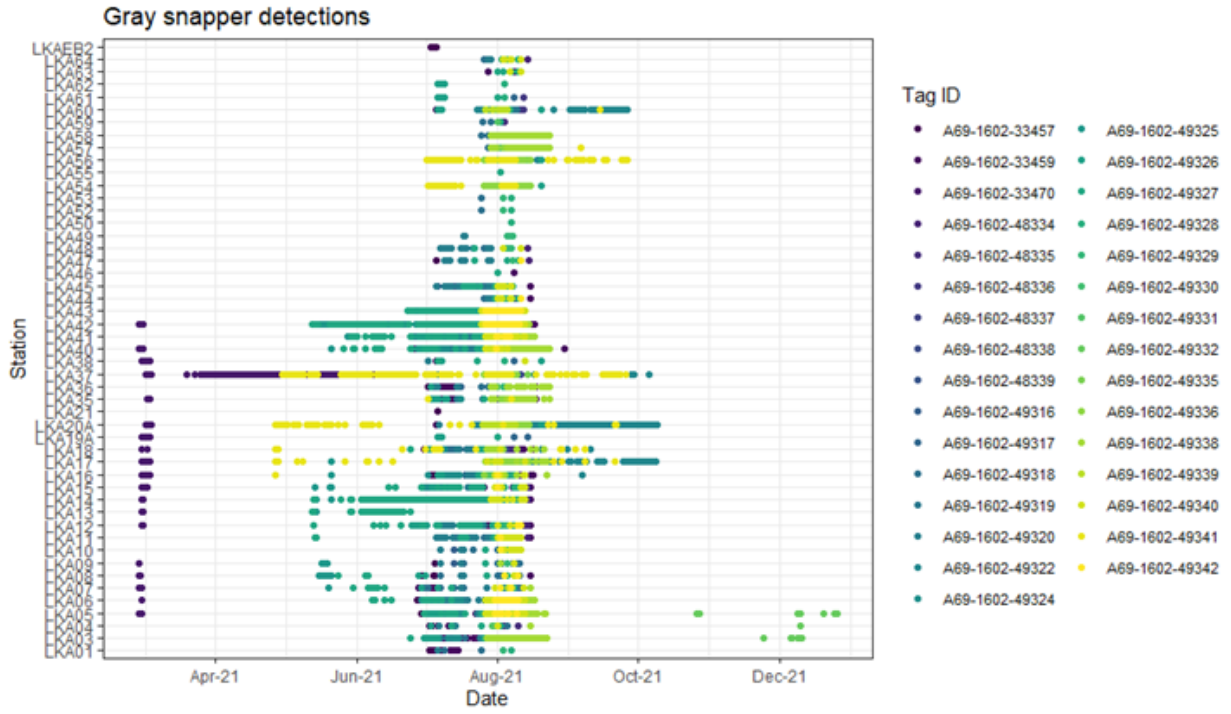

Figure 2. Preliminary data showing grey snapper detections at acoustic receiver stations in and around Western Dry Rocks in 2021. Colors represent transmitter/tag identification numbers of tagged grey snapper. Detections are from preliminary raw data and 27 of 31 grey snapper were tagged in June and July 2021.

sites, including acoustic telemetry to estimate movement and connectivity, stationary cameras for fish presence/absence and behavior, EK80 split beam and Autonomous Underwater Vehicle (AUV) surveys to map biomass in the water column, and oceanographic instruments to measure variability in currents and water temperatures. For objective 2, life history samples were collected during periods of suspected spawning activity including gonads, otoliths, scales, and tissue samples. For objective 3, aerial surveys and hydrophones were used to monitor boating activity, and intercept, email, and in-person surveys were conducted to determine effects on stakeholders.

In the first two years of the seven-year project, over 40,000 fish have been counted in underwater visual census surveys, over 100 fish have been acoustically tagged, and more than 100 hours of underwater video have been captured. Additionally, more than 300 economic surveyed were completed, 16 hours of aerial surveys were conducted, and several terabytes of hydrophone and split beam data have been collected. Results for this study are preliminary, as monitoring changes to fish populations require several years of data collection and the seasonal spatial closure went into effect in April of 2021, but suggest additional benefits when multiple data sources are used in a holistic approach. The combination of data sets, like fish count data from the UVCs (Fig. 1) and movement data from acoustically tagged fish (Fig. 2) will complement each other to identify spatial and temporal patterns in spawning aggregations, detect fish movements to and from spawning grounds, and provide a more comprehensive view of the effectiveness of the closure.

KEYWORDS: ecological monitoring, fish habitat, fish spawning aggregations, fisheries management

LITERATURE CITED

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