

# Western Dry Rocks Science Plan: Using Multidisciplinary Science to Examine the Efficacy of a Seasonal Fishing Closure at a Multi-species Spawning Aggregation Site

## Plan Científico de Western Dry Rocks: Uso de la Ciencia Multidisciplinaria para Examinar la Eficacia de un Cierre de Pesca Estacional en un Sitio de Agregación de Desove de Múltiples Especies

## Plan Scientifique de Western Dry Rocks: Utiliser la Science Multidisciplinaire pour Examiner l'efficacité d'une Fermeture Saisonnière de la Pêche sur un Site de Frai Multi-espèces

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Many reef fish species form spawning aggregations to increase reproductive success. However, the predictability of these events in time and space makes them vulnerable to targeted fishing (Russel et al. 2011, Sadovy and Domeier 2005). Understanding the ecological importance and vulnerability of spawning aggregations, the Florida Fish and Wildlife Conservation Commission implemented a one-square-mile seasonal fishing closure called Western Dry Rocks, located 16 kilometers southwest of Key West, Florida, in 2021.

This closure was designed to protect a multi-species spawning aggregation, including economically and ecologically important species such as mutton snapper (*Lutjanus analis*), gray snapper (*Lutjanus griseus*), and permit (*Trachinotus falcatus*). Acknowledging the potential biological and socioeconomic implications of this action, the Commission included a seven-year sunset clause requiring a re-evaluation of this closure informed by research and monitoring.

To guide this evaluation, a multidisciplinary group of researchers, in coordination with resource managers, created the “Western Dry Rocks Science Plan”. This plan provides a framework for evaluating both ecological and socioeconomic outcomes. The overarching goal was to support decision-making that reflects the best available science that is transparent and grounded in evidence that considers both biological trends and the experience and perspectives of resource users.

### METHODOLOGIES

The Western Dry Rocks Science Plan (Morley et al. 2025) was created through collaboration between ecological scientists and human dimension specialists. We collaborated with resource managers to ensure our research efforts would be applicable to the re-evaluation process. The science plan provides a comprehensive research framework focused on two central goals: 1) Monitoring changes in fish spawning aggregations at Western Dry Rocks and surrounding fish communities, and 2) Assess resources users’ opinions to Western Dry Rocks regulations and changes in resource use. To achieve this, we identified a suite of techniques categorized into ecological and socioeconomical approaches. Techniques for Goal 1 include: underwater fish counts, autonomous underwater vehicle surveys, underwater camera deployments, acoustic telemetry tagging of fish, and biosampling for age, growth and reproductive patterns. Goal 2 will be evaluated through: economic surveys, semi-structured interviews with different resource users groups, and aerial surveys and passive acoustic hydrophones to document changes in boating pressure.

To evaluate outcomes in a clear and accessible format, we incorporated a “traffic light” performance metric system (adapted from Gallacher et al. 2016). Each metric is assigned a color based on observed trends as follows:

- Green – positive trend/improvement
- Yellow – neutral or uncertain trend
- Red – negative trend or decline
- Gray – insufficient data for assessment

This visual framework supports effective communication with resource users, managers, and the broader public (Figure 1).

PERFORMANCE METRIC	DATA SOURCES		CRITERIA FOR COLOR ASSIGNMENT
Changes in fish abundance at aggregation sites within the closure	Reef fish surveys Biomass surveys Underwater cameras		Increase in abundance of focal species at aggregation sites inside the closure over time.
			No measurable difference in abundance of focal species at aggregation sites inside the closure over time.
			Decrease in abundance of focal species at aggregation sites inside the closure over time.
			Not enough information to assess this metric.

**Figure 1.** Example from the metric evaluation tables in the Western Dry Rocks Science Plan. Columns indicate the metric, data sources used, and the assigned traffic light colors based on specific criteria for color assignment.

**RESULTS AND DISCUSSION:**

While full results will not be available until the completion of the seven-year monitoring period, active data collection is underway across both ecological and socioeconomic domains. Implementation of the science plan has already provided us with insights to the benefits and challenges of conducting interdisciplinary marine science.

A major strength of this science plan is its intentional integration of ecological and human dimension research. While marine spatial management initiatives often prioritize biological data, we explicitly considered evaluating not only ecological outcomes but also examining perceptions surrounding the closure and any economic effects it may have. Such integration is essential for evaluating marine spatial management yet remains underutilized in practice. Another asset of this science plan was its development in coordination with resource managers, enhancing its relevance and direct application in decision-making.

Despite these strengths, challenges have emerged. The project began as a multidisciplinary collaboration, with ecological and social science teams working in parallel. However, the transition to true interdisciplinary collaboration – where research from both domains are synthesized to co-produce knowledge – has proven more complex than expected. Shifting to a true interdisciplinary integration will enhance our assessment of the Western Dry Rocks closure and remains a goal of this project.

Looking ahead, the success of the Western Dry Rocks closure will hinge not only on measured ecological and social outcomes, but also on the ability to clearly communicate those findings to diverse audiences, including managers, scientists, fishers, and the broader public necessitating continued efforts towards interdisciplinary research.

**LITERATURE CITED**

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