



# Mission: Iconic Reefs and National Coral Reef Monitoring Program Reef Fish Analyses

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## 1 Introduction

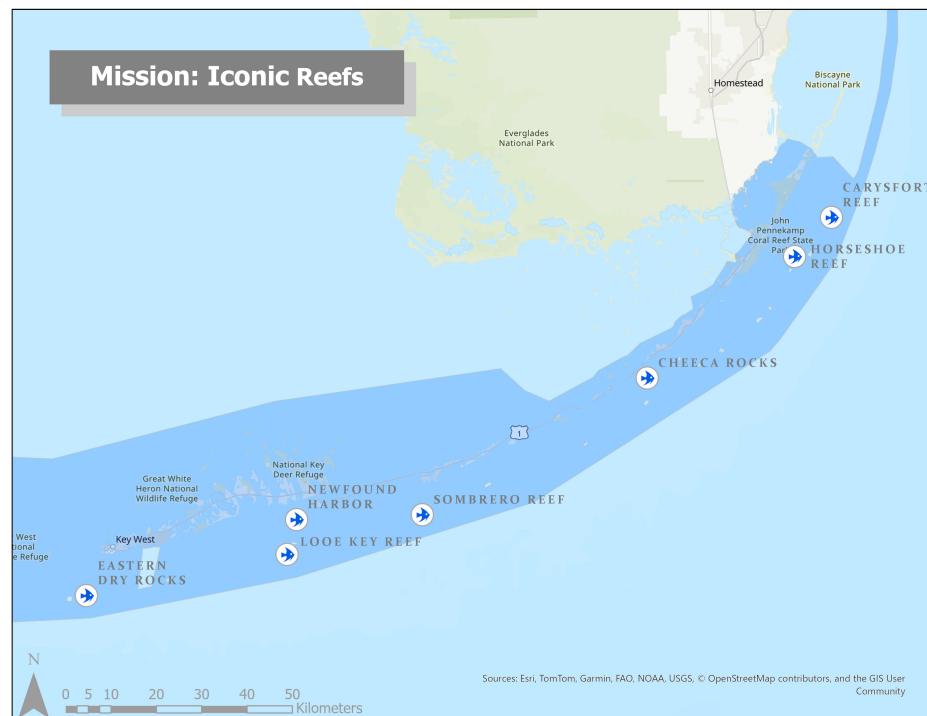
**Mission: Iconic Reefs** is a multi-institutional initiative designed to restore ecological function and biodiversity across key reef sites in the Florida Keys. Led by NOAA in collaboration with federal, state, institutional, and non-profit partners, M:IR targets nearly three million square feet of reef at seven key coral reefs in the Florida Keys National Marine Sanctuary (FKNMS): Carysfort (North and South), Cheeca Rocks, Eastern Dry Rocks, Horseshoe Reef, Looe Key, Newfound Harbor, and Sombrero Reef.. The overarching M:IR goal is to restore coral cover and reef function to a self-sustaining state.

Monitoring the response of reef fish populations to these restoration interventions is essential to quantify the broader ecological impacts of restoration efforts (Feeley et al. 2025). The National Coral Reef Monitoring Program (NCRMP) conducts non-extractive Reef Visual Census (RVC) surveys using a stationary-point-count method modified from Bohnsack and Bannerot (1986) (Bohnack and Bannerot 1986; CRCP 2024). Surveys are conducted on shallow (<30 m), hard-bottom reef habitats and employ a stratified-random, one-stage design within 50 m × 50 m grid cells to ensure representative sampling across depth and rugosity strata (CRCP 2024; Ault et al. 2021). For this analysis, the NCRMP dataset was restricted to strata types overlapping M:IR sites to allow direct comparisons of fish communities inside and outside restoration areas.

Six reef fish species were selected to represent a range of trophic levels and functional roles. NCRMP's extensive sampling provides population-level insights into density (number of individuals per 177 m<sup>2</sup> ± SE), occurrence (frequency of detection within and outside M:IR sites ± SE), and relative length frequency distributions. Density and occurrence metrics enable detection of shifts in abundance and distribution patterns in response to environmental disturbances and management interventions (Ault et al. 2021). Length frequency data provide detailed information on population structure, recruitment, and potential fishing impacts, serving as an indicator of restoration effectiveness and long-term population sustainability (Ault et

al. 2021). Analysis was completed using the Blondeau & Ganz RVC Statistics package in R (Ganz and Blondeau 2015)

## 1.1 Map of M:IR Sites



## 2 Data

To allow for direct comparisons of fish populations inside the M:IR restoration areas with control, non-restored areas across the Florida Keys reefs, the NCRMP dataset was restricted to strata types and depth zones (0-12 m) found within M:IR sites (table 1). Standard fish metrics, including density, occurrence, and relative length composition, are for selected fish species (table 2). Computational formulas of standard metrics for a single-stage stratified random sampling design are modified from Smith et al. (2011b) and provided in detail in Grove et al. (2021) and Bryan et al. (2016). Statistical comparisons evaluated density and occurrence differences between M:IR and NCRMP estimates for each survey year. This report focuses on coral populations and benthic community metrics; a separate report can be found for fish population assessments [Krampitz et al., 2025](#). Fish analysis scripts are open source and available through the [NCRMP Fish R package](#) (Ganz and Blondeau 2015).

### 2.1 Strata

Table 1: Number of reef fish survey sites inside and outside M:IR areas in each stratum by year.

| PROT    | STRAT | description                         | 2022 | 2024 |
|---------|-------|-------------------------------------|------|------|
| Outside | FK01  | Inshore reefs, all depths           | 0    | 15   |
| Outside | FK02  | Mid-channel patch reefs, all depths | 101  | 100  |
| Outside | FK03  | Offshore patch, all depths          | 61   | 36   |
| Outside | FK04  | Forereef, low rugosity, <12m        | 95   | 105  |
| Outside | FK05  | Forereef, high rugosity, <12m       | 88   | 87   |
| Inside  | FK01  | Inshore reefs, all depths           | 0    | 12   |
| Inside  | FK02  | Mid-channel patch reefs, all depths | 12   | 13   |
| Inside  | FK03  | Offshore patch, all depths          | 7    | 8    |
| Inside  | FK04  | Forereef, low rugosity, <12m        | 5    | 15   |
| Inside  | FK05  | Forereef, high rugosity, <12m       | 61   | 64   |

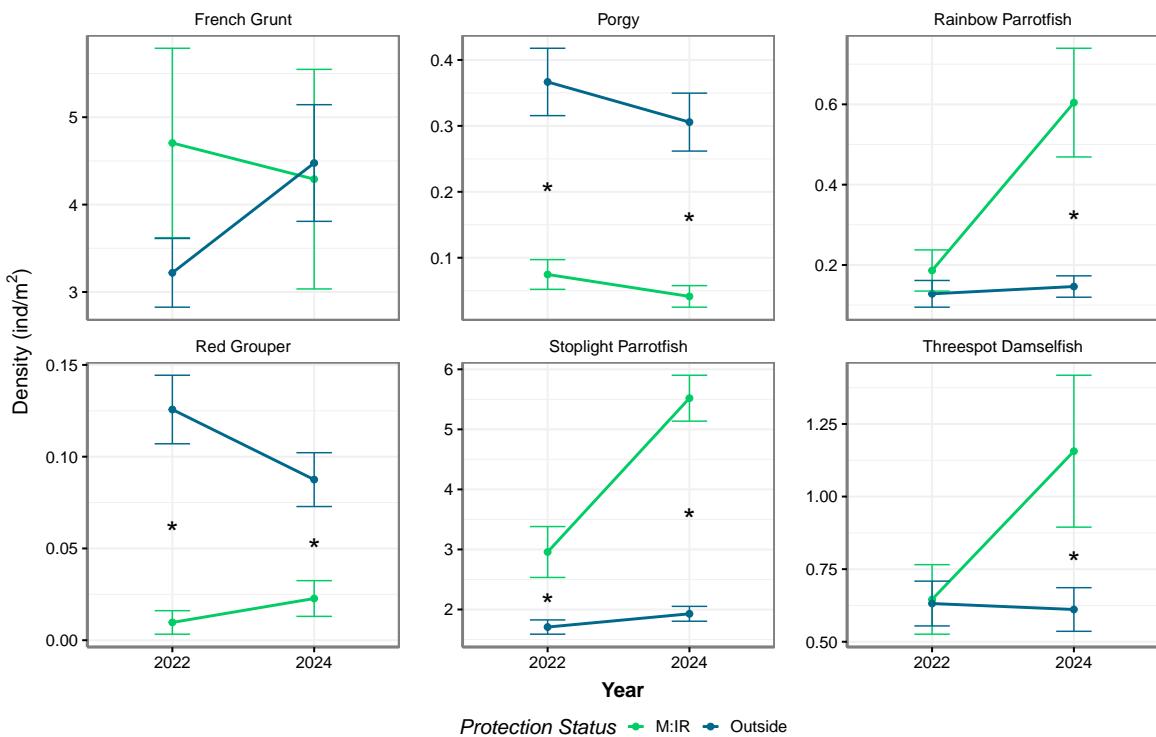
## 2.2 Fish Species

Table 2: Fish species with representative photos. For analysis, both porgy species were combined.

| Species Code | Common Name          | Scientific Name               | Photo   |
|--------------|----------------------|-------------------------------|---|
| HAE FLAV     | French Grunt         | <i>Haemulon flavolineatum</i> |    |
| SPA VIRI     | Stoplight Parrotfish | <i>Sparisoma viride</i>       |    |
| SCA GUAC     | Rainbow Parrotfish   | <i>Scarus guacamaia</i>       |    |
| STE PLAN     | Threespot Damselfish | <i>Stegastes planifrons</i>   |   |
| CAL CALA     | Saucereye Porgy      | <i>Calamus calamus</i>        |  |
| CAL NODO     | Knobbed Porgy        | <i>Calamus nodosus</i>        |  |
| EPI MORI     | Red Grouper          | <i>Epinephelus morio</i>      |  |

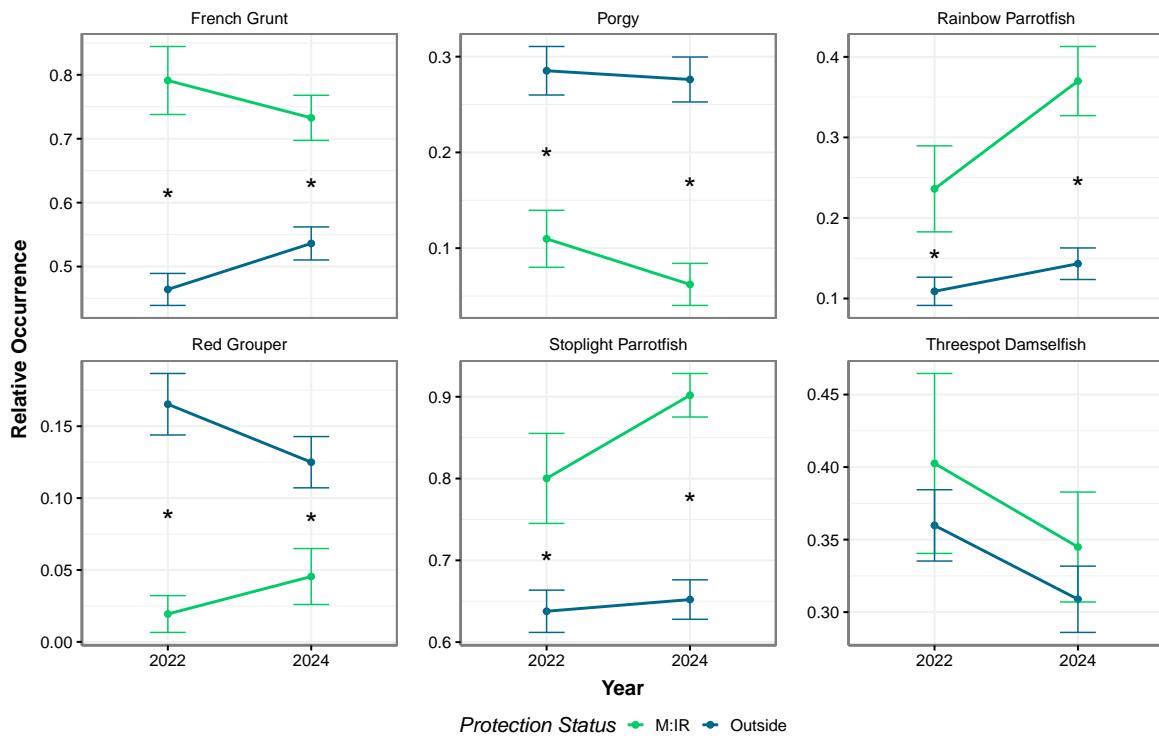
### 3 Density

NCRMP's comprehensive sampling design provides a broad, population-level perspective on the status and trends of the reef fish community. In particular, trend data can provide insight into how species respond to events including regional management actions such as targeted coral restoration efforts within the M:IR sites. Density results are shown as the number of individuals per survey area  $177 \text{ m}^2 \pm \text{SE}$ .



## 4 Occurrence

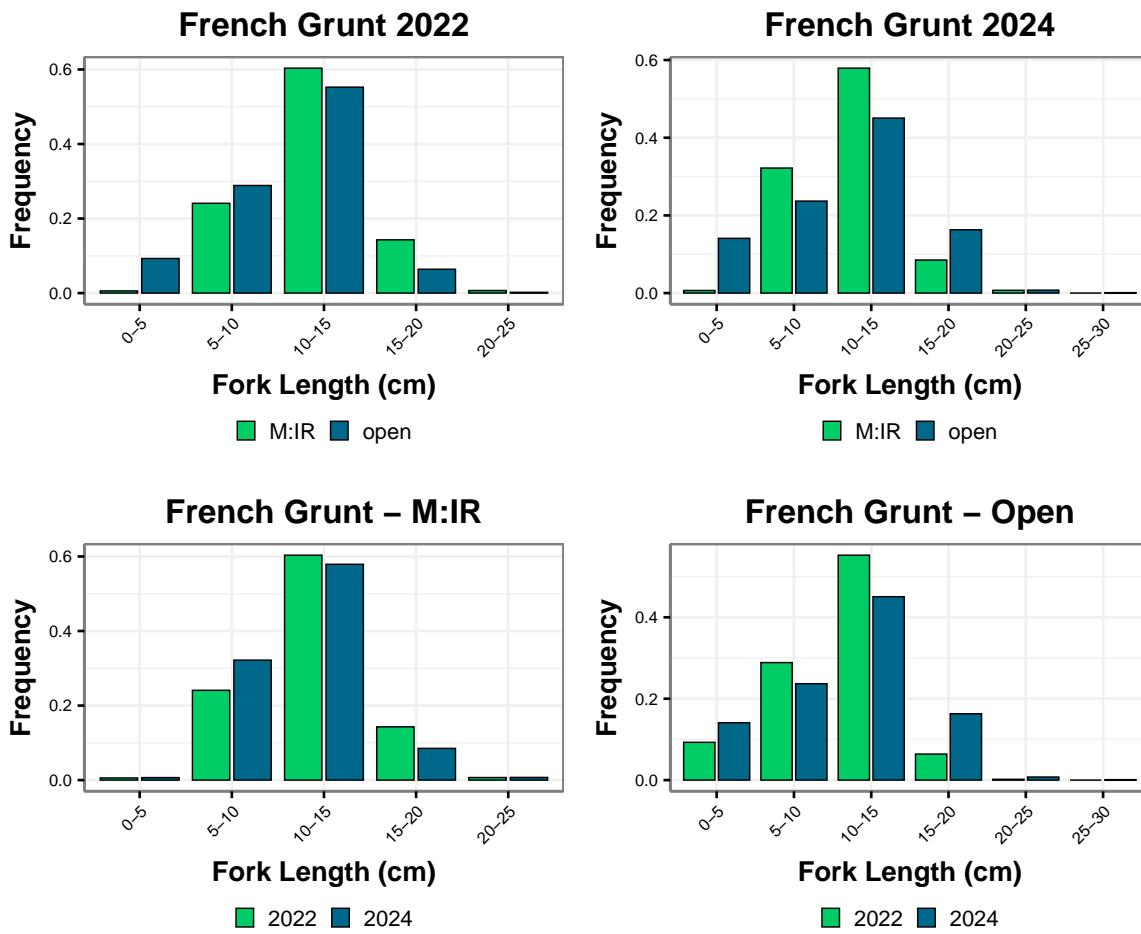
Occurrence measures how often a species is detected in surveys, providing insight into its distribution within M:IR sites and outside of M:IR sites in the Florida Keys. Results show presence regardless of abundance, helping to identify widespread versus rare species. Survey occurrence results are shown within M:IR sites (inside) and in the Florida Keys (outside)  $\pm$  SE.



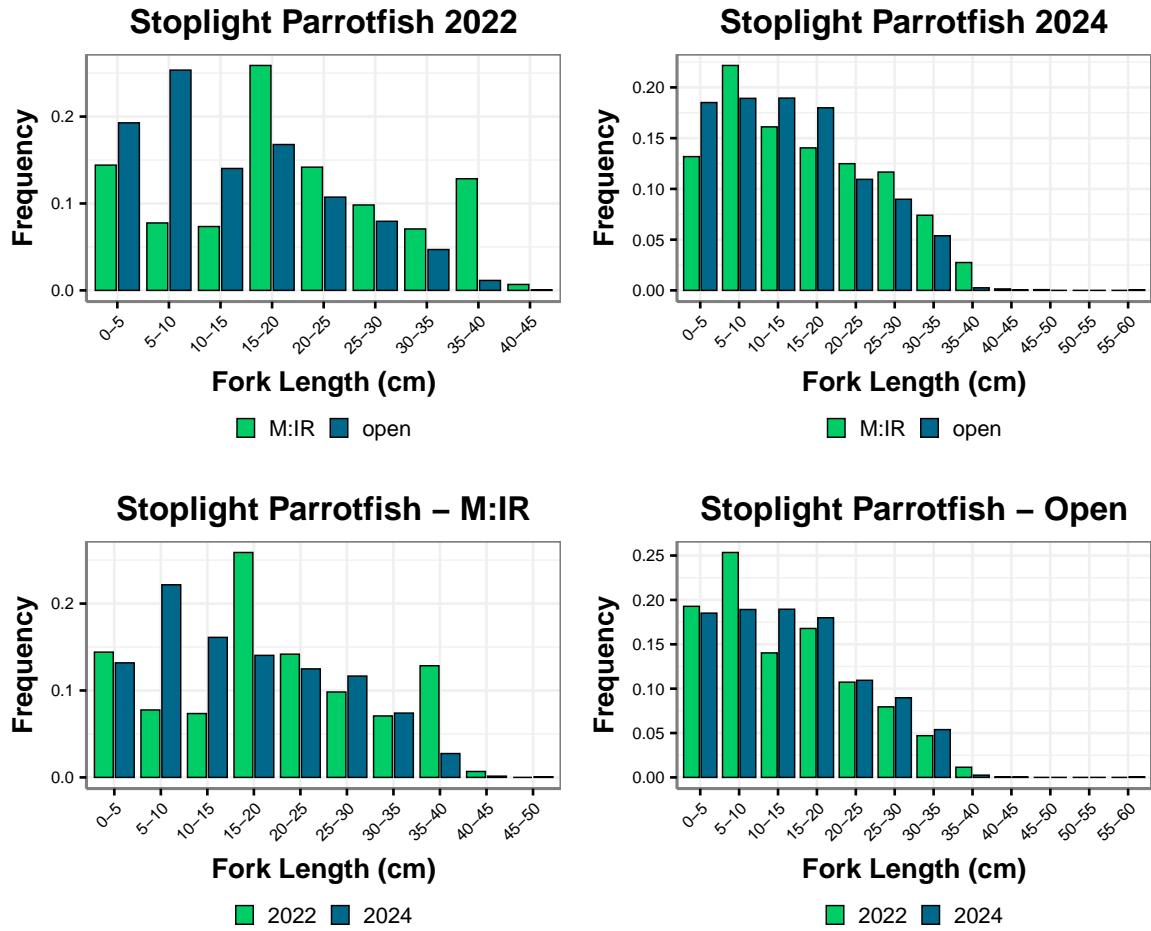
## 5 Relative Length Frequency

Length compositions provide a detailed description of a selected fish's population structure. These highly informative figures can show the length at which a fish species recruits to the coral reef (i.e., young of year or from nursery habitat), length classes removed by the local fisheries, and the effectiveness of management actions

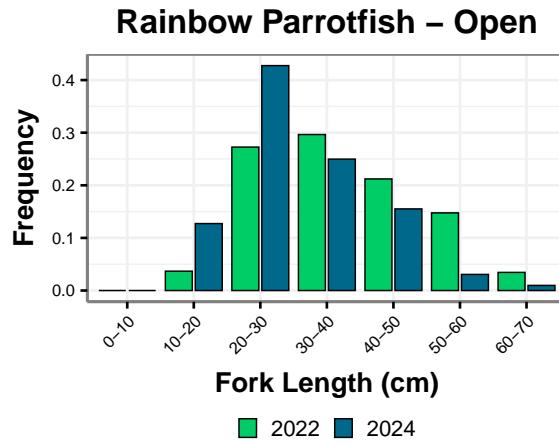
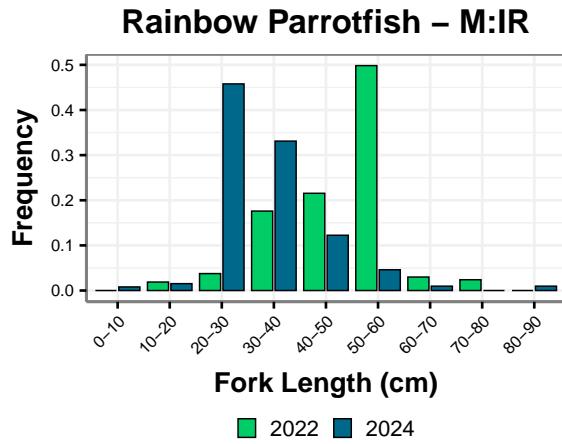
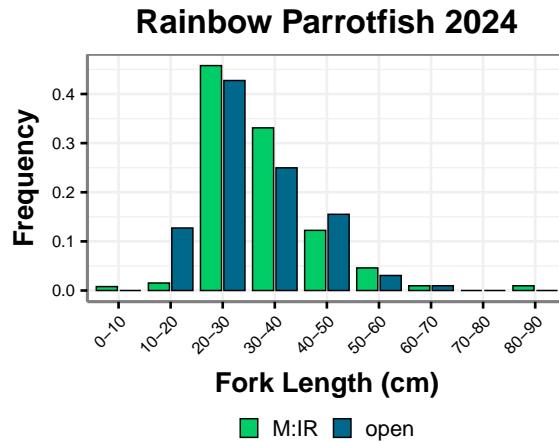
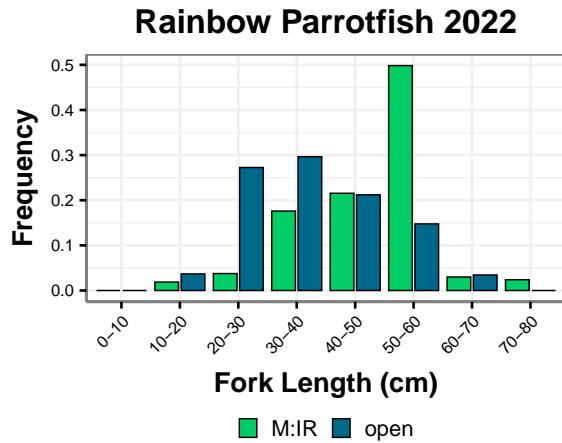
### 5.1 French Grunt



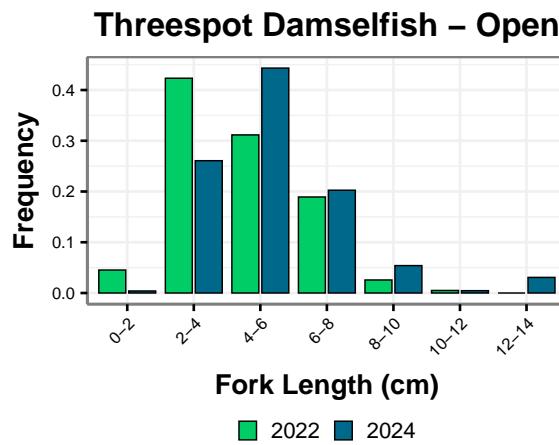
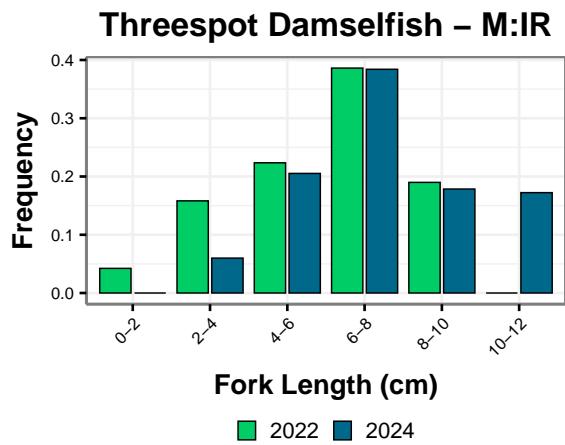
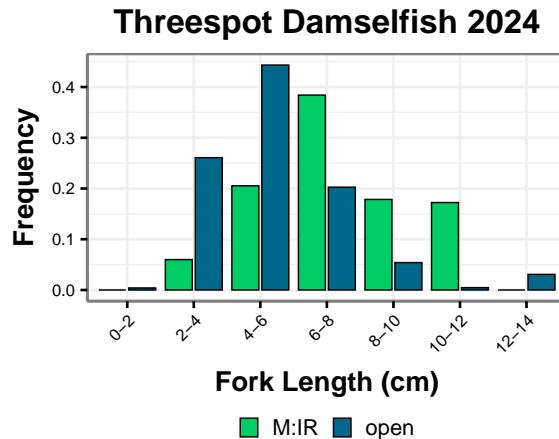
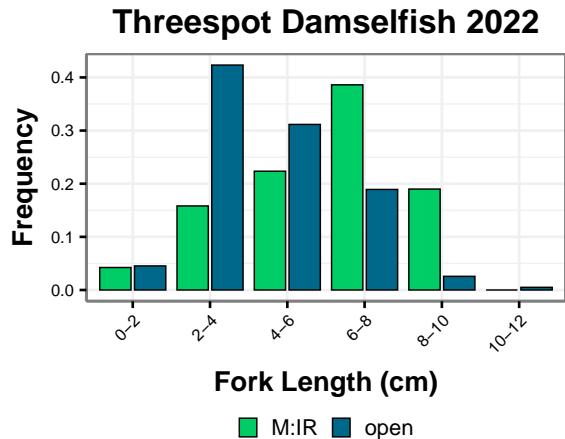
## 5.2 Stoplight Parrotfish



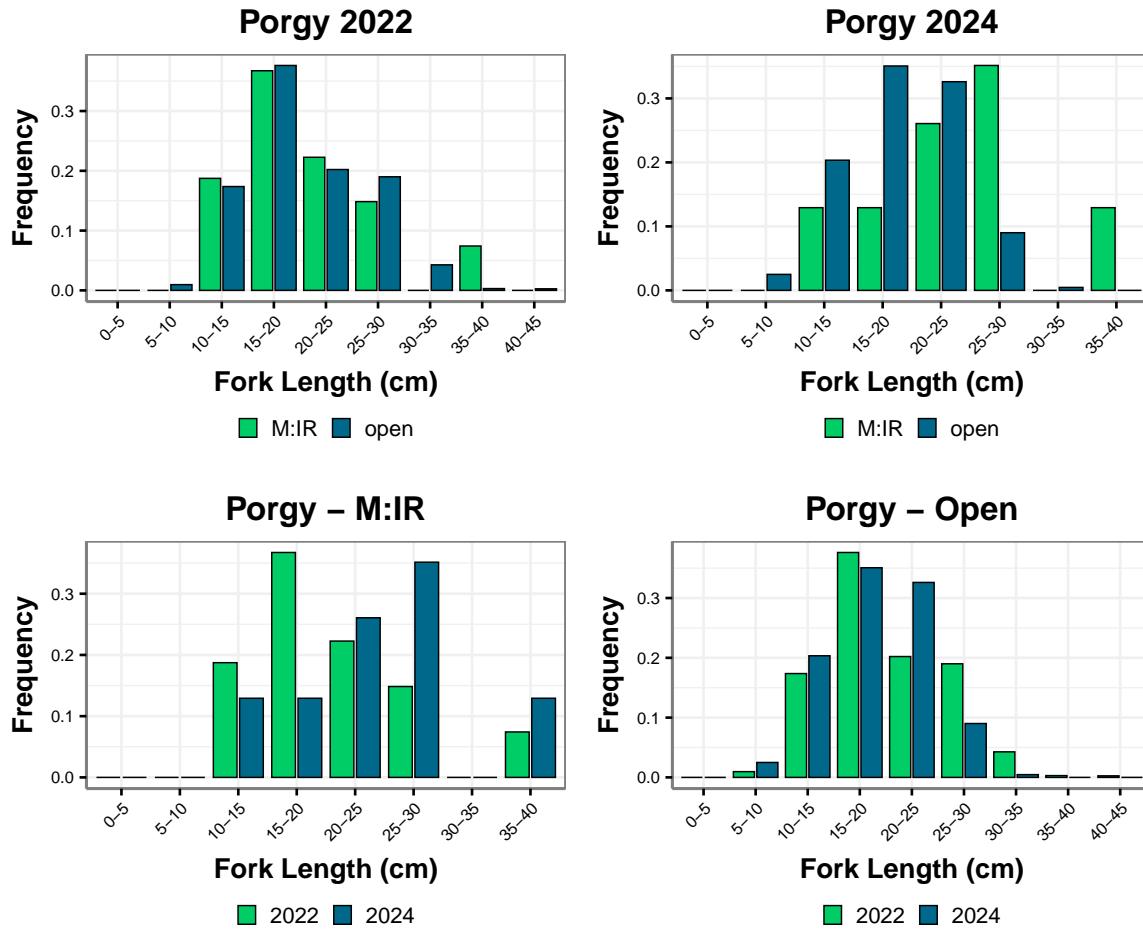
### 5.3 Rainbow Parrotfish



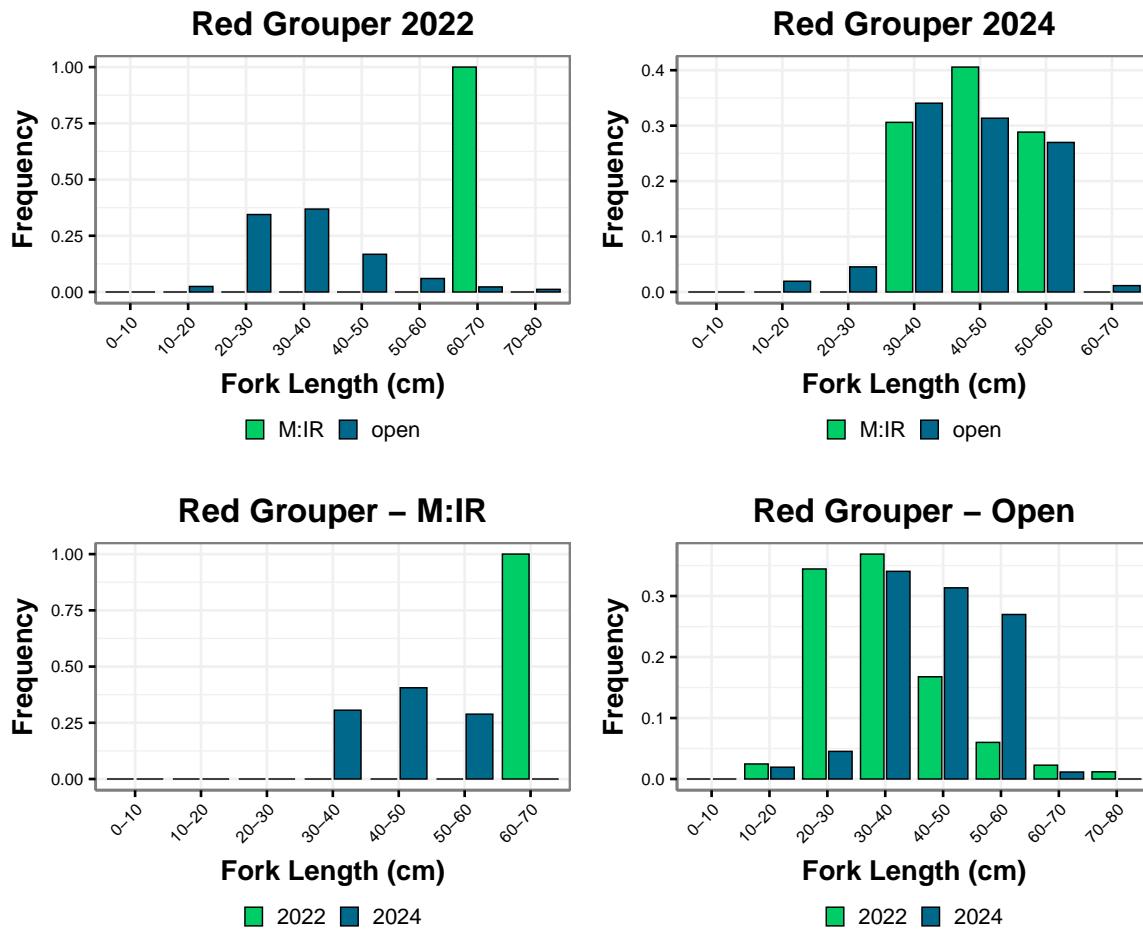
## 5.4 Threespot Damselfish



## 5.5 Porgy



## 5.6 Red Grouper



## 6 Points of Contact

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