

# Proposed treatment and modelling of the CDFW ROV survey data for copper rockfish

Melissa Monk and Chantel Wetzel

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# Data Filtering

- The data was initially evaluated to determine what level, if any, of data filtering should be conducted.
- The final selection of data filtered was based on:
  - a. Extreme usable area estimates
  - b. Depths where copper rockfish would be expected to be observed
  - c. Transects that cross into both MPA and Reference areas
  - d. Sites (MPA group) that were only sampled in one of the super year periods

# Usable Area Filtering

- There are a handful of transects in both the north and the south that have either very small or very large usable area estimates.
  - South
    - 0% quantile = 21 m<sup>2</sup>,
    - median = 1,038 m<sup>2</sup>,
    - 100% quantile = 265,727 m<sup>2</sup>
  - North
    - 0% quantile = 260 m<sup>2</sup>,
    - median = 968 m<sup>2</sup>,
    - 100% quantile = 327,474 m<sup>2</sup>
- Remove transect with usable area estimates outside the 96th quantile
  - South - removed 36 transects
    - Resulting range of usable area estimates are 603 - 2,181 m
  - North - removed 38 transects
    - Resulting range of usable area estimates are 638 - 2,298 m

# Depth Filtering

- Determine the range of depths where copper rockfish have been observed by the ROV survey
  - Evaluate the range of depths with observations across both areas combined:
    - Minimum depth of 19 meters
    - Maximum depth of 100 meters
- Remove transect where the average transect depth is outside this range
  - South - removed 3 transects
  - North - removed 8 transects

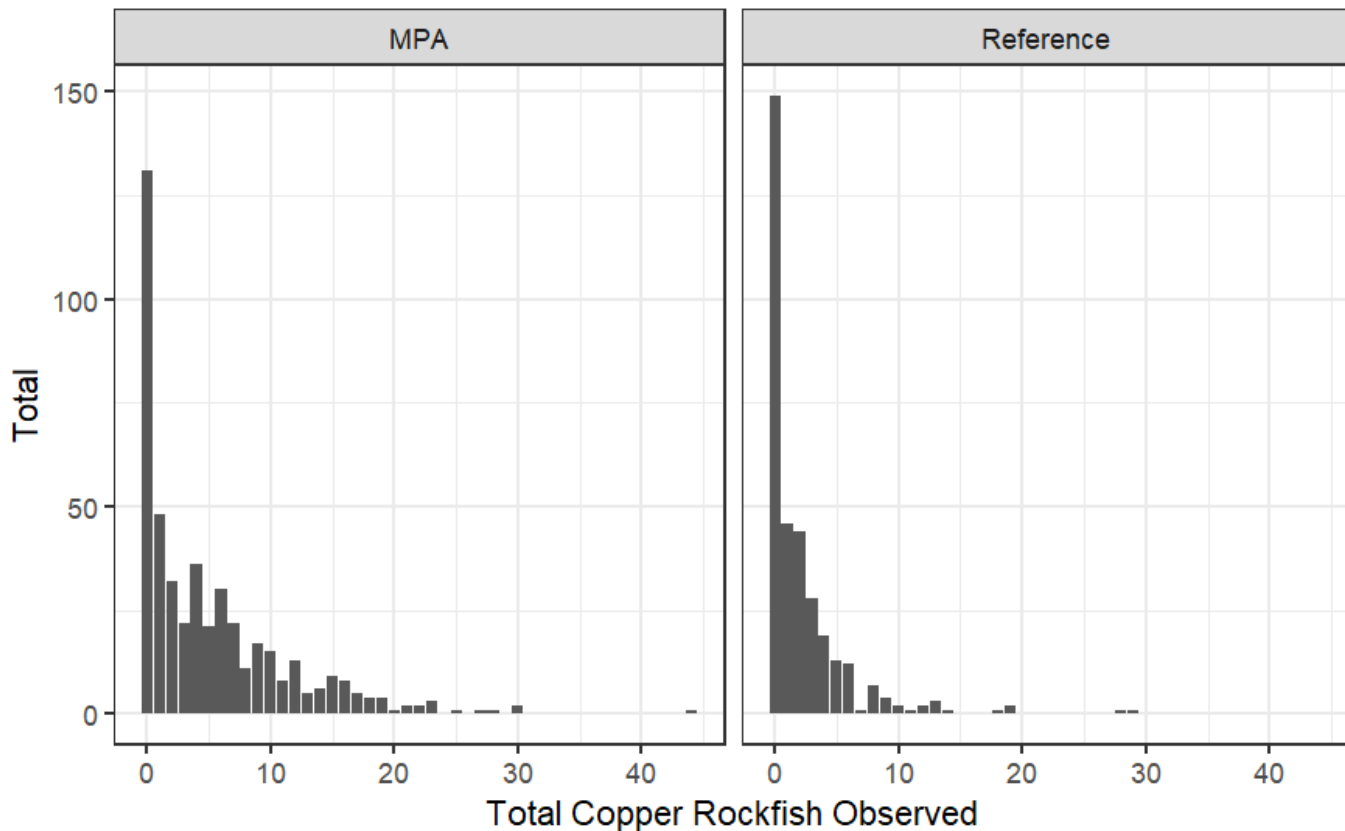
# MPA/Reference Transects

- Remove transects that cross from MPA to Reference area (or vice versa) based on the the designation of MPA/Outside
  - Modeling will include variables that indicate whether a transect is within an MPA or Reference area to estimate location effects
  - Only removed records south of Point Conception
  - South - removed 41 transects

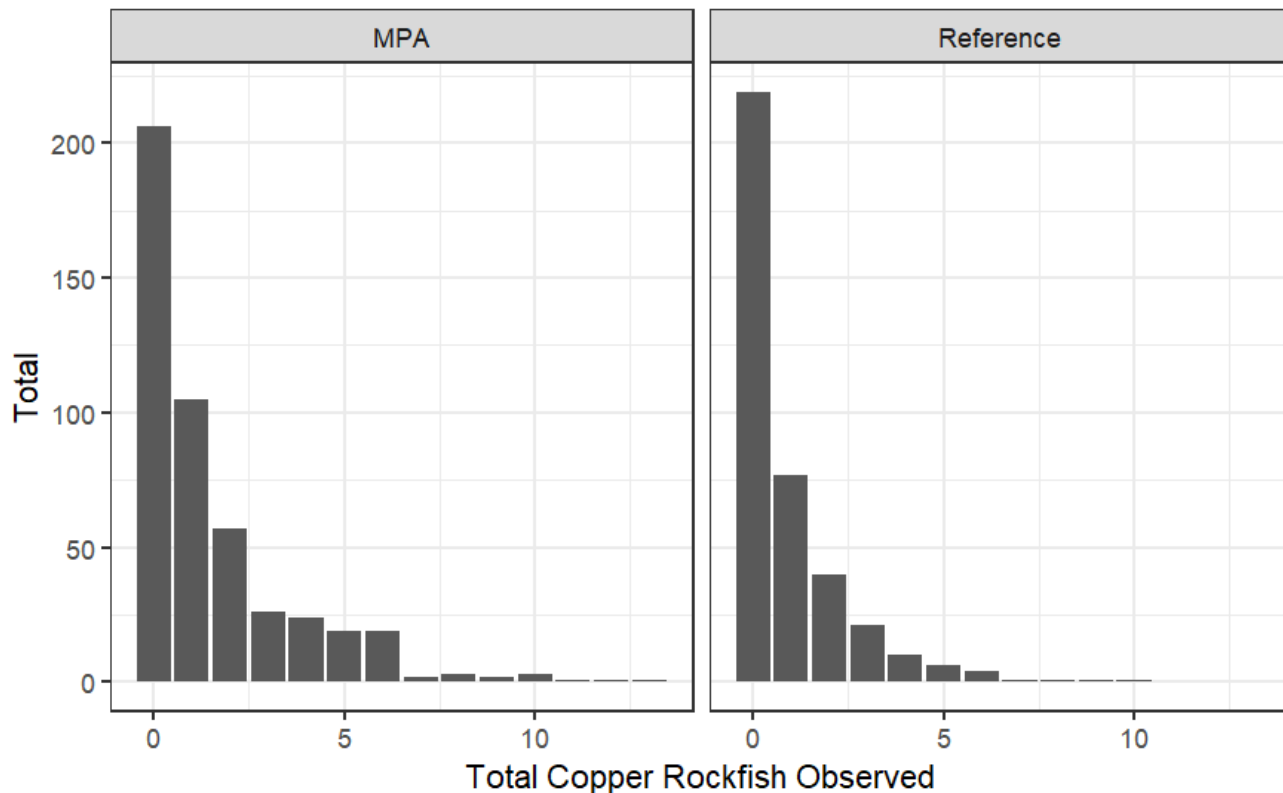
# Areas without Sampling both Super Year

- Remove records where a sampling area (MPA Group) was only sampled in one of the super year period.
- South
  - Removed 12 transects
  - Anacapa Island Reference Area
- North
  - Removed 12 transects
  - N. Farallon Islands Reference Area
  - Piedras Blancas Reference Area
- Overall retained transects post data-filtering
  - South - 798 transects
  - North - 850 transects

# Visualize the Remaining Data: South of Pt. Conception



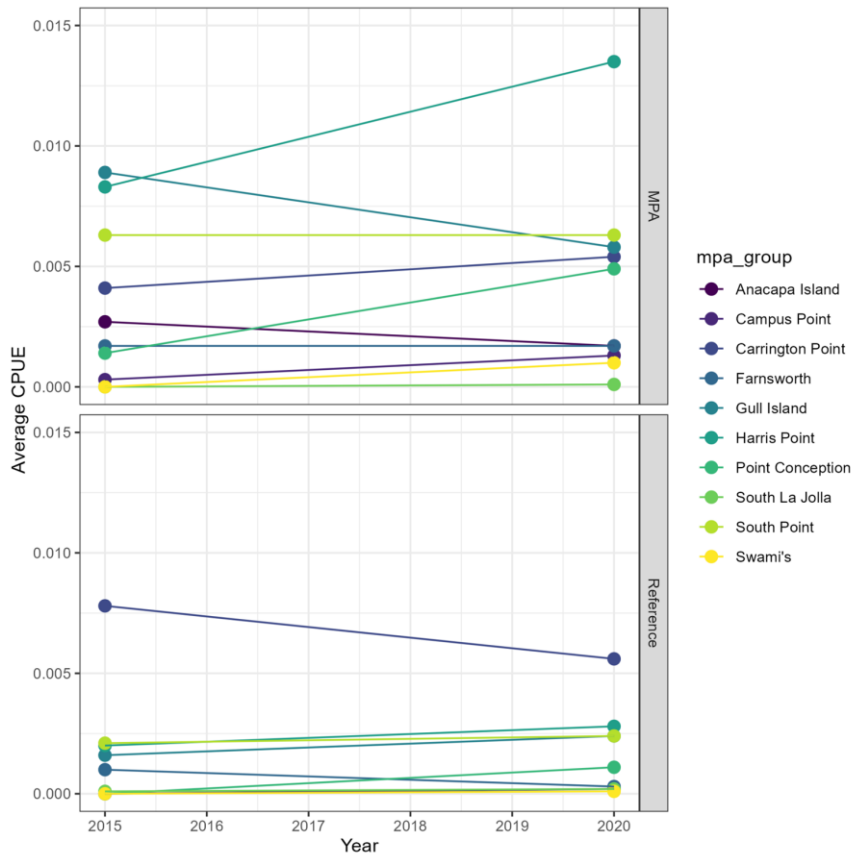
# Visualize the Remaining Data: North of Pt. Conception



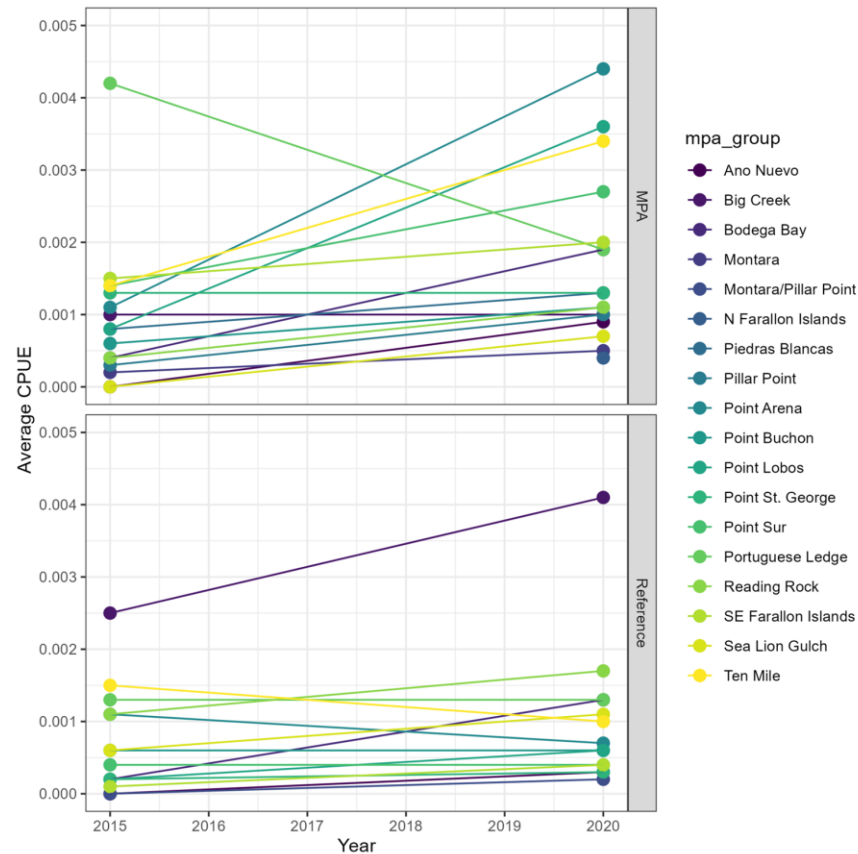


# Plot the Raw Catch-per-Unit-Effort by Area

## S. of Pt. Conception

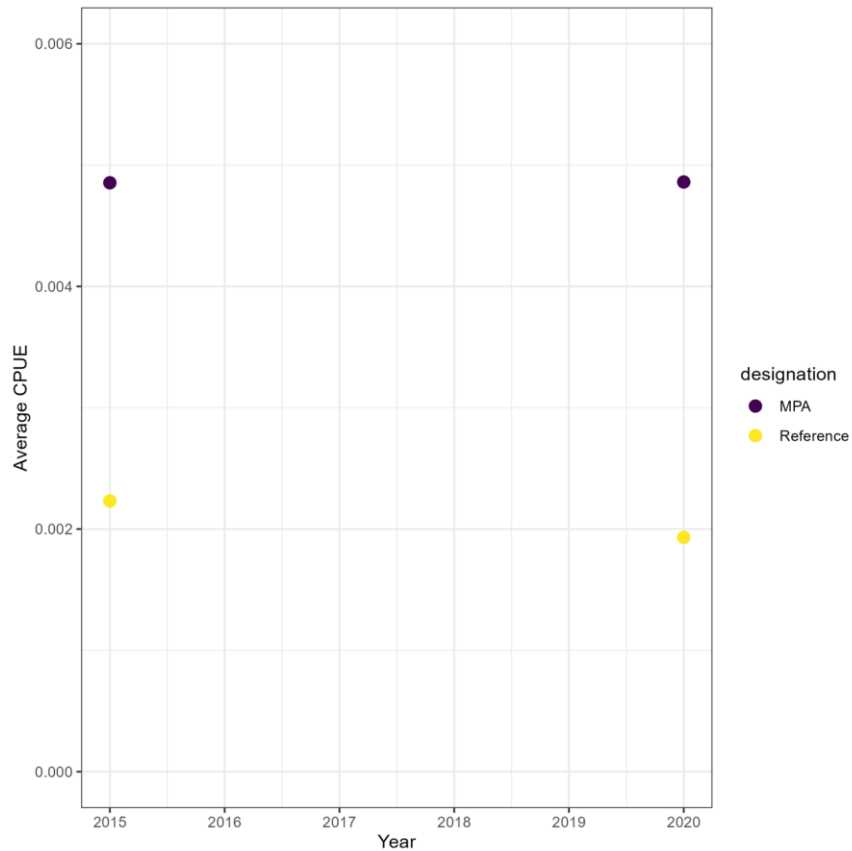


## N. of Pt. Conception

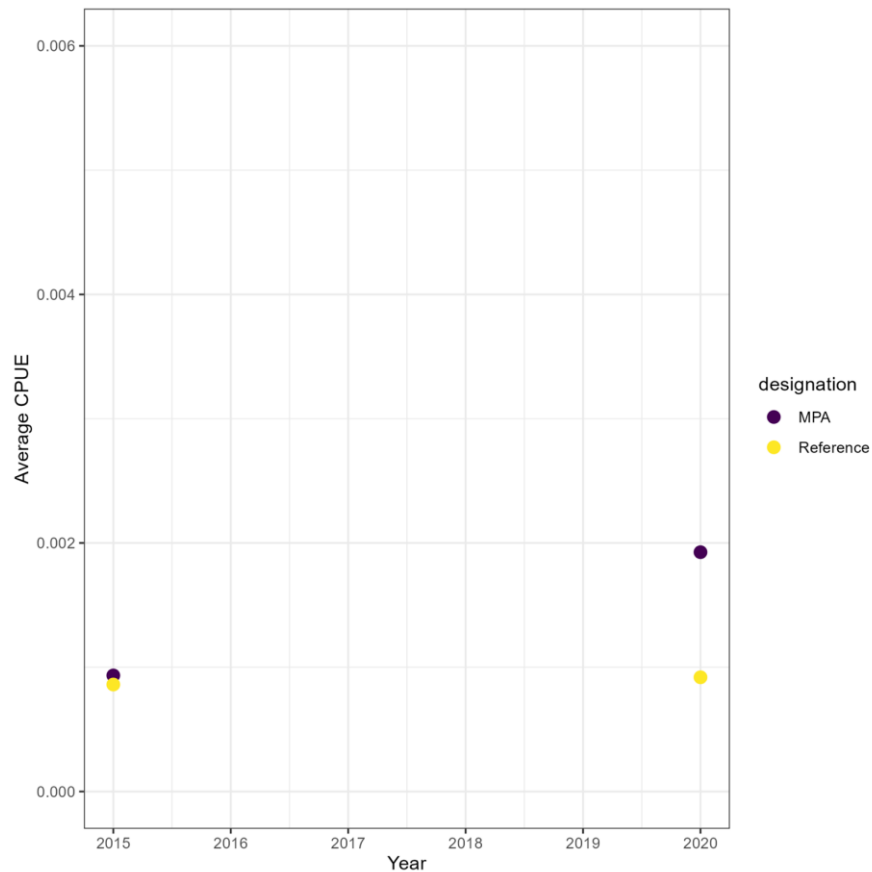


# Plot the Raw Catch-per-Unit-Effort by Designation

S. of Pt. Conception



N. of Pt. Conception



# Model Selection - South

- Investigated factors and covariates based on super year, site designation (MPA or Reference), proportion hard substrate, proportion mixed substrate, proportion soft substrate, depth, depth<sup>2</sup>, interaction term between site designation and super year, and offset in log space for usable area.

## Limited Subset of the Model Configurations Explored:

Designation	Depth Polynomial	Prop. Hard	Prop. Mixed	Prop. Soft	Super Year	Designation: Super_year	offset-log(usable area)	Delta AIC
+	+	N.A.	N.A.	-1.71	+	NA	+	0
+	+	N.A.	N.A.	-1.71	+	+	+	1.39
+	+	1.76	1.64	N.A.	+	NA	+	1.95
+	+	0.12	N.A.	-1.64	+	NA	+	1.95

# Model Selection - North

Designation	Depth Polynomial	Prop. Hard	Prop. Mixed	Prop. Soft	Super Year	Designation: Super_year	offset-log(usable area)	Delta AIC
+	+	N.A.	N.A.	N.A.	+	+	+	0
+	+	N.A.	0.45	N.A.	+	+	+	0.06
+	+	-0.16	N.A.	N.A.	+	+	+	1.6
+	+	N.A.	N.A.	-0.11	+	+	+	1.86
+	+	N.A.	0.46	0.02	+	+	+	2.1

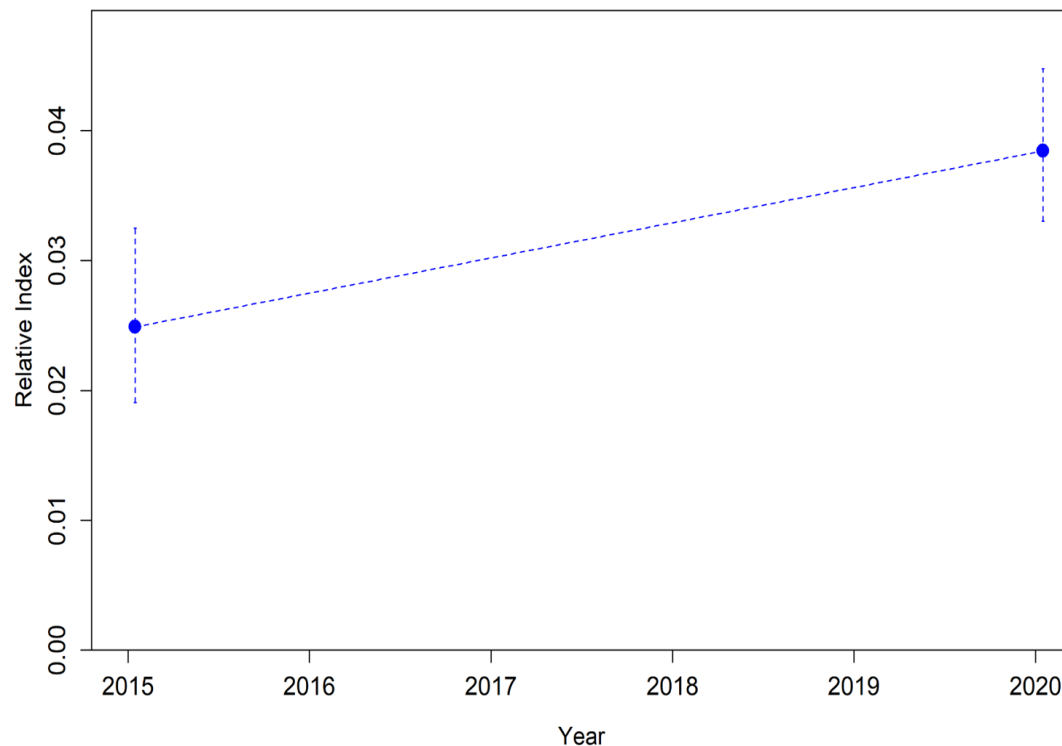
# Final Model Structure

- Initially explored a negative binomial error structure but this did not appear to align with the data, particularly for the south. Finally, selected a delta-lognormal model were it assumes a binomial structure for the presence/absence model and a lognormal distribution for the catch rate model.
- South
  - $n \sim \text{as.factor}(\text{super year}) + \text{as.factor}(\text{designation}) + \text{poly}(\text{depth scaled}, 2) + \text{prop. soft substrate scaled} + \text{as.factor}(\text{super year}):\text{as.factor}(\text{designation}) + \text{offset}(\log(\text{usable area}))$
- North
  - $n \sim \text{as.factor}(\text{super year}) + \text{as.factor}(\text{designation}) + \text{poly}(\text{depth scaled}, 2) + \text{as.factor}(\text{super year}):\text{as.factor}(\text{designation}) + \text{offset}(\log(\text{usable area}))$

# North of Point Conception

- Area-weighted index assuming 20% area is inside an MPA and 80% area open to fishing.

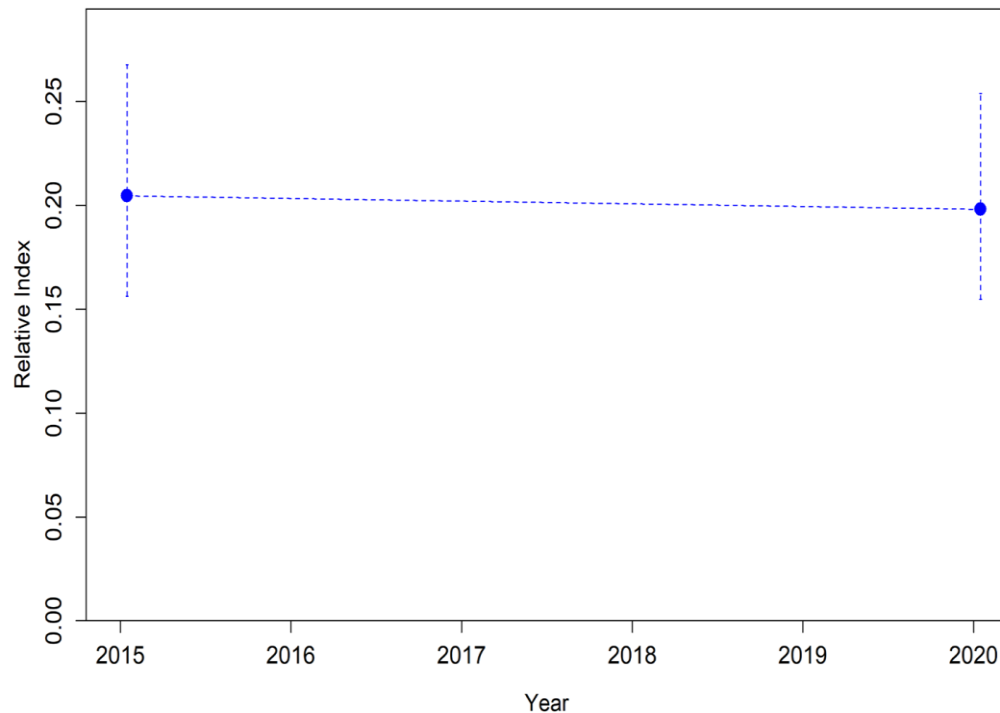
Super Year	Estimate	logSE
2015	0.02489	0.136
2010	0.03844	0.078



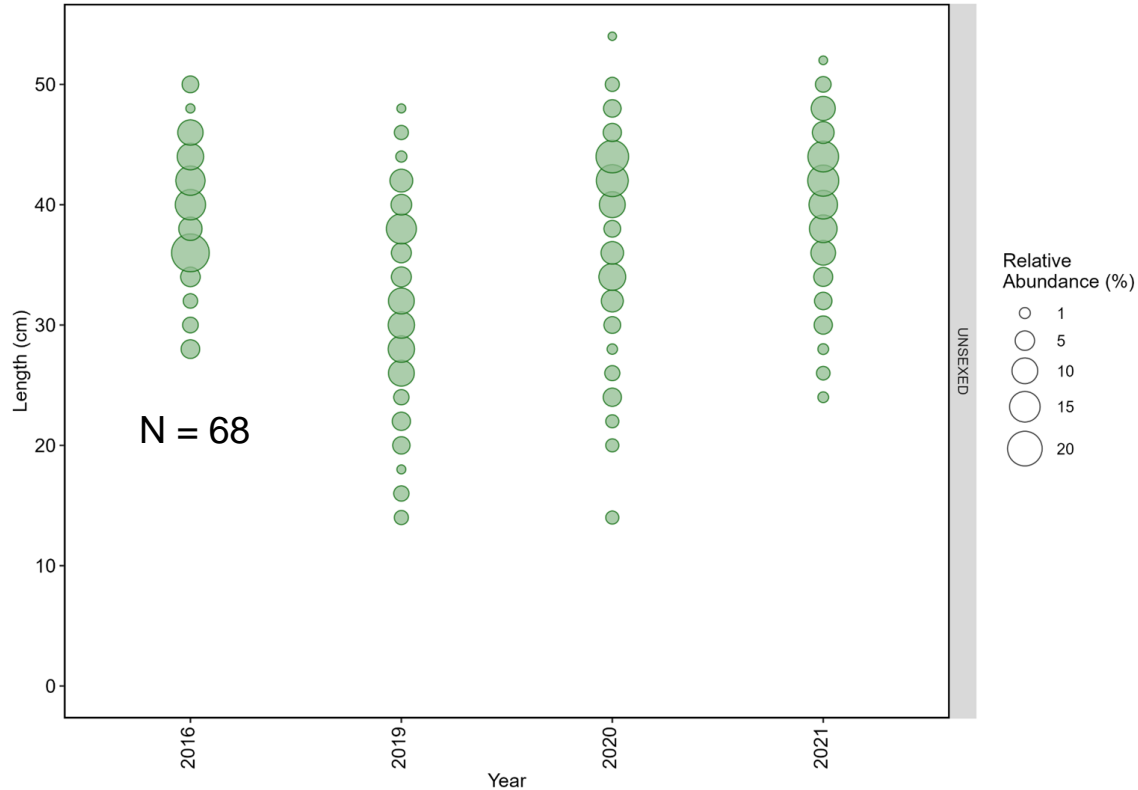
# South of Point Conception

- Area-weighted index assuming 8% area is inside an MPA and 92% area open to fishing.

Super Year	Estimate	logSE
2015	0.20449	0.137
2010	0.19817	0.126



# N. of Point Conception Weighted Length Compositions





# S. of Point Conception Weighted Length Compositions

