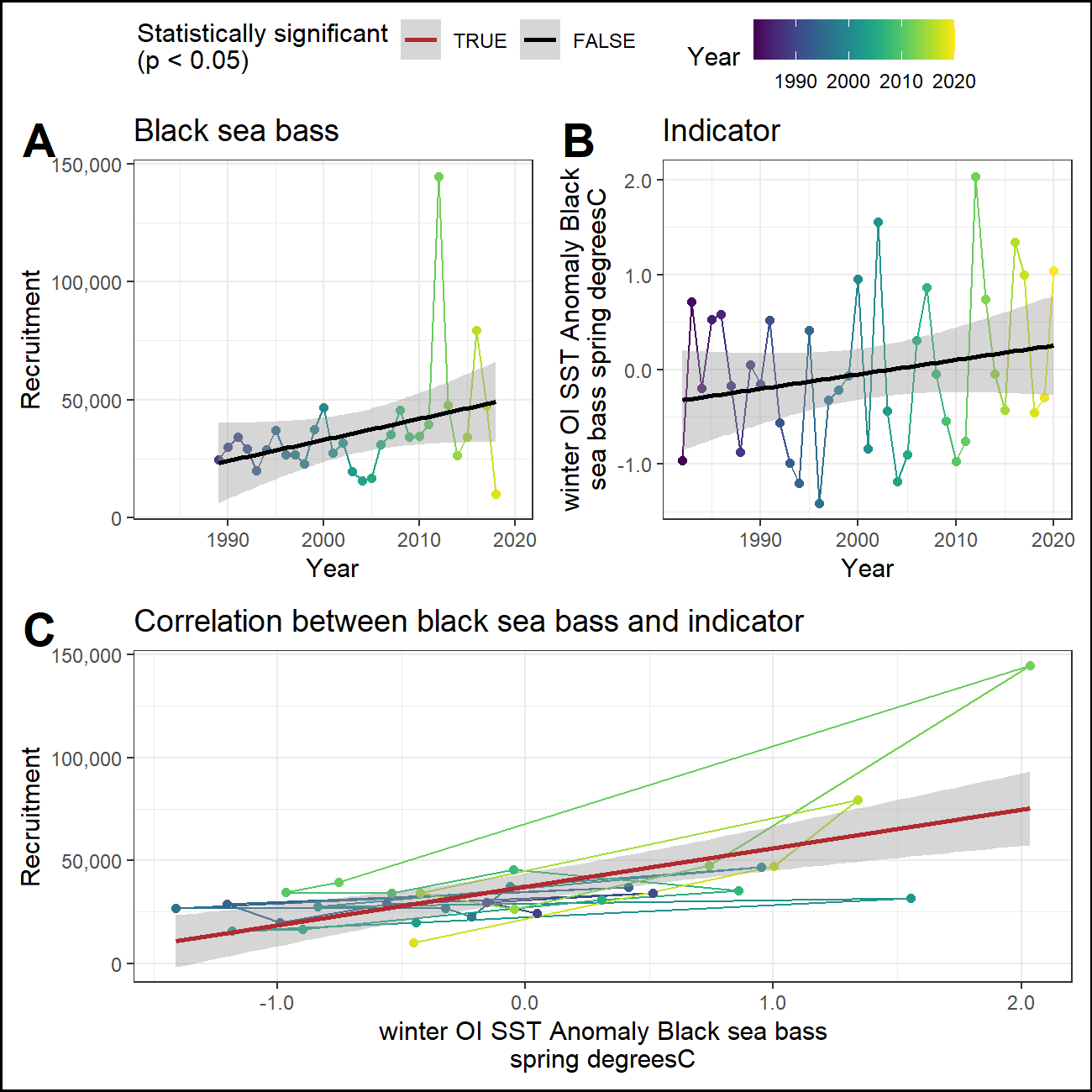
Black sea bass indicator analysis

Abigail Tyrell

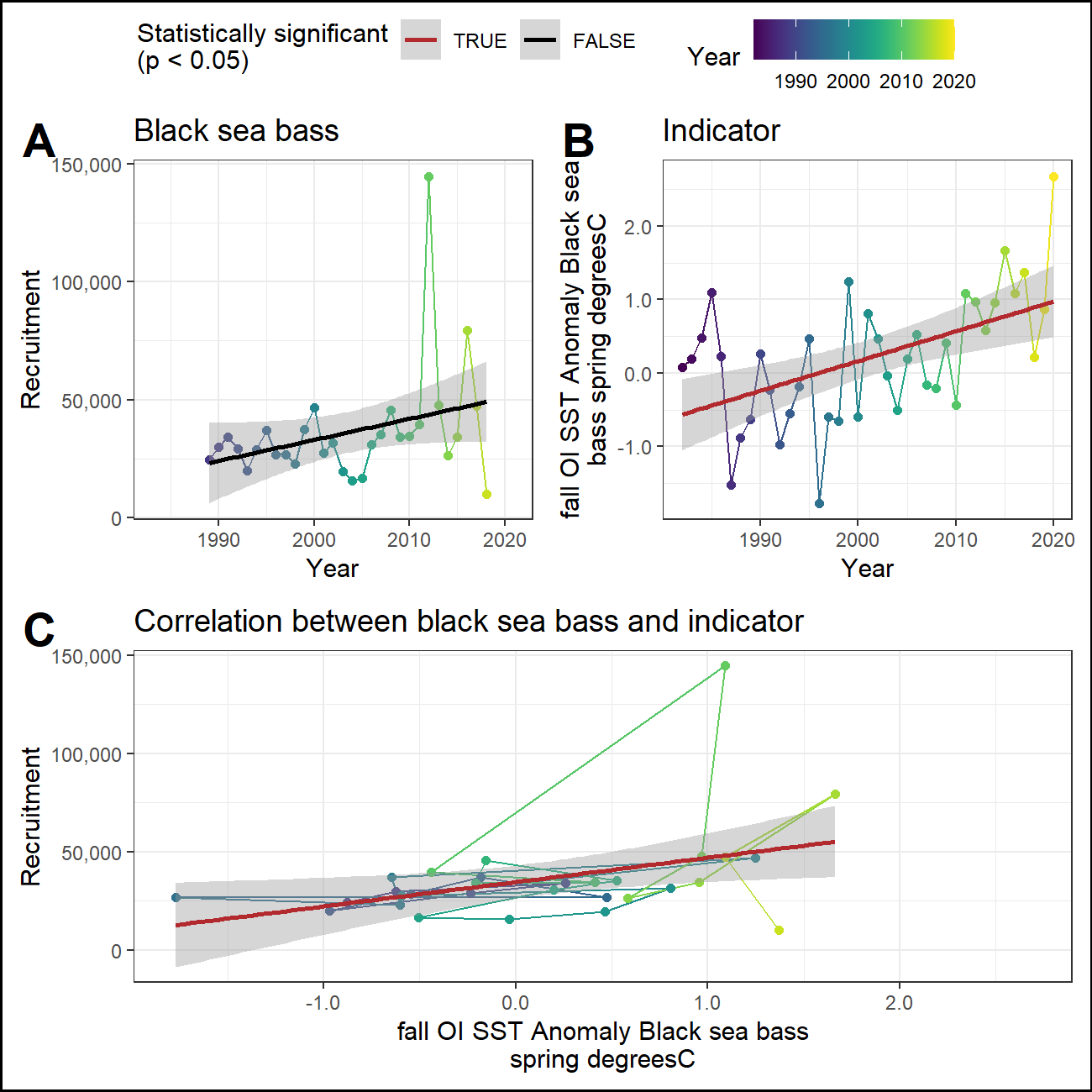
03 May 2021

## Recruitment

### Winter SST anomaly

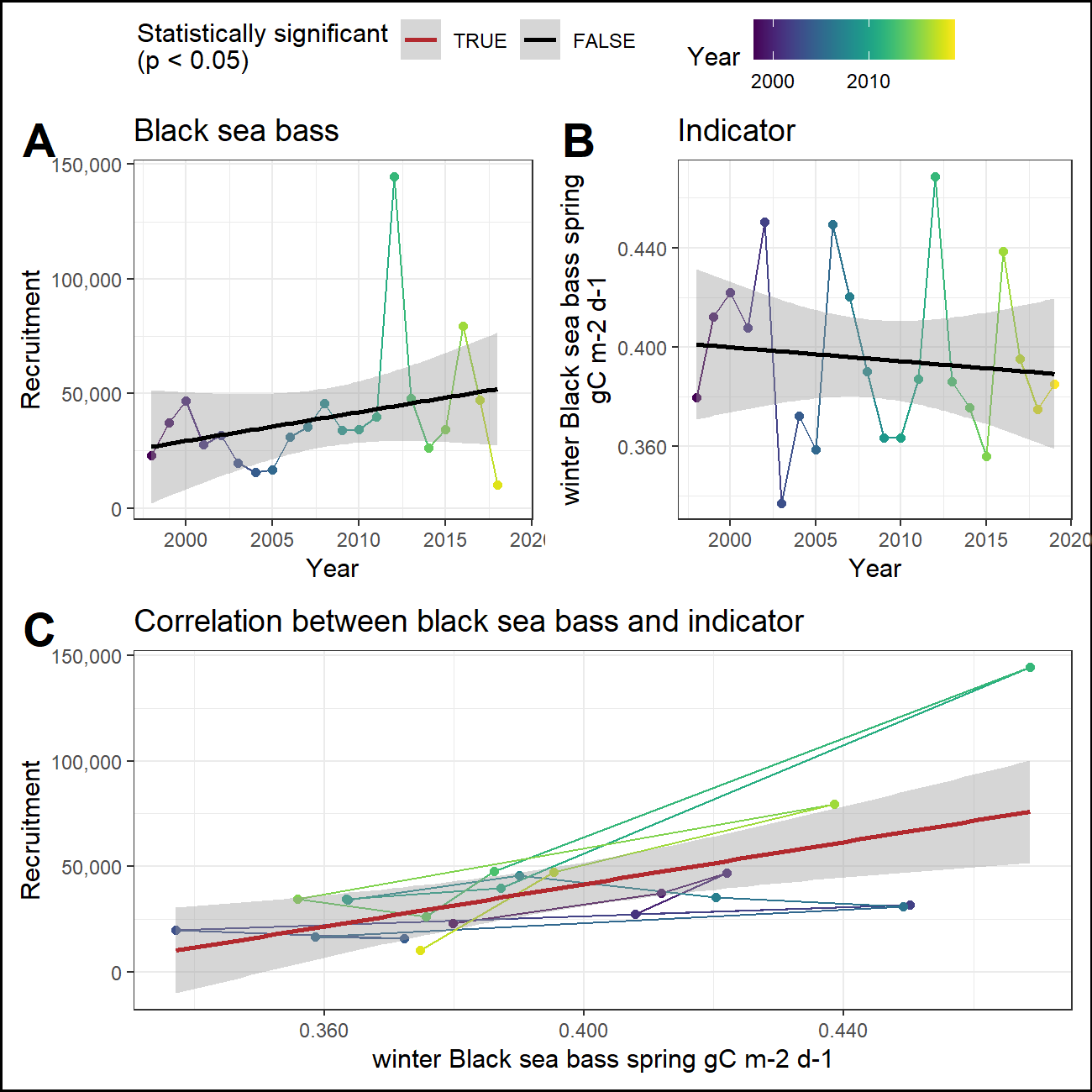


### Fall SST anomaly (prior year)



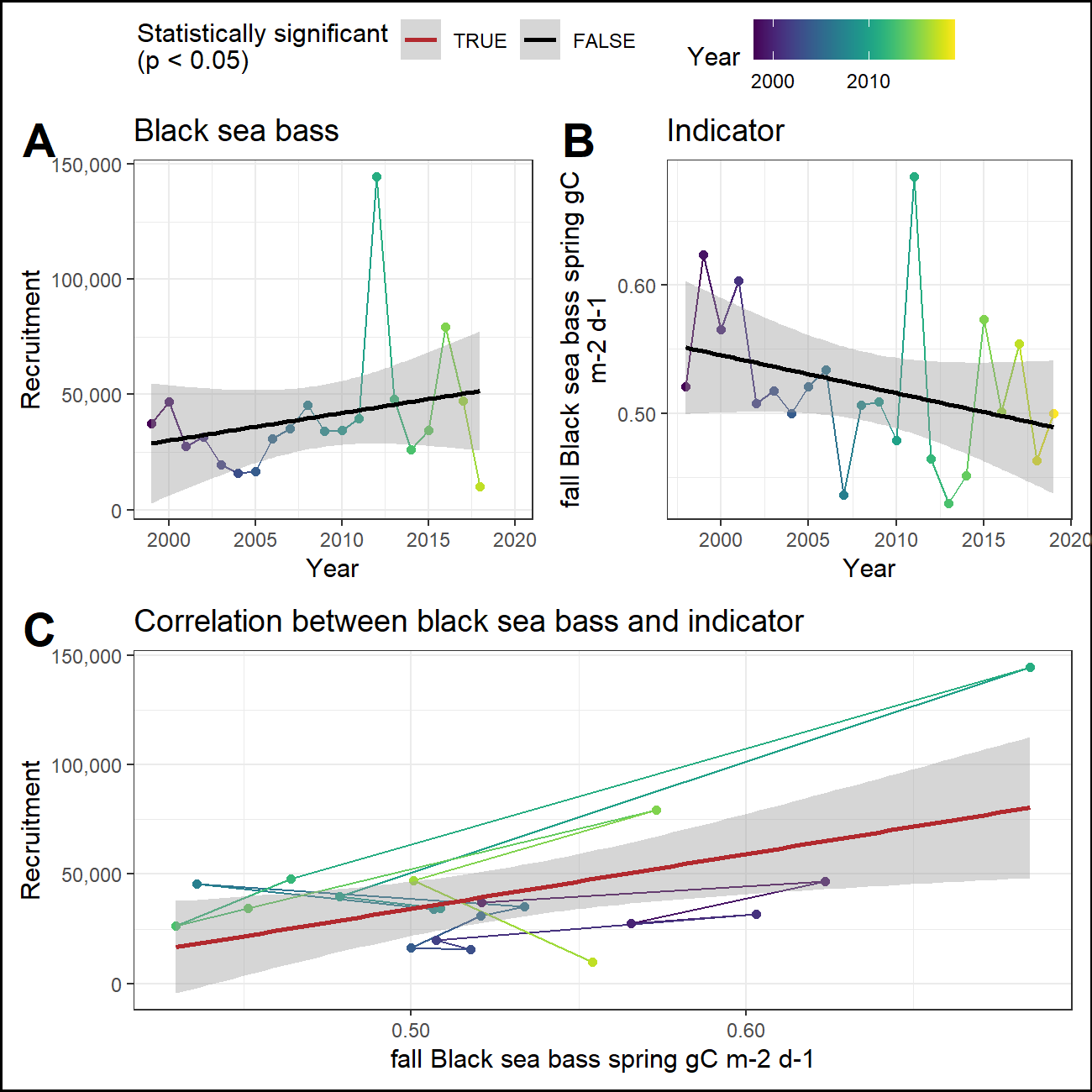
##   
##   
## [1] "Time"   
## [2] "winter OI SST Anomaly Black sea bass spring degreesC"

### Winter primary production



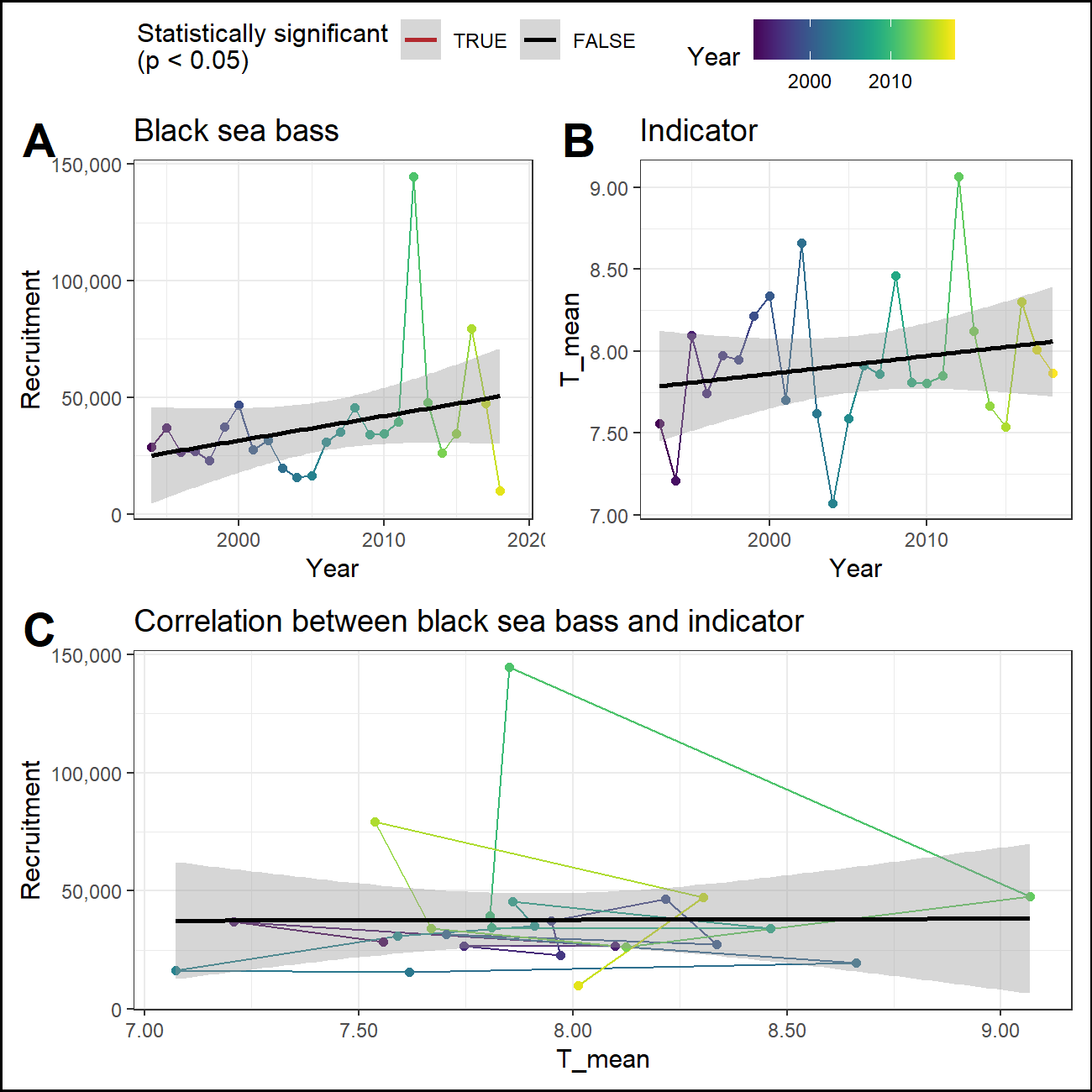
##   
##   
## [1] "Time"   
## [2] "winter OI SST Anomaly Black sea bass spring degreesC"  
## [3] "fall OI SST Anomaly Black sea bass spring degreesC"

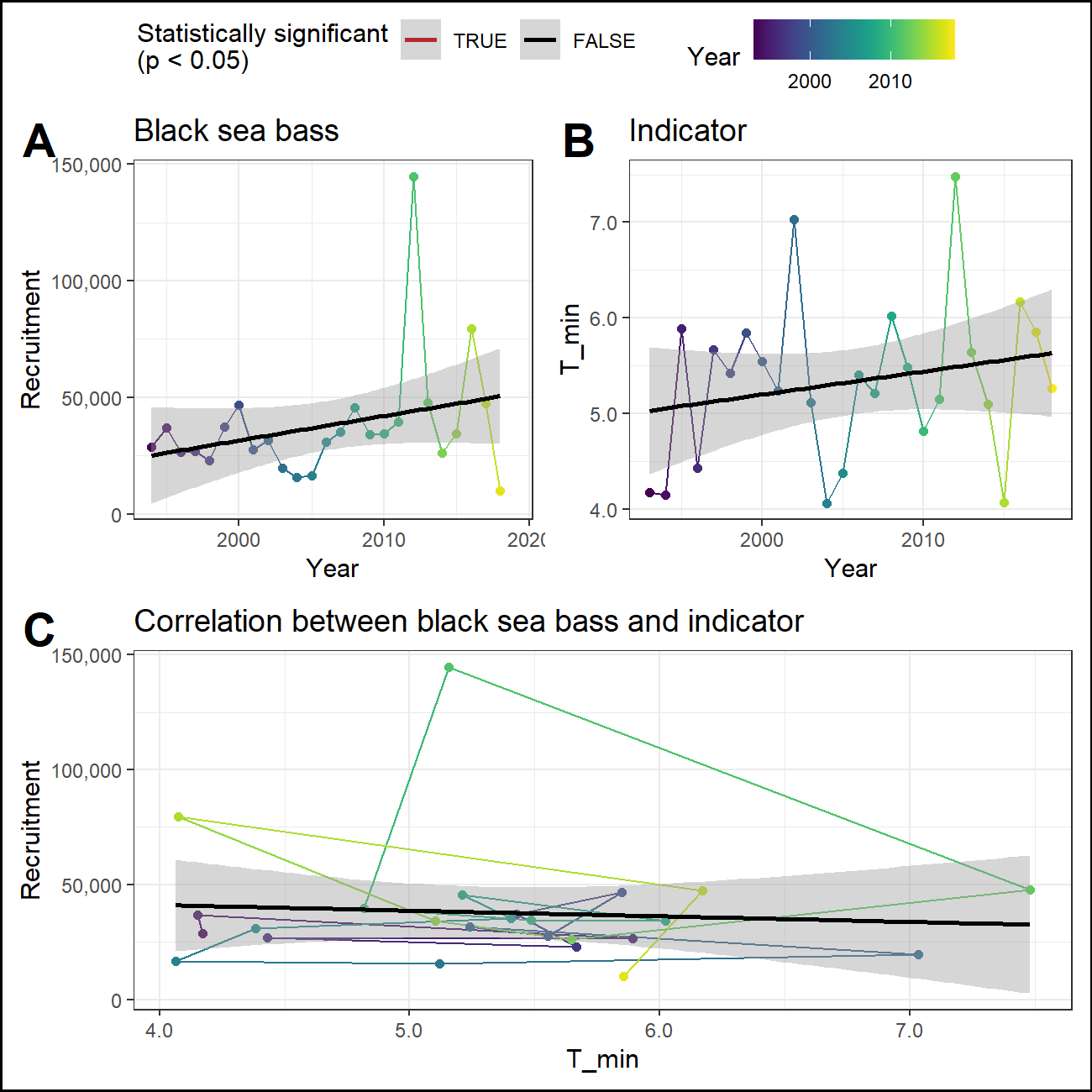
### Fall primary production (prior year)

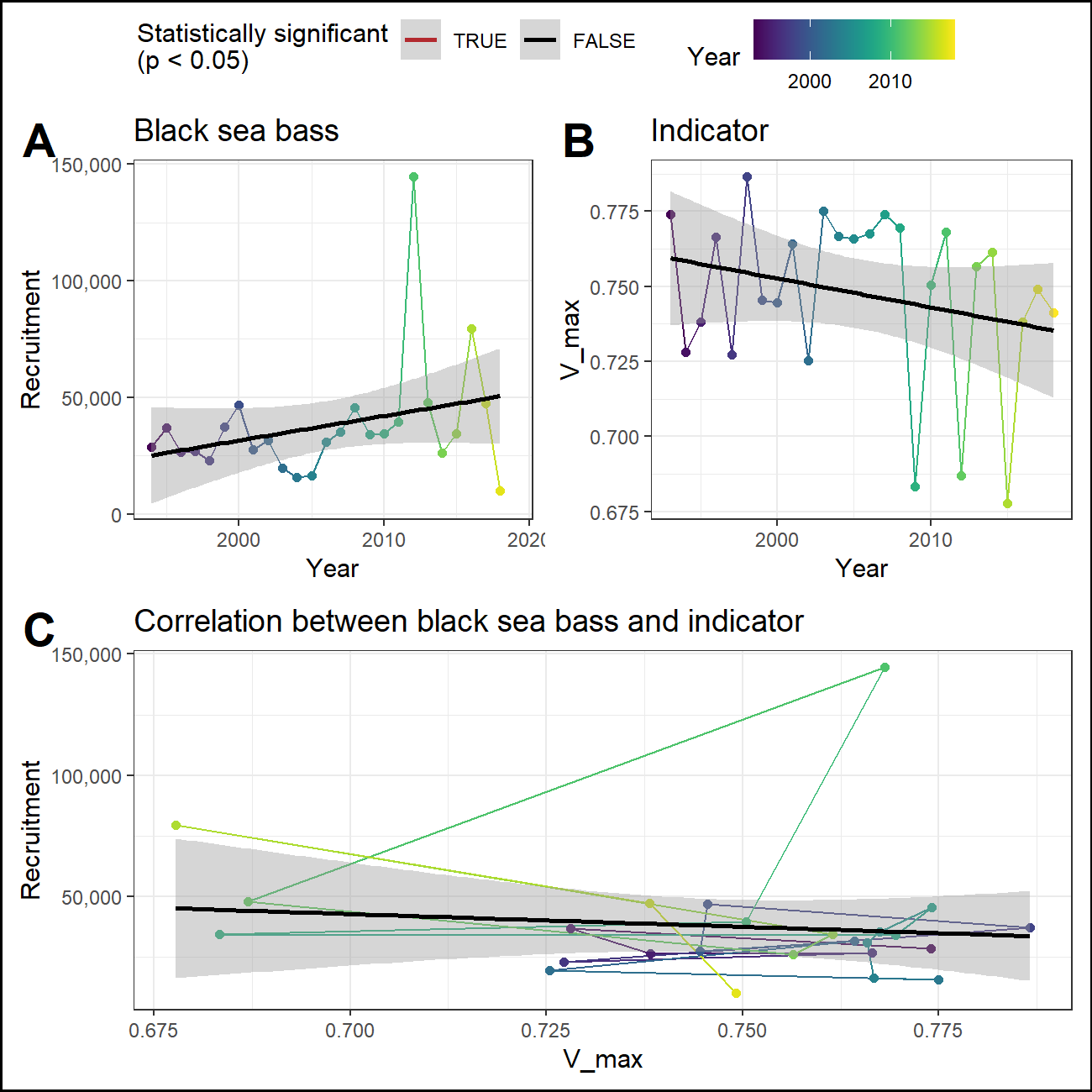
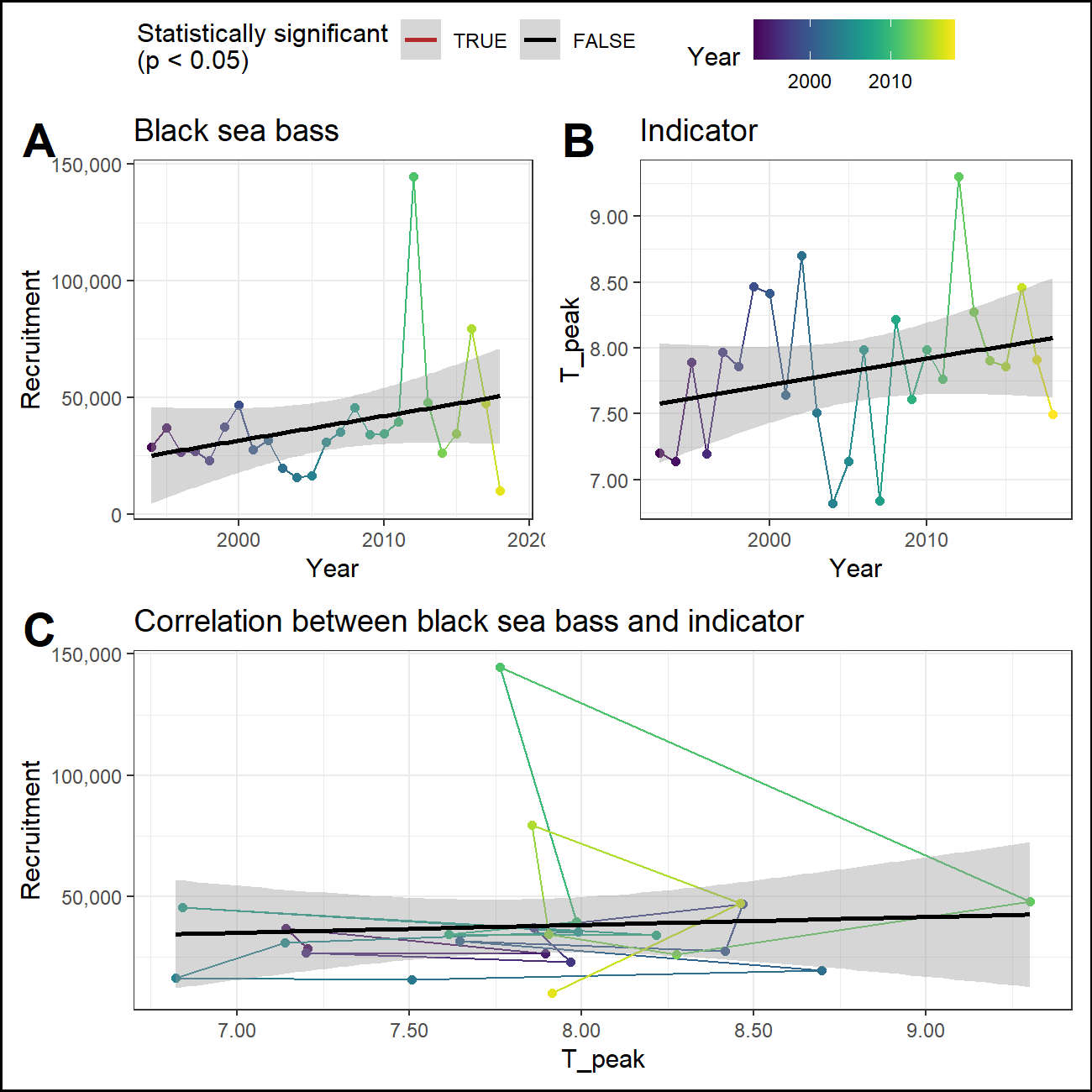


##   
##   
## [1] "Time"   
## [2] "winter OI SST Anomaly Black sea bass spring degreesC"  
## [3] "fall OI SST Anomaly Black sea bass spring degreesC"   
## [4] "winter Black sea bass spring gC m-2 d-1"

### Cold pool index (prior year)





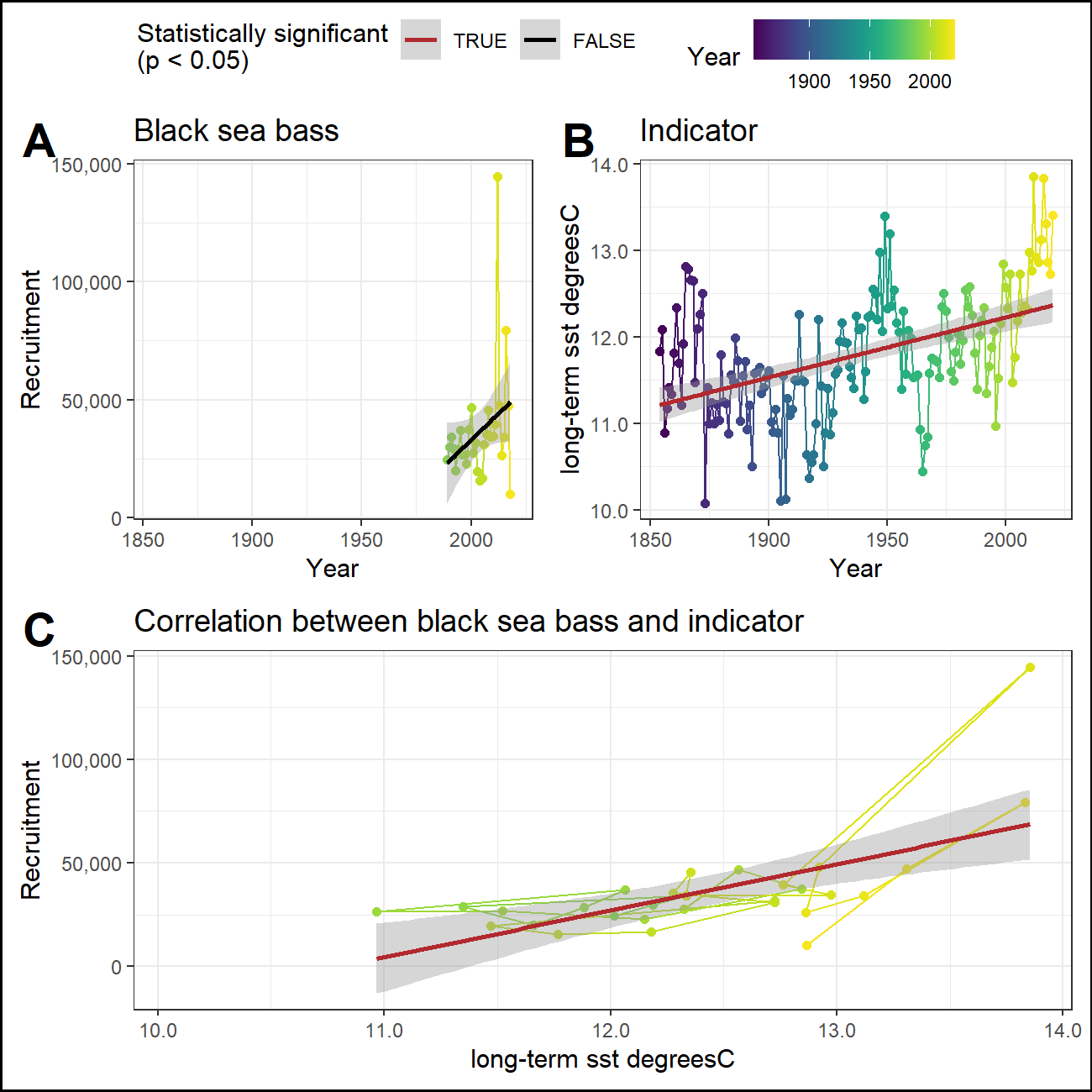


### Predator abundance

## Ecosystem

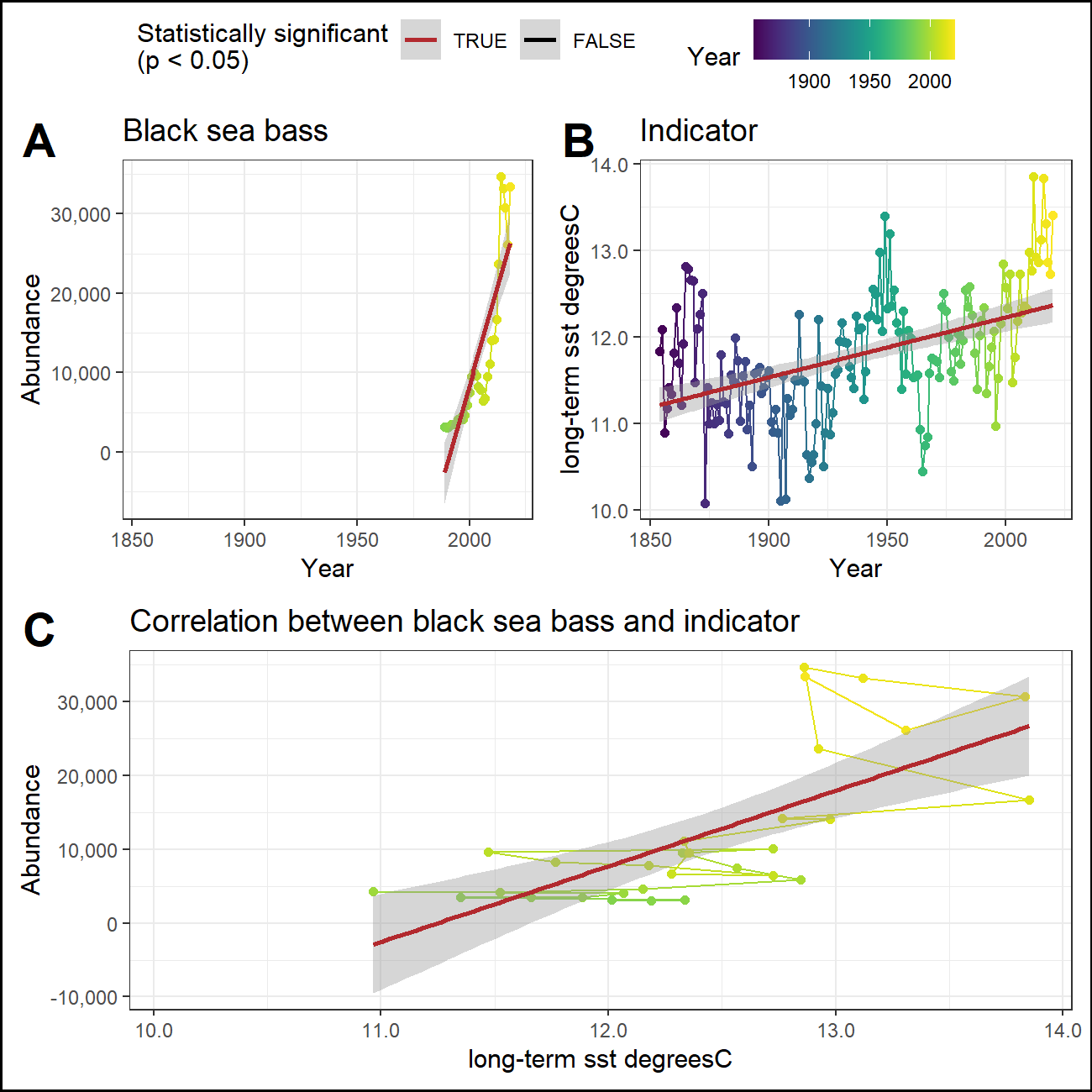
### Sea surface temperature

#### Recruitment



##   
##   
## [1] "Time"   
## [2] "winter OI SST Anomaly Black sea bass spring degreesC"  
## [3] "fall OI SST Anomaly Black sea bass spring degreesC"   
## [4] "winter Black sea bass spring gC m-2 d-1"   
## [5] "fall Black sea bass spring gC m-2 d-1"

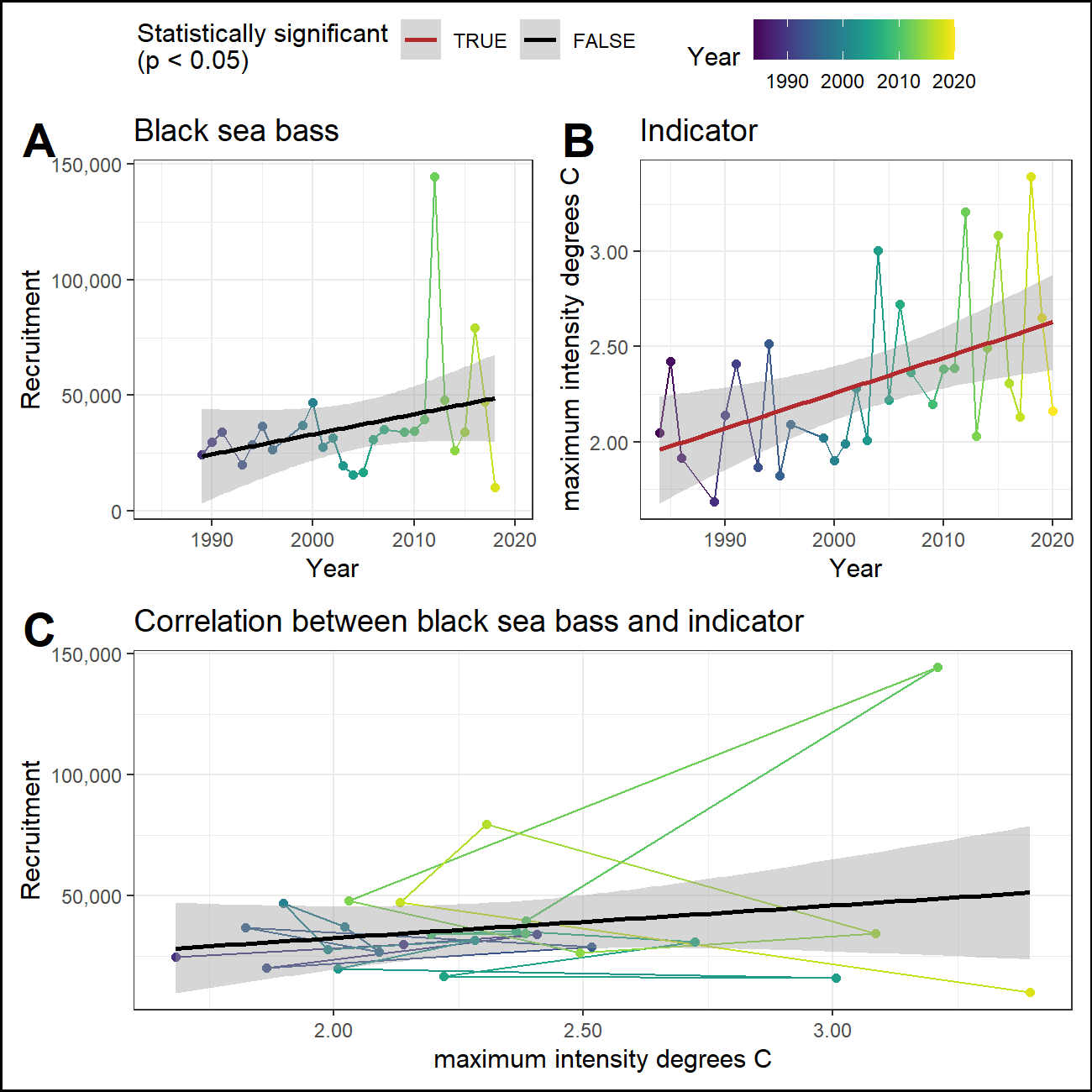
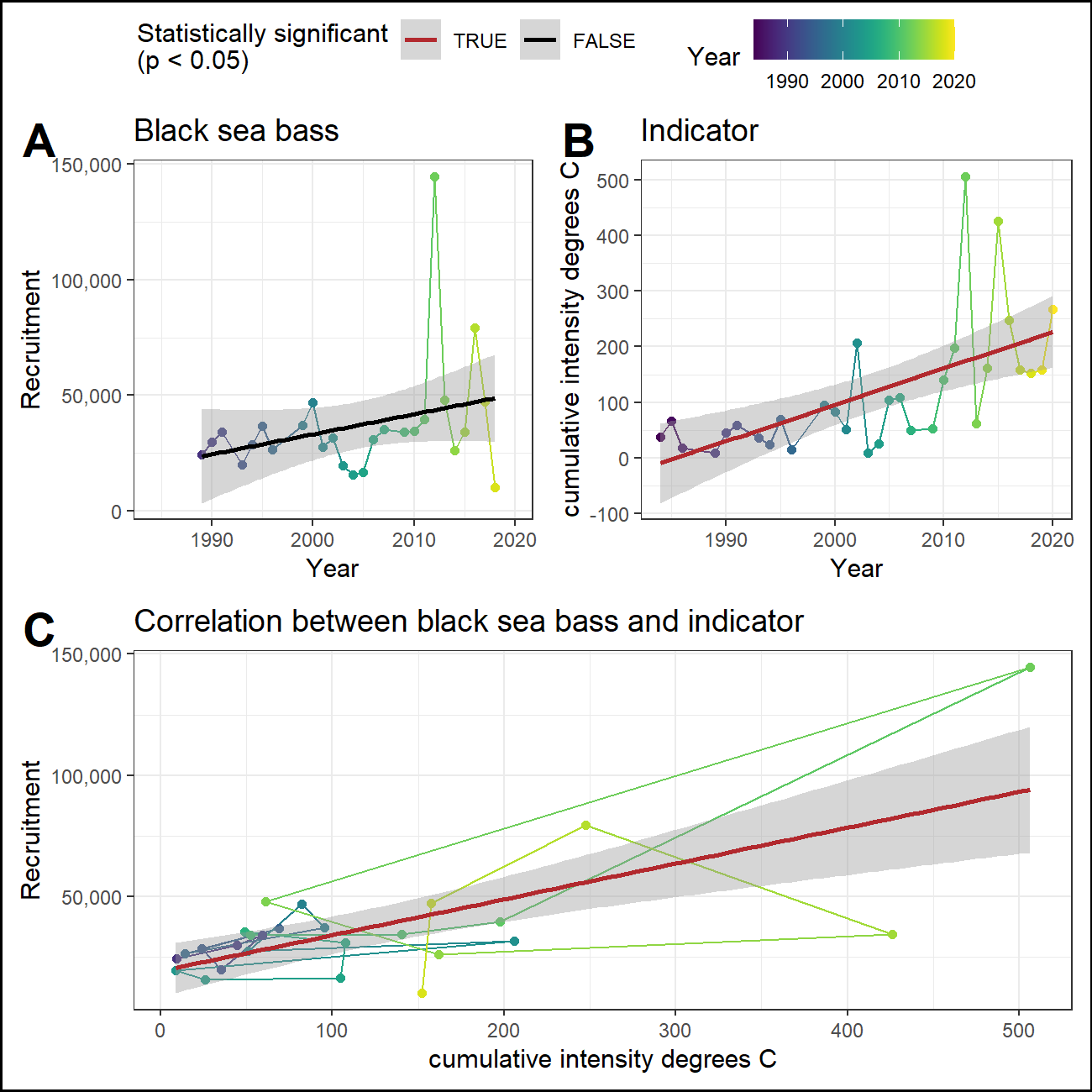
#### Abundance



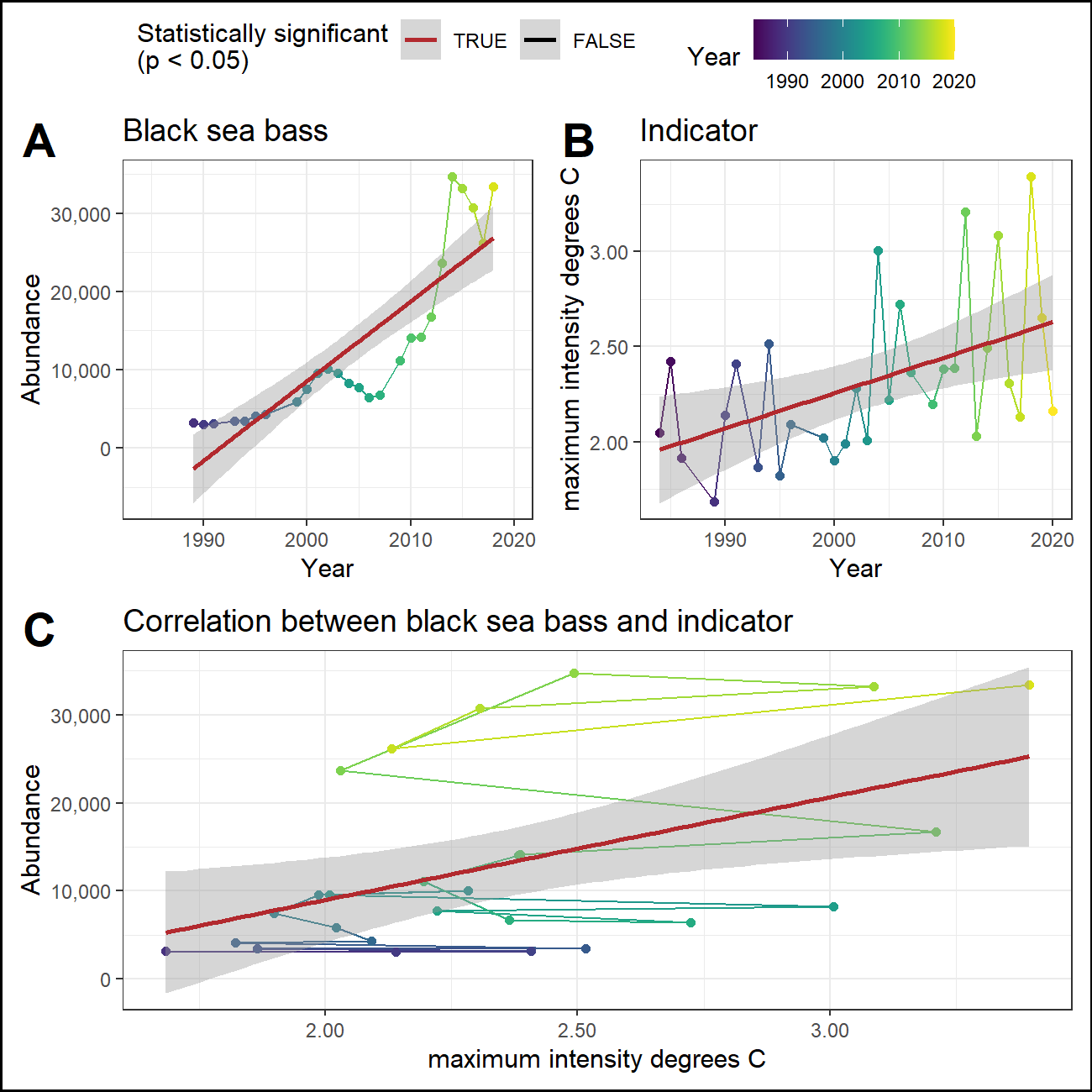
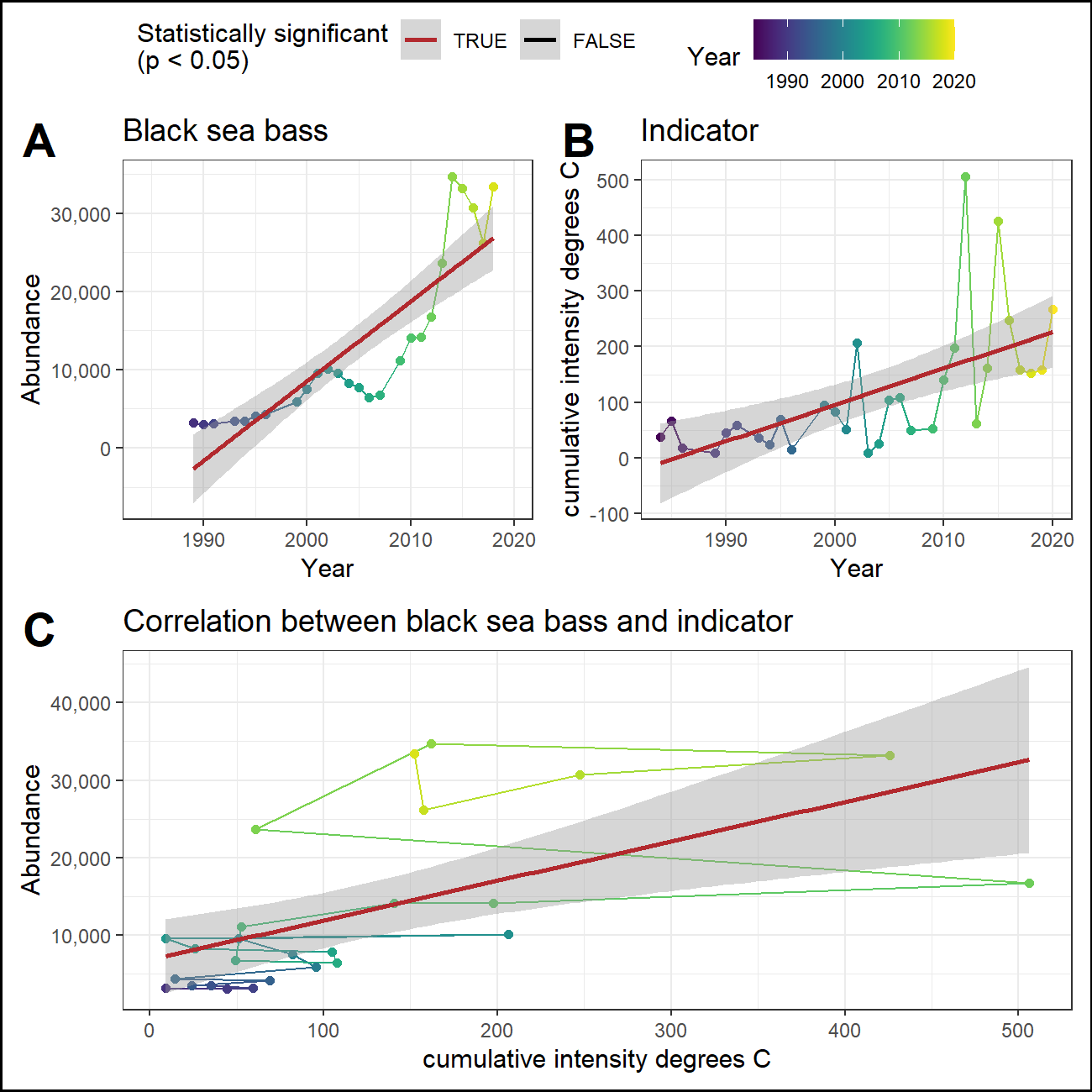
### Marine heatwaves

#### Recruitment

##   
##   
## [1] "Time"   
## [2] "winter OI SST Anomaly Black sea bass spring degreesC"  
## [3] "fall OI SST Anomaly Black sea bass spring degreesC"   
## [4] "winter Black sea bass spring gC m-2 d-1"   
## [5] "fall Black sea bass spring gC m-2 d-1"   
## [6] "long-term sst degreesC"



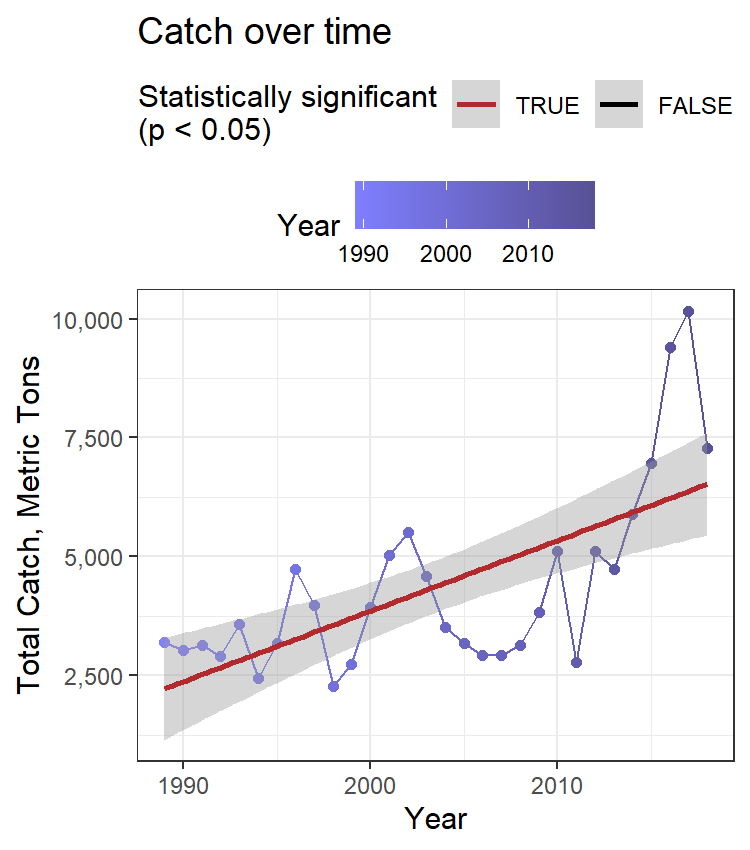
#### Abundance



##   
##   
## [1] "Time"   
## [2] "winter OI SST Anomaly Black sea bass spring degreesC"  
## [3] "fall OI SST Anomaly Black sea bass spring degreesC"   
## [4] "winter Black sea bass spring gC m-2 d-1"   
## [5] "fall Black sea bass spring gC m-2 d-1"   
## [6] "long-term sst degreesC"   
## [7] "cumulative intensity degrees C"

## Management

### Total catch



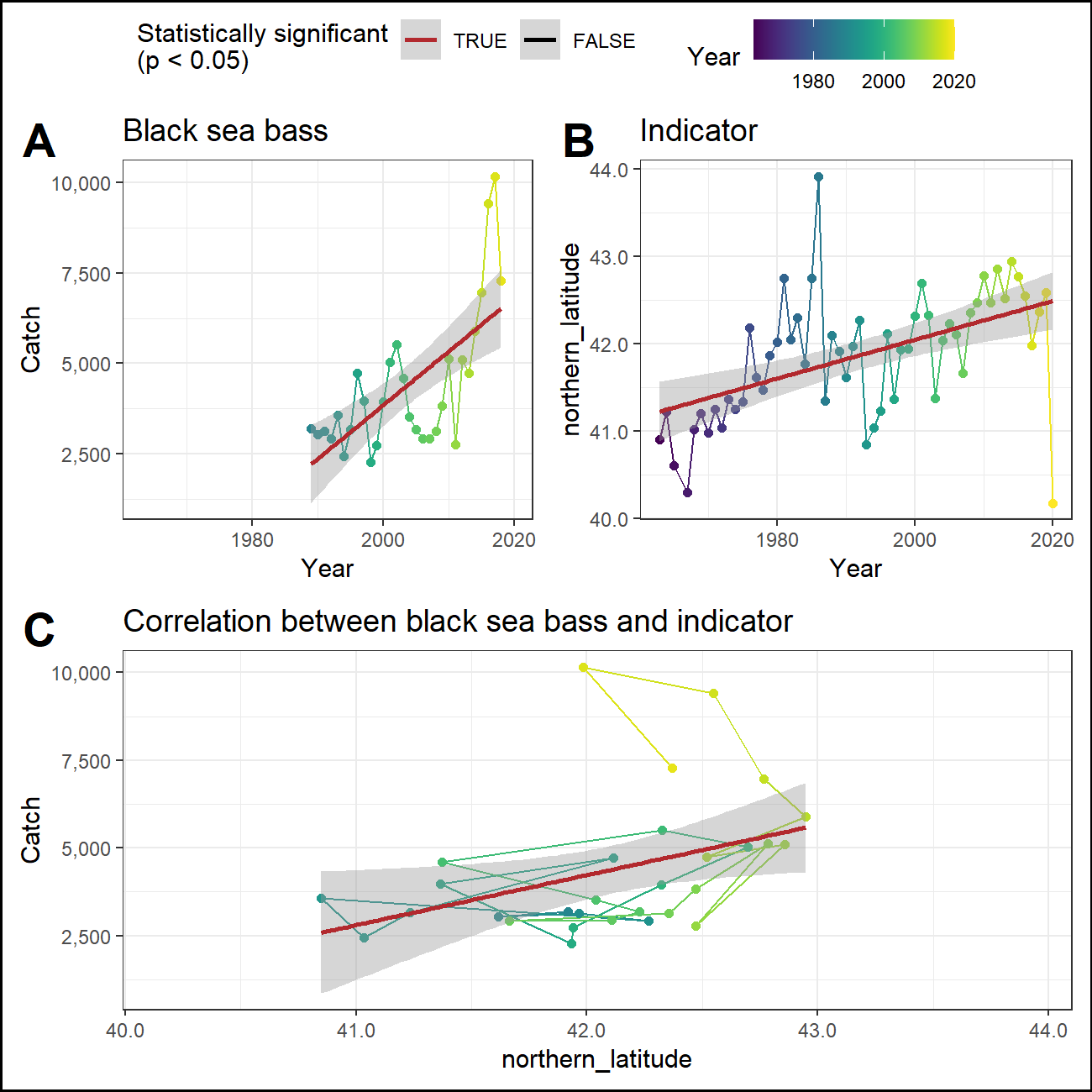
### CPUE

### Catch vs TAC

### Stock range

#### Northern range

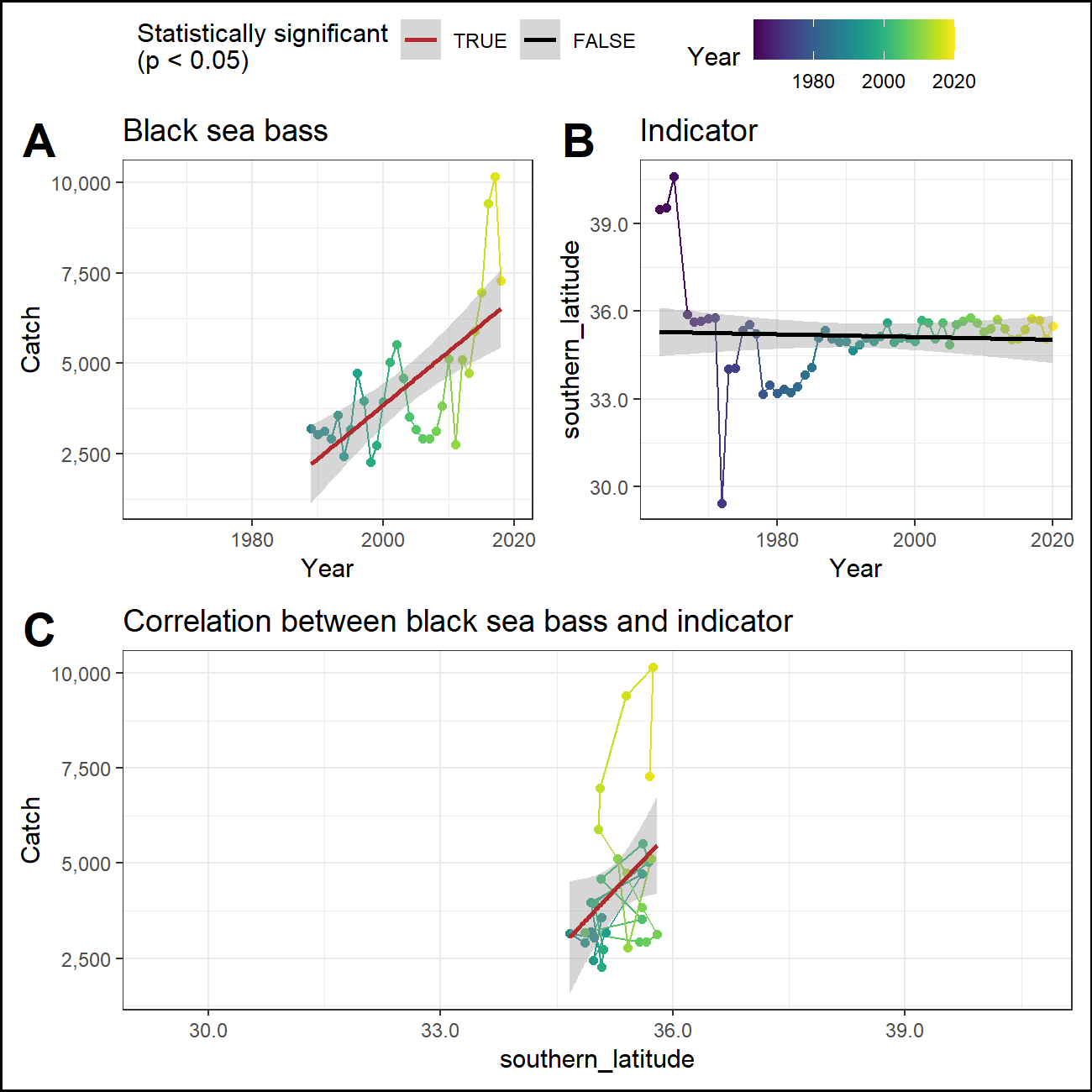
Northernmost survey observation in each year.



##   
##   
## [1] "Time"   
## [2] "winter OI SST Anomaly Black sea bass spring degreesC"  
## [3] "fall OI SST Anomaly Black sea bass spring degreesC"   
## [4] "winter Black sea bass spring gC m-2 d-1"   
## [5] "fall Black sea bass spring gC m-2 d-1"   
## [6] "long-term sst degreesC"   
## [7] "cumulative intensity degrees C"   
## [8] "maximum intensity degrees C"

#### Southern range

Southernmost survey observation in each year.



##   
##   
## [1] "Time"   
## [2] "winter OI SST Anomaly Black sea bass spring degreesC"  
## [3] "fall OI SST Anomaly Black sea bass spring degreesC"   
## [4] "winter Black sea bass spring gC m-2 d-1"   
## [5] "fall Black sea bass spring gC m-2 d-1"   
## [6] "long-term sst degreesC"   
## [7] "cumulative intensity degrees C"   
## [8] "maximum intensity degrees C"   
## [9] "northern\_latitude"

### Center of mass

## Report card

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time | winter OI SST Anomaly Black sea bass spring degreesC | fall OI SST Anomaly Black sea bass spring degreesC | winter Black sea bass spring gC m-2 d-1 | fall Black sea bass spring gC m-2 d-1 | long-term sst degreesC | cumulative intensity degrees C | maximum intensity degrees C | northern\_latitude | southern\_latitude |
| 2016 | 1.34, high | 1.09, neutral | 0.44, high | 0.5, neutral | 13.83, high | 124.89, high | 124.89, high | 42.55, neutral | 35.39, neutral |
| 2017 | 1, high | 1.37, high | 0.4, neutral | 0.55, neutral | 13.31, high | 79.92, neutral | 79.92, neutral | 41.99, neutral | 35.74, neutral |
| 2018 | -0.45, neutral | 0.21, neutral | 0.37, neutral | 0.46, neutral | 12.87, high | 77.71, neutral | 77.71, neutral | 42.37, neutral | 35.7, neutral |
| 2019 | -0.3, neutral | 0.87, neutral | 0.39, neutral | 0.5, neutral | 12.73, high | 80.26, neutral | 80.26, neutral | 42.59, neutral | 35.05, neutral |
| 2020 | 1.04, high | 2.68, high | NA | NA | 13.41, high | 134.81, high | 134.81, high | 40.17, low | 35.5, neutral |
| recent mean | 0.53 ± 0.83 | 1.24 ± 0.91 | 0.4 ± 0.03 | 0.5 ± 0.04 | 13.23 ± 0.44 | 99.52 ± 27.93 | 99.52 ± 27.93 | 41.93 ± 1.01 | 35.48 ± 0.28 |
| long-term mean | -0.04 ± 0.83 | 0.21 ± 0.89 | 0.4 ± 0.03 | 0.52 ± 0.06 | 11.79 ± 0.72 | 59.83 ± 58.78 | 59.83 ± 58.78 | 41.87 ± 0.73 | 35.16 ± 1.53 |

